UNIVERSITY OF MASSACHUSETTS

BULLETIN

1973

Summer Session 1973

Undergraduate Course and Faculty Directory,
Amherst, 1973-74

Administrative Officers and Faculty, Amherst, 1973

Graduate School, 1974-75

U.Mass.-Boston, 1973-74

Medical School, 1973-74

(The Stockbridge School catalog for 1972-74 is bound in the 1972 Bulletin volume.

The General Information Bulletin for 1973-74 is bound in the 1972 Bulletin volume; the General Information Bulletin for 1974-75 will be bound in the 1974 Bulletin volume.)

Summer Session 1973

University of Massachusetts Bulletin

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VOLUME LLXV No. 1 FEBRUARY 1973

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1973 Summer Session Calendar

MAIN EIGHT-WEEK SESSION

Registration day: June 25
Classes begin: June 26
Final day for dropping and/or adding courses: July 13
Final day for submitting Pass/Fail cards: July 13
Classes end: August 17

DAILY SCHEDULE

Standard classes are sixty minutes in duration, and are normally scheduled to meet Monday through Friday. The standard starting times are: 7:45 a.m.; 9:00 a.m.; 10:15 a.m.; 11:30 a.m.; 1:00 p.m.; 2:15 p.m.; 3:30 p.m.

Final examinations will be given during regular class time. At the option of the instructor, two class periods may be used.

The Course Descriptions section covers the content of most of the courses offered during this Summer Session and indicates the dates particular courses meet only if they do not conform to the regular eight-week session. Course times and locations are listed in the computer-printed insert in the middle of this Bulletin. A final schedule of courses will be available at registration.

Special Sessions

Some departments offer certain courses and programs at dates other than the main eight-week term. These dates are given under the course descriptions and/or under the section on Special Programs.

Inquiries

Information not included in this Bulletin may be secured by writing:

Summer Session
Office of the Provost
Whitmore Administration Building
University of Massachusetts
Amherst, Mass. 01002

The University

Founded in 1863, the University of Massachusetts is one of 66 land grant colleges and universities in the United States providing public education, research, and service. The University campus at Amherst, situated on 1,100 acres in the picturesque Connecticut River Valley, enrolls 23,700 students and is served by a $200-million physical plant. The University has continually expanded to meet the growing needs of the Commonwealth. The University of Massachusetts at Boston opened in 1965 and currently enrolls approximately 5,560 students. The new University of Massachusetts Medical School at Worcester opened in the fall of 1970, and plans are presently being developed for the establishment in Amherst of a law center.

At Amherst, a broad and continuous program is provided by the undergraduate schools and colleges, the Graduate School, the Summer Session, and the Division of Continuing Education. Basic units are the College of Food and Natural Resources, the College of Arts and Sciences, the Schools of Business Administration, Education, Engineering, Home Economics, Nursing, and Physical Education, and the Department of Public Health. The University also has voluntary Army and Air Force ROTC programs, an active Phi Beta Kappa chapter, and more than 400 student organizations. Numerous centers and bureaus actively serve the Commonwealth in such fields as government research, labor relations, natural resources, and population.

The University has joined Smith, Amherst, Hampshire and Mount Holyoke Colleges in a five-college cooperative program, developing specific Ph.D. programs as well as operating a radio station and offering lectures, special courses, and inter-library loans.

General Information

APPLICATION PROCEDURE

Pre-registration may be accomplished by submitting application and registration forms to the Registrar's Office, 213 Whitmore Administration Building, for undergraduates, and to the Graduate School, Graduate Research Center, for graduate students, prior to June 11. Course registrations and schedules will be arranged for persons applying by this date. Applications received later than this date will not be processed, but returned to the student. In such cases no scheduling will be done in advance, no bill or housing assignment will be made until Registration Day, and the student may find certain courses closed because of capacity enrollment. Course registration and scheduling will be handled on a "first-come, first-served" basis. Although every effort is made to accommodate scheduling requests, the University cannot guarantee enrollment in a particular course section. Early application will help to ensure a preferred schedule and will enable registration to proceed in a minimum of time.

Students whose applications have been processed must still appear on Registration Day to obtain their schedules. Applications for students who do not appear will be cancelled after the late registration period.

Application forms are included in this Bulletin and may also be obtained from the Registrar's Office, 213 Whitmore Administration Building, or from the Graduate School, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002.

Any student who holds a degree must apply through the Graduate School whether he is taking courses for credit or not, even though he is applying for undergraduate courses. Acceptance to the University Summer Session is not an acceptance to the University for any regular session.

REGISTRATION

Registration for the main eight-week session will be held on June 25 in Boyden Gymnasium. Students may register from 9:00 a.m. to 12 noon and from 1:30 to 4:30 p.m. See also Summary of Registration Procedures just before the Course Descriptions section in this Bulletin.

HOUSING

It is the policy of the Board of Trustees to require the housing of undergraduates in University residence halls. Exemptions to this rule are granted to married students, to those commuting from the home of their parents, to seniors, and to those 21 years of age as of registration day.

Residence halls will open for occupancy at 1:00 p.m. on the day immediately preceding Registration Day and will close on the final day of classes. Room assignments will be available to pre-registered students upon arrival.

All rooms are provided with basic furniture, including beds and mattresses, desks, desk chairs, lounge chair, wastebaskets, bulletin boards, window drapes, and night stands. Each student is responsible for providing ash trays, pillows, bed linen, blankets, and towels. Linen service may be obtained by contract with a private linen service.

Those eligible to reside off-campus may obtain housing information by writing to the Off-Campus Housing Office, 235 Whitmore Administration Building, University of Massachusetts, Amherst, Massachusetts 01002.

BOARD

The University Food Services will offer a 15 meal ticket during the Summer Session. The charge for the 15 meal ticket (three meals a day, Monday through Friday) will be $18 per week. All students in University residence halls are required to purchase a meal ticket except those students who are seniors, 21 at the time of registration, or married. These board contracts offer a highly selective menu with a "seconds" policy on all items.

Food may be purchased on a cash basis at the Campus Center—Student Union snack bars and the snack bar located in Worcester Commons.

MOTOR VEHICLE REGULATIONS

All student, faculty, and staff motor vehicles must be registered with the Parking Office, Room 105, Hampshire House. All students may be permitted to have a motor vehicle on campus, provided it is registered with the Parking Office and complies with published University regulations. Copies of these motor vehicle regulations should be obtained at the Parking Office.

Visitors are requested to use the new multi-level Campus Center Parking Garage unless another lot is suggested.

All areas are under roving security surveillance. Visitors may secure information at the Parking Control Booths or at the Security Building. Inquiries concerning parking should be directed to the Parking Authority, University of Massachusetts, Amherst, Massachusetts 01002.

ADMINISTRATIVE CONTACTS

The usual initial contact for students with the administrative staff is based upon a student's local residence: residence hall students should begin with their Area Directors, men and women commuters with the Office of Non-resident Student Affairs.

EXPENSES

In order to avoid delays at registration, students are encouraged to pre-register by mail before June 11 for the main eight-week term of Summer Session. This will enable the Bursar's Office to prepare a bill for each student, making it possible for the student to pay in advance. A STUDENT CANNOT REGISTER UNLESS HIS BILL IS PAID IN FULL.

As this Bulletin is prepared long in advance of the summer, the fees listed are subject to change.

TUITION for residents of Massachusetts	$12.50 per credit
TUITION for non-residents of Massachusetts	$42.50 per credit
HEALTH FEE*	$ 2.25 per week
CAMPUS CENTER FEE*	$ 2.00 per week
STUDENT ACTIVITIES FEE*	$ 2.00 per week
BOARD— WEEKDAYS ONLY	$18 per five-day week
RENT**	$20.65 per week

Books, Stationery and Supply Expenses

Students should be prepared to pay for necessary books and incidental supplies. Certain departments make special charges for laboratory supplies.

***Required fees, to be paid by all students including commuters.**

****Depending on residence hall assignment, other rent rates are $18.90 and $22.75 per week.**

TUITION AND FEE REFUNDS

A student who leaves the University before a term is completed will ordinarily be granted a refund of tuition and fees according to the following schedule:

1) During the first week of the term	60%
2) During the second week of the term	20%
3) After the second week	No refund

A student who makes an advance payment and then for any reason does not attend any part of Summer Session will be given a full refund of tuition and fees after contacting the appropriate Registrar's Office.

A student involuntarily called into military service before the completion of a term will be given a pro rata refund of tuition and fees, provided that he receives no academic credit for the work of that term. If academic credit is given, there will be no refund.

A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

No refund will be given of prepaid room rent after a term has begun and the room has been occupied.

RESIDENCE

New students who are residents of Massachusetts must file a Certificate of Residence with the Treasurer's Office in order to obtain a residential tuition rate. The application form includes the appropriate certificate.

Academic Information

ADDING OR DROPPING COURSES

Students may add or drop any course until July 13 without notation on their record. No course may be added after this date. After July 13, students who drop a class receive a "voluntary F" (failing) unless they obtain their academic Dean's approval. With this approval, the student will receive a W (withdrawn).

PASS/FAIL OPTION

A regularly enrolled student must be enrolled for three 3-credit courses to use his pass/fail option, unless he or she is an education major. A non-education major taking a course in education, may elect one other outside pass/fail course.

OVERLOAD OF CREDITS

A full Summer Session program is usually considered to consist of three 3-credit courses. Students who wish to register for additional credits must secure approval as follows:

1) 12 credits (one extra course)
   Academic Dean (University students)
   Coordinator of Summer Session (visiting students)
2) A senior graduating in summer or the following January may register for 12 credits without extra permission.

Forms for overloads for undergraduates may be secured in the Registrar's Office, 213 Whitmore Administration Building. Graduate students should inquire at the Graduate Office, Graduate Research Center.

AUDITING

A student who intends to audit a course must register and pay the regular tuition and activities fees. There is no special audit fee. A student who drops a course during the term, but wishes to continue on an audit basis, will receive a grade in accordance with the existing regulations governing the Add and Drop periods.

ACCELERATED ENROLLMENT

The University invites superior high school students to begin their college education immediately upon graduation by enrolling in the Summer Session. For the highly motivated student, perhaps already convinced that his formal education will require graduate or professional studies, an early start may conserve valuable time. Similarly, students in financial need may find it less expensive to complete their undergraduate education in less than four years. Summer Session attendance can substantially reduce the time necessary to obtain a bachelor's degree.

Students who wish to start their University of Massachusetts undergraduate work in the summer are advised to apply to the Admissions Office for regular admission by the fall of their senior year. At the same time, they should indicate their desire for summer study. The registrar's Office will forward a Summer Session application and detailed information regarding the summer program.

Students who have been accepted at institutions other than the University of Massachusetts may enroll in the summer program, providing they secure the approval of their college. A space for this approval is furnished on the Summer Session application.

THESIS AND PROBLEMS CREDIT

Graduate students contemplating special course work and thesis work during the Summer Session should seek the permission of their department heads and/or advisers. Special and thesis courses are listed by number in the Course Descriptions section of this Bulletin. A student who fails to register for such work will not receive an Identification Card and cannot use University facilities.

CREDIT FOR SUMMER WORK

All courses carry degree credit and are equivalent in method, content, and credit to courses offered at the University during the regular academic year. Credits obtained in these courses are ordinarily accepted as transfer credits by other colleges and universities.

Students who are registering for the first time or who have registered previously and desire to pursue an advanced degree at the University must secure the approval of the requisite departments and approval of the Dean of the Graduate School on the appropriate application form.

WITHDRAWALS

An undergraduate student who has attended Summer Session classes and who wishes to drop all of his courses and thus terminate enrollment must observe formal procedures. Summer Session withdrawal papers originate in the Office of Non-resident Student Affairs for commuting students, and with the Southwest Area Coordinator for on-campus residents. If a student withdraws from the Summer Session after July 13, grades of WF or WP will be entered, as appropriate, for all courses.

Summer Session withdrawal papers for graduate students may be obtained at the Graduate School, Graduate Research Center.

Special Academic Programs

GERMAN STUDIES IN FREIBURG

The Department of Germanic Languages and Literatures sponsors a six-week summer program, one week in Berlin and five weeks in Freiburg, Germany. Courses in elementary, intermediate, and advanced German are offered. Students may earn up to six University of

Massachusetts credits. There is a three-week period for independent travel in Europe between the initial week in Berlin and the five-week study program in Freiburg. Dates of the program are June 17 to August 24.

The course fee of $825 covers round-trip international travel, tuition, room and board, and special excursions to a number of places of cultural and historic interest, including Koln, Aachen, and the Black Forest. The program is open to both graduate and undergraduate students and is based at the University of Massachusetts Study Center in Freiburg. Contact: Professor F.W. von Kries, Department of Germanic Languages and Literatures, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

STUDY IN BOLOGNA

The University sponsors a program of summer study in Bologna, Italy, beginning in Mid-June and ending the last week of August. The program is staffed primarily by members of the faculty of the University. The curriculum consists of regularly scheduled University courses on subjects in which the Italian location contributes significantly to the students' understanding and experience. These courses include Art History, History of Italy, Literature, Italian Language, and Cultural Anthropology. Field trips to major cultural centers in Italy are an integral part of the program. Any student in good academic standing at his college or university is eligible. Students will be expected to take two of any of the three-credit courses in the fields of Art, History, Italian, Government, and Music. Cost to the student will be approximately $875. Enrollment is limited. Contact: Professor Anthony Terrizzi, Department of French and Italian, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

HISPANIC STUDIES IN MADRID

In its 1973 program in Madrid, June 16 to August 24, the Department of Hispanic Languages and Literatures offers four graduate/undergraduate courses in literature and the history of ideas and one undergraduate class in art, taught at the Prado Museum. All courses are conducted in Spanish and carry three credits each. The normal load is six credits. The purposes of the program are:

1. to provide access (for qualified students) to intensive advanced work in literature and history of ideas;

2. to offer the experience of total immersion in the Spanish language and culture;

3. to introduce students to Spanish scholars and creative intellectuals and artists who have not come to the U.S. to teach. Among the distinguished faculty for 1973 are Pedro Lain Entraglo, Ciriaco Moron Arroyo, José Luis Alonso-Misol, and José Olivio Jiménez.

In addition to a six-week course of study, the program offers lectures, visits to the theatre and other cultural activities, and integrated weekend trips. The basic fee includes tuition, room and board in a selected private home (June 20 to August 5), lectures, and excursions. Basic cost to Massachusetts students is $[illegible], to non-residents, $705. Travel to and from Spain is not included, but arrangements may be made for those who wish to take advantage of the Five-College charter flight.

Contact: Director, Madrid Program, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

OXFORD PROGRAM

A special group of courses in English literature is regularly offered at Trinity College, Oxford, during July and part of August. The six-week session corresponds with the regular session of this University and awards University of Massachusetts credit. The courses are all taught by Oxford dons (current or past), and the Bodleian Library is available for extensive research. Graduate and undergraduate courses are offered and vary each year according to the availability of specialists at Oxford and the interests of students. Special evening lectures by noted authorities supplement these offerings. Overall cost to the student is $890. Contact: Professor Ernest Hofer, Department of English, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002

ST. VINCENT FIELD PROGRAM IN ANTHROPOLOGY

The Department of Anthropology is sponsoring a program of supervised field research in cultural anthropology for graduate students and advanced undergraduates to be held at St. Vincent, West Indies, June 4 through July 28, 1973. The program consists of one week of orientation to the culture of St. Vincent and discussion of research problems and location, six weeks of supervised research, and a final week of discussion and evaluation of research results. Cost to the student, including round-trip air fare (from New York), tuition, room and board, is estimated at $600. Contact: Professor T. M. Fraser, Director, Department of Anthropology, Machmer Hall, University of Massachusetts, Amherst, Massachusetts 01002.

PROGRAM ABLE

Program ABLE (Accelerated Business Leadership Education), offered by the School of Business Administration, is designed to develop and enhance managerial skill among members of minority groups in our society. Persons who are presently employed in business and possess an undergraduate degree, or are graduates of accredited schools or colleges, are eligible for enrollment.

The program leads to the Master of Business Administration degree. An initial Summer Session consists of an intensive sequence of instruction in the disciplines underlying graduate business administration. Following successful completion of the summer work, students are admitted to the regular M.B.A. program of the School of Business Administration.

The program may be completed in two academic years. Financial aid is available, based on need. Contact: Program ABLE, 114 SBA Building, University of Massachusetts, Amherst, Massachusetts 01002.

Summer Activities

Each year the University of Massachusetts Summer Activities Committee offers a varied and balanced presentation of the arts, intramural sports, and recreational activities. Prominent musical artists and lecturers are engaged, and both national travelling art exhibits and exhibits of local artists are shown. A film series provides at least one film a week. The Summer Repertory Theatre presents plays of professional quality. Organized sports include softball, volleyball, tennis, and badminton. Individual participation is encouraged for swimming, outing trips, picnics, and crafts programs. All programs are coeducational.

Details of the Summer Program events and ticket information will be available at registration, the Student Activities Office, and the Fine Arts Council Office.

Student Affairs

Student Affairs, under the direction of Vice Chancellor Robert W. Gage, provides services for students' non-academic needs. Student Affairs offices and departments, with a brief description of services, are listed in this section.

Questions pertaining to University services may be referred to the Student Affairs Information Desk, 229 Whitmore, 5-2192.

ADMISSIONS, RECORDS, AND FINANCIAL AID
Dean of Admissions, Records, and Financial Aid
Dr. William Tunis, 255 Whitmore (5-0222)

UNDERGRADUATE ADMISSIONS
Director, Mr. Robert J. Doolan
255 Whitmore (5-0222)
The Admissions Office is responsible for all administrative procedures concerning undergraduate admissions including liaison with high school guidance counselors, community college staff personnel and other admissions officers for transfer students; and admissions standards set in coordination with the Provost and other academic departments.

TRANSFER AFFAIRS
Director, Dr. Ernest Beals
208 Whitmore (5-0860)
The Office of Transfer Affairs serves as a general resource center for all transfer matters. The Transfer Office provides a full-scale program of articulation for all transfers who enroll at the University. This includes the areas of admission, orientation, credit evaluation, financial aid, and liaison with the Counseling Center.

One of the major functions of the Office is to work with the academic departments on campus and at the community colleges in a cooperative effort to provide smooth transition for the transfer student in academic programs from one institution to the other.

REGISTRAR'S OFFICE
Registrar, Mr. Ralph D. Jones
213 Whitmore (5-0555)
The Registrar's Office is responsible for enrollment and registration of undergraduates, administrative procedures relating to course loads (adding and dropping courses), course of study, withdrawals, producing grade reports, transcripts, and maintaining the permanent academic record cards.

FINANCIAL AID
Acting Director, Mr. Lynn Santner
232 Whitmore (5-0801)
The Financial Aid Office has information concerning area employment, scholarships, loans, etc. The Office assists students with financial counseling and also aids in finding suitable employment, awards, loans, grants, scholarships, and assigning part-time work.

CAREER PLANNING AND PLACEMENT
Director, Mr. Robert Morrissey
239 Whitmore (5-2225)
Career Planning and Placement service assists undergraduate and graduate students, as well as alumni, in formulating and pursuing short- and long-range career objectives. The service includes personal and group counseling, assisting registrants in the planning of job campaigns, acting as an official source for references and complete credentials, providing centralized coordination for on-campus student/employer information and personal interviews, being a referral agent for interim work experience during full/part-time study, processing assistance in teacher certification application preparation, maintaining a resource library for career planning and graduate study, and offering resource personnel for in-service assistance to campus departments, individual faculty members, and student organizations.

COMMUNITY DEVELOPMENT AND HUMAN RELATIONS
Acting Director, Dr. Norma B. Gluckstern
Munson Hall (5-0864)
The Office of Community Development and Human Relations helps foster a human relations viewpoint throughout the Office of Student Affairs, helps develop and train residence hall leaders in a more humanistic system of residence hall living, provides human relations training in those critical areas of a university that are potentially volatile, such as police-community relations and black-white relations.

The Office also trains facilitators and community developers to function in formal programs sponsored by the CDHR Office and to encourage research in a community development and human relations program on campus. Work of the office is also carried on through courses in Continuing Education and the School of Education, through weekend laboratories, and ongoing weekly groups and police-training institutes.

COUNSELING CENTER

Dr. J. Alfred Southworth, Director, 243 Whitmore Administration Building (5-0333).

The Counseling Center supports the student's efforts

to develop into a mature, useful, self-fulfilled member of society. The Center's day-to-day work with the student-client involves psychological counseling on personal, social, educational, and vocational problems.

Consultation: Students consult with Counseling Center staff on such diverse topics as the construction of opinion polls, attitudes of staff towards campus issues, or approaches to remedying a difficult situation with parents, studies, roommates, etc. Students are encouraged to consult with the staff on any topic that would appear to be even remotely connected with the broad interests of the staff or the services offered by the Center. Many come to talk over transient adjustment problems or personal difficulties that they do not choose to share with friends, parents, or instructors. Many seek help with decision-making in vocational and educational matters. Most are dealing with problems of daily living that are a part of college life.

All individual counseling contacts with members of the Counseling Center staff are strictly confidential. No information is released to members of the University community, to parents, or to outside agencies (such as graduate schools, law enforcement agencies, or draft boards) without the student's explicit authorization in advance.

When the need arises, the Counseling Center staff also administers and interprets psychological tests for assessing students' abilities, interests, and personalities.

Appointments: Generally, students seeking an appointment are seen immediately for an initial intake interview. An appointment is then made within a few days of the first interview.

DEPARTMENT OF PUBLIC SAFETY

Director, Mr. David L. Johnston
Security Building (5-2121)

The Department of Public Safety includes the University Police, the Security Guard Force, the Parking Office, and the University's Police Training Institute. It works closely with the Town of Amherst Police Department, the Massachusetts State Police, and other state law enforcement and public service agencies to provide high quality law enforcement, regulatory training, and public interest services for the Amherst campus of the University. It works also with federal law enforcement agencies, upon specific request, to assist in the enforcement of relevant federal laws.

The Campus Security Force is responsible for the security of University property, provides protection of life and liberty, parking control, emergency transportation of sick and injured, and guard services when valuables are being received and transported, and is responsible for the enforcement of certain regulations established by the Board of Trustees. In accordance with provisions of the Code of Student Conduct, student ID cards or other means of identification must be shown upon request to any properly identified member of the security department, to enable him to perform his assigned duties.

The University Police have full police powers on all University lands and are Special Officers for the Town of Amherst. They are governed by federal, state and local laws and Trustee regulations. The police are also guided by a code of ethics adopted by the International Association of College and University Security Directors.

The University Security Guards are assigned to parking control duties during the day and patrol of residence hall areas at night. They have authority to issue parking violation tickets, but otherwise do not have police power unless simultaneously serving as Auxiliary Police Officers.

They are also concerned with the night security of all buildings and property of the University and patrol the campus in assigned areas. They may request unauthorized people to leave buildings after normal closing hours and assist authorized people to enter buildings.

Some security guard personnel are stationed in residence halls to provide information, guard against loss of University property, keep out unauthorized persons, and work with the Heads of Residence and Area Directors to maintain control in residence units.

GREEK AFFAIRS

Director, Mr. Paul S. Stevens
229 Whitmore (5-2711)

This office plans and directs all administrative functions for fraternity and sorority members and chapters, advises elected officers and committee chairmen in chapters, provides individual and group counseling, advises and aids in programming for Greek Council, and acts as a liaison between the University administration and the "Greek" system.

HEALTH SERVICES

Mr. Barry Averill, Director, Health Center (5-2671).

The University Health Services helps students prevent health problems which might limit the effectiveness of their college experience. Direct services to students are supported by the Health Fee.

A staff of physicians, nurses, psychologists, pharmacists, physical therapists, technologists, and other personnel especially trained to meet student health needs provide comprehensive care in a well-equipped Health Center Infirmary. Students are encouraged to use the Health Services to obtain health care in the same way they would consult their family physician and would use the community hospital at home.

Those students who have paid the Health Fee are entitled to any care rendered on the campus by members of the staff of the Health Services.

Out-Patient Clinic: For a minor problem, such as a mild cold, a nurse often can offer effective treatment and save waiting time or a student can obtain medication and instructions for treating an uncomplicated respiratory infection through the Health Center pharmacy.

In general, medications prescribed by the staff are

provided without additional cost to students who have paid the Health Fee, except certain medications prescribed for prolonged periods. Laboratory studies, x-ray, physical therapy, and aid for emotional problems are available at the Health Center, also without additional cost.

In-Patient Clinic: The Health Center is also a hospital providing bed care for up to 65 students with serious illnesses. Usually the time lost from schoolwork is minimized if students remain on campus in the Health Center, where books and class notes are available, instead of going home to a hospital. Notification of parents and faculty is ordinarily the student's responsibility.

The details of medical problems are held in strict confidence and will be released to others only with the patient's permission. Parents are not notified when students visit the medical clinic or when students are admitted as in-patients unless a serious condition exists; for example, requiring major surgery.

Mental Health Division (5-2337): The medical clinic physicians may recommend that a student consult one of the Mental Health staff if it appears that a medical problem is partly the result of tension or anxiety; this is often the case with students who live under conditions of considerable stress. Students may make an appointment with one of the Mental Health staff, located in Machmer Hall.*All records are strictly confidential and will not be released without student authorization.*

Health Education Division (5-2492): The Division provides a broad range of activities aimed at helping students develop attitudes and behavioral patterns which will promote optimal personal and community health. It includes Room to Move (a joint health education project with Counseling and the Vice Chancellor's office), and the Peer Sex Education Program. The Division's goal is to promote physical and emotional well-being by engaging the student in a learning process that will develop positive attitudes and behavior with respect to personal and community health.

Environmental Health and Safety Division (5-2682): The Division coordinates efforts to assure a safe and healthful environment for students, visitors, and employees of the University. Areas of specialization are general safety, fire prevention, radiation protection, and environmental health.

Support Services: This division includes laboratory, X-ray, records, pharmacy, and physical therapy services.

HOUSING OFFICE
Director, Mr. J. Bruce Cochrane
235 Whitmore (5-2100)
The Housing Office supervises residence hall room assignments and room changes, maintains the master record of resident and non-resident student local addresses, and coordinates the room security deposit system. All changes of local address must be recorded with the Housing Office.

NON-RESIDENT STUDENT AFFAIRS
229 Whitmore (5-2712).
This Office coordinates all services relating to students not housed in university residence halls. During the school year, approximately one-half of the student body (predominantly graduate students) resides off campus.

During 1972-73, the Office of Non-Resident Student Affairs with the advice of the Commuter Assembly and from input received from non-resident students and married students, was reshaped to provide broader, more complete, and appropriate services for non-resident students. This Office is a center providing, either directly or indirectly, a very wide range of University resources to students residing in the community.

STUDENT ACTIVITIES
Campus Center (5-2351)
The Student Activities Office in the Campus Center is the focal point for social, community, governmental, social action, cultural, and educational enrichment activity, in addition to serving as the headquarters for Recognized Student Organizations (R.S.O.) and the Program Office. It provides resource material and counsel on program planning, organizational work and group dynamics, entertainment selection and procurement, service and aid projects for campus and community, special interest activities and recreation, as well as counsel on budgeting, purchasing, and contracting. The Student Activities Office also provides banking, bookkeeping, and auditing service for student organizations.

Participating in extracurricular activities offers opportunities to further the broader objectives of a college experience. More than 50 professional clubs on campus extend classroom interest through closer contact with members of the faculty and representatives of the professions. For those interested in communications, there are several campus publications. A wide range of social and cultural programs are coordinated through the residential colleges.

The following staff personnel may be contacted for any service or assistance needed:

Gerald F. Scanlon, Assistant Dean of Students, Coordinator of Student Activities; Sheila A. McRevey, Assistant Coordinator of Student Activities; James Riley, Jill W. Cochrane, and Dayvid Nelsun, Program Advisers; Armand H. Demers, Supervisor of R.S.O. Accounts; and Lawrence Popple, R.S.O. Accountant.

VETERANS AFFAIRS
Student Coordinators, Frank Cotter, Art Shelley
239 Whitmore (5-0803)
The Veterans Affiars Office provides assistance and coordinates paperwork for students eligible for educational benefits through the Veterans Administration, either as veterans or as children of deceased or disabled veterans. They should present certification of eligibility at registration. If already receiving benefits, they should enroll again for them.

Generally, the Veterans' office provides special assistance to the veteran in the areas of housing, part-time work, short-term loans, academic and financial counseling, disabled veterans programs, and opportunities for state and federal benefits.

Student Services

Additional student services not under the auspices of Student Affairs but which play an important role in non-academic campus life follow.

CAMPUS CENTER

Mr. Warren T. Grinnan, Manager, Room 818, Campus Center (5-0585).

The Campus Center Manager administers and coordinates the management policies of the Campus Center Complex (which includes the Student Union Building and the new Campus Center). The duties include close coordination with the Campus Center Governing Board, serving on various committees concerned with student services, and supervision of the Campus Center Complex staff and services. Major areas of responsibility include the University Store, Campus Center Food Services, Lobby and Games Area, Campus Center Overnight Accommodations, Parking Garage, Print Shop, and Conference Operations.

FOREIGN STUDENT ADVISER

Mr. John Jessup, Jr., 239 F Whitmore Administration Building (5-2843).

The Foreign Student Adviser offers assistance to foreign students, faculty, and staff, and should be consulted in all matters pertaining to their official immigration status while in the United States. In addition, the adviser may be consulted regarding any other problems which a person from another country encounters while at the University, such as housing, financial matters, and personal relations.

Summer Registration Procedure

PRE-REGISTRATION

1. Review and select courses from this Summer Session Bulletin.

2. Complete Summer Session registration form. (Residency, if applicable.) Graduate students are required to complete the special student application form also, if they are not already graduate students.

Use schedule line numbers given in the Schedule of Courses section.

3. Mail form(s) to Registrar's Office (Undergraduate, 213 Whitmore Administration Building, *or* Graduate, Graduate School, Graduate Research Center). Deadline: June 11.

4. Pay tuition and fee bill upon mail request.

5. Confirm registration on June 25, at Boyden Gymnasium.

6. Course changes received prior to June 4 will be processed. If received later, they must be taken care of on Registration Day.

7. Housing assignments are mailed directly to pre-registered students.

8. Secure Dining Commons tickets through Dining Commons representative at Boyden Gymnasium on Registration Day; or see representative at the Central Food Service, Worcester Dining Commons, after Registration Day.

9. All tuition and fee bills must be paid before attending classes.

REGISTRATION DAY — JUNE 25

(At Boyden Gymnasium, or at Registrar's Office after this date.)

1. Review and select courses from this Summer Session Bulletin and from final Schedule of Courses available at Registration.

2. Complete application forms, using schedule line numbers.

3. Have courses approved by department representatives and name insured on class roster.

4. Pay tuition and fee bills at Cashier's Office.

5. Complete housing arrangements with Housing Representative at Boyden Gymnasium on Registration Day; or at Housing Office, 235 Whitmore Administration Building, after Registration Day.

6. Complete dining arrangements, if desired, with representative at Boyden Gymnasium; or, after this date, at Worcester Dining Commons.

COURSE CHANGES

(At Boyden Gymnasium on Registration Day, or at Registrar's Office or Graduate School after Registration Day.)

1. Review and select courses from this Summer Session Bulletin and from final Schedule of Courses to be published in June.

2. Complete course add-drop form.

3. Secure departmental approval and have name insured on department roster before having the Registrar's Office review it.

4. Pay any remaining bill at Cashier's Office.

5. Deliver data processing cards to departments.

Course Description

INFORMATION FOR COURSE SELECTION—PLEASE READ CAREFULLY

The Course Descriptions and the inserted Schedule of Courses, in conjunction with the final Schedule of Courses to be printed just prior to registration, include all of the information needed to select a schedule of courses.

Numbers preceding the course titles conform to the following outline:

000-099 Non-credit courses, non-quality point courses, entrance deficiencies

100-199 Undergraduate credit only—Lower Division

200-399 Undergraduate credit only—Upper Division

399 Honors Work

400-499 Professional courses which presume a bachelor's degree

500-699 Graduate credit only; courses corresponding to 200-399 series

700-999 Graduate level courses

Two numbers preceding a course title designate a course offered for both undergraduate and graduate credit. You must sign for either graduate or undergraduate credit—not both.

The capital letters appearing in parentheses after course titles designate various categories of courses required for graduation. This designation is not necessary on the application form.

When you have selected those courses you wish to take in the Course Descriptions section of this Bulletin, proceed to the Schedule of Courses insert and find the same course, its time and location, and line number. *Specific registration instructions are listed in the Summary of Registration Procedures section in this Bulletin.*

All courses are for three credits unless otherwise indicated. In cases of specifically arranged hours, the student and instructor must agree on the number of credits to be earned. The student must indicate the desired number of credits on the application.

All undergraduate courses given under the supervision of the School of Education are graded on a Pass/Fail basis only.

Unless indicated, there are no prerequisites. Each class is 60 minutes in duration, unless otherwise specified.

Any of the following courses are subject to withdrawal if there is insufficient registration.

Inquiries concerning information not included in this Bulletin should be addressed to:

Summer Session
Office of the Provost
Whitmore Administration Building
University of Massachusetts
Amherst, Mass. 01002

Accounting

120. INTRODUCTION TO FINANCIAL ACCOUNTING.
Introduction to principles underlying the preparation of financial statements.

130. INTRODUCTION TO MANAGERIAL ACCOUNTING.
Continuation of 120. Emphasis on development and application of accounting data for planning and control.

211. BUSINESS INFORMATION SYSTEMS.
Data processing methods and design of file structures as they relate to business information systems.

The role of the accountant and manager in the design and operation of the systems. Complementary methods of providing information to management for purposes of control, planning, and decision-making.

220. FINANCIAL REPORTING I.
Intensive examination of fundamental concepts underlying financial reporting. Current literature dealing with effects of alternative methods upon measurement of periodic income.

221. FINANCIAL REPORTING II.
Continuation of 220 and an introduction to consolidated financial statements of affliated companies.

385/700. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

370. FEDERAL INCOME TAX PROCEDURE.
Federal income tax laws and regulations as they affect individuals; preparation of tax returns.

Anthropology and Archeology

104. INTRODUCTION TO CULTURAL ANTHROPOLOGY (D).
Social and cultural anthropology dealing with variations among societies in technology and economics, social and political organization, art, religion, and ideology.

370/670. NORTH AMERICAN INDIANS.
Indian tribes with various levels of technological development and social complexity, from areas north of Mexico; their environmental context; and the impact of non-Indian societies on their cultures.

380/680. FIELD COURSE IN CULTURAL ANTHROPOLOGY.
Supervised training in cultural anthropological research for the advanced undergraduate or graduate student. Location varies from year to year. Prerequisites, advanced course work in anthropology and permission of instructor. *Credit, 6.*

395/695. FIELD COURSE IN CULTURAL ANTHROPOLOGY, ST. VINCENT, W.I.
A supervised introduction to cultural anthropological field work, the foundation of a professional career in anthropology. (See Special Academic Programs.) 8 weeks in June and July *Credit, 6.*

Art

100. BASIC DRAWING (C).
Drawing in black and white, applying pencil, crayon, charcoal techniques to representation in line and tone, emphasizing sound observation and effective presentation.

115. INTRODUCTION TO ART (C).
An introduction to great works of art studied in historical sequence, including techniques and aesthetic principles.

120. BASIC DESIGN I (C).
Two-dimensional design concepts arising out of work with specific problems in a variety of media. 6 studio hours.

112. BASIC DESIGN II (C).
Continuation of Art 120. Specific 3-dimensional problems stressing the interrelationship of materials, processes, techniques, and sculptural concepts. Prerequisite, Art 120. 6 studio hours.

220/520. PAINTING I (C).
Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitations of sound composition. Prerequisites. Art 100, 120. 6 studio hours.

224/524. PAINTING III.
Continuation of Art 220. Prerequisite, Art 220. 6 studio hours.

230/530. ADVANCED DRAWING.
Investigation and development of various techniques and media with special emphasis on figure drawing. Prerequisites, Art. 100, 102. 6 studio hours.

280/580. CERAMICS I (C).
Involvement with form through the use of clay and related materials. Hand building and work on the potter's wheel stress a creative, aesthetic approach and related ceramic history. Prerequisite, Art 100 or 120.

287/587. MODERN ART, 1880 TO THE PRESENT (C).
Major artists such as Cezanne and Gauguin, Picasso, Matisse, Klee, Jackson Pollock, Optical and Pop artists. Main developments of style in relation to these artists.

385, 386, 700 - 706. SPECIAL PROBLEMS. *Credit varies.*

Asian Studies

290. INTENSIVE INTERMEDIATE CHINESE.
Advanced conversation, elementary composition, extensive reading. Increase knowledge of Chinese characters up to 1200. Daily 4 hour class. *Credit, 8.*

(Courses continued, pg. 15.)

Registration Application

Summer Session 1973

UNIVERSITY OF MASSACHUSETTS AT AMHERST

Completed applications should be returned as follows:

For undergraduate work
Registrar's Office
213 Whitmore Administration Building
University of Massachusetts
Amherst, Massachusetts 01002
(Telephone: 545-0555)

For graduate work
Graduate School Office
Graduate Research Center
University of Massachusetts
Amherst, Massachusetts 01002
(Telephone: 545-0721)

Registration Application—Summer Session 1973—Amherst

SPECIAL NOTICE— Admission to the Summer Session in no way implies admission to a regularly scheduled semester [fall or spring] of the University

PLEASE PRINT

Name _____
CZ-A05 LAST FIRST INITIAL

Home Address _____
BA1 NUMBER STREET

City _____ State _____ Zip Code _____ Home Tel. _____

Country of Citizenship _____

Summer Billing Address, if different _____ Zip Code _____ A
BA2

EDUCATIONAL RECORD

Secondary School	date

Colleges Attended	degree	dates

CHECK AND COMPLETE ONE OF THE FOLLOWING APPROPRIATE ITEMS:

☐ 1. Currently enrolled University of Massachusetts student: Campus—
☐ Amherst ☐ Boston (complete Block 1)

☐ 2. *Formerly enrolled University of Massachusetts student: Campus—
☐ Amherst ☐ Boston (Complete Block 1) Date of last attendance _____

*Note—Studente twice dismissed from the University for academic deficiency are not eligible to attend Summer Session without approval from the Board of Admissions and Records.

☐ 3. Accepted as a new University of Massachusetts student:
☐ Regular ☐ Undergraduate ☐ Graduate
☐ Accelerated Summer Freshman

☐ 4. A summer visiting student only ☐ Undergraduate (complete Block 2)
☐ Graduate (credits *not applicable* towords graduate degree at *this university.*)

UNDERGRADUATE FROM BOSTON CAMPUS BLOCK 1 This certifies that the student has been enrolled at the Boston Campus and has our approval to take courses listed. Record Clear: ☐ Yes ☐ No (If No, state nature of encumbrance)	Adviser's Signature Registrar's Signature Date

UNDERGRADUATE FROM OTHER COLLEGES BLOCK 2 This certifies that the student has been enrolled at this institution and has our approval to take the courses listed.	Name of College Signature Title Date

TENTATIVE PROGRAM OF COURSES

	Schedule Line Number	Department	Course Number	Starting Date	Credits	
Special Sessions						R
						R

	Schedule Line Number	Department	Course Number	Meeting Period	Credits	
MAIN 8 WEEK TERM						N
						N
						N
						N

REGULAR UNIVERSITY STUDENTS:

Student Number- ☐☐☐☐☐☐☐

CAMPUS- 'U'- UGrad-Amherst
'C'- Grad-Amherst
'B'- Boston Campus

CLASS ☐☐

STUDENTS NOT ENROLLED at this Univarsity in Spring 1973 or Accepted for Fall 1973

Code Boxes Appropriately:
A 1 ☐ 'G'- Graduate 'S'- Undergrad

☐ 'N'- Non-Vet 'M'- Mass. Vet 'V'- Other Vat

S Z ☐ 'M'- Male 'F'- Female

☐ 'M'- Mass. Res. 'O'- Other Stata 'F'- Foreign

☐ 'S'- Single 'M'- Married 'D'- Divorced 'W'- Widowed

☐ 'CT'- Citizen 'UN'- Not Citizen

BIRTHDATE- ☐☐ day ☐☐ month ☐☐ year

Social Security Number ☐☐☐☐☐☐☐☐☐

Major Department at your Institution- _____

A 2 0 ____ ____ ____ ____ ____ ____

RESIDENCE PLANS - Check One:

☐ Commuting from home of parent or spouse

☐ Plan to live off-campus (See regulations- Undergrads must be 21)

☐ Plan to live in Residence Hall. Roommate choice is: _____

For Office Use Only

No. Credits _____ C 2 5 ☐☐

Tuition _____

Activities _____

Health _____

Board ☐ _____

Rent ☐ _____

Campus Center _____

Total

DORM CODE ____

dis schedule listing of summer courses is tentative
id subject to change. It shows course area, number,
me, credits, section, code number needed for regis-
:ation, days of meeting, time, building and room
mber where known. Consult course listing in this
ooklet for detail of course content.

DEPT	COURSE	SCHEDULE	TITLE		CORE BLDG	CR ROOM
		SEC	NUMBER	MEETING TIMES		
-C-C-O-U-N-T-I-N-G						
CCTG	120	200004	INTRO FINAN ACCTG			3CR
	1M	200026	MTUWTHF 9.00		SBA	5
CCTG	130	200171	INTRO TO MGRL ACCTG			3CR
	1M	200193	MTUWTHF 11.30		SBA	1
CCTG	211	200343	BUS INFO SYSTEMS			3CR
	1M	200365	MTUWTHF 1.00		SBA	4A
CCTG	220	200515	FINAN RPTG I			3CR
	1M	200537	MTUWTHF 11.30		SBA	4A
CCTG	221	200682	FINAN RPTG II			3CR
	1M	200709	MTUWTHF 10.15		SBA	4A
CCTG	370	200854	FED INC TAXES			3CR
	1M	200876	MTUWTHF 10.15		SBA	5
CCTG	385	201020	SPECIAL PROBLEMS			1-3
	1M	201042	BY ARRGT			
-N-T-H-R-O-P-O-L-O-G-Y						
NTH	104	201197	INTRO CULTURAL ANTH	D		3CR
	1M	201214	MTUWTHF 9.00		HERT	231
NTH	370	201369	N AMER INDIANS	D		3CR
	1M	201381	BY ARRGT			
NTH	380	201531	FLD CRSE IN CLT ANTH			6CR
			SPEC SESS, 6/1 - 8/17 FRANCE			
	1C	201553	BY ARRGT			
NTH	385	201703	SPECIAL PROBLEMS			1-6
	1M	201725	BY ARRGT			
NTH	395	201870	W. INDIES FLD SCHOOL			6CR
			SPEC SESS, 6/4 - 7/27 IN W. INDIES			
	1D	201892	BY ARRGT			
NTH	670	202046	N AMER INDIANS			3CR
	1M	202068	BY ARRGT			
NTH	680	202218	FLD CRSE IN CLT ANTH			6CR
			SPEC SESS, 6/1 - 8/17 IN FRANCE			
	1C	202230	BY ARRGT			
NTH	695	202385	W. INDIES FLD SCHOOL			6CR
			SPEC SESS, 6/4 - 7/27 W. INDIES			
	1D	202402	BY ARRGT			
NTH	700	202557	SPECIAL PROBLEMS			1-6
	1M	202579	BY ARRGT			
A-R-T						
ART	100	202729	BASIC DRAWING	C		3CR
	1M	202741	MTUW 7.45-10.00		BART	225
			THF 7.45-10.00		BART	225
ART	115	202896	INTRO TO ART	C		3CR
	1M	202913	MTUWTHF 11.30		HERT	231
ART	120	203062	BASIC DESIGN I	C		3CR
	1M	203084	MTUW 1.00-3.15		MARX	6
			THF 1.00-3.15		MARX	6
ART	122	203234	BASIC DESIGN II	C		3CR
	1M	203256	MTUW 9.00-11.15		MARX	6
			THF 9.00-11.15		MARX	6
ART	220	203406	PAINTING I	C		3CR
	1M	203428	MTUW 1.00-3.15		CLRK	202
			THF 1.00-3.15		CLRK	202
ART	224	203573	PAINTING III			3CR
	1M	203595	MTUW 1.00-3.15		CLRK	202
			THF 1.00-3.15		CLRK	202
ART	230	203745	ADVANCED DRAWING			3CR
	1M	203767	MTUW 10.15-12.30		BART	225
			THF 10.15-12.30		BART	225
ART	280	203917	CERAMICS I	C		3CR
	1M	203939	MTUW 7.45-10.00		MUNX	1
			THF 7.45-10.00		MUNX	1
ART	287	204088	MOD ART 1880-PRESENT	C		3CR
	1M	204105	MTUWTHF 10.15		HERT	231
ART	385	204250	SPECIAL PROBLEMS			1-3
	1M	204272	BY ARRGT			
ART	386	204422	SPECIAL PROBLEMS			1-6
	1M	204444	BY ARRGT			
ART	520	204599	PAINTING I			3CR
	1M	204616	MTUW 1.00-3.15		CLRK	202
			THF 1.00-3.15		CLRK	202
ART	524	204761	PAINTING III			3CR
	1M	204783	MTUW 1.00-3.15		CLRK	202
			THF 1.00-3.15		CLRK	202
ART	530	204933	ADVANCED DRAWING			3CR
	1M	204955	MTUW 10.15-12.30		BART	225
			THF 10.15-12.30		BART	225
ART	580	205109	CERAMICS I			3CR
	1M	205121	MTUW 7.45-10.00		MUNX	1
			THF 7.45-10.00		MUNX	1
ART	587	205276	MOD ART 1880-PRESENT			3CR
	1M	205298	MTUWTHF 10.15		HERT	231
ART	700	205448	SPECIAL PROBLEMS			3CR
	1M	205460	BY ARRGT			
ART	701	205610	SPECIAL PROBLEMS			3CR
	1M	205632	BY ARRGT			
ART	702	205787	SPECIAL PROBLEMS			3CR
	1M	205804	BY ARRGT			
ART	703	205959	SPECIAL PROBLEMS			3CR
	1M	205971	BY ARRGT			
ART	704	206125	SPECIAL PROBLEMS			3CR
	1M	206147	BY ARRGT			
ART	705	206292	SPECIAL PROBLEMS			3CR
	1M	206319	BY ARRGT			
ART	706	206464	SPECIAL PROBLEMS			3-6
	1M	206486	BY ARRGT			
A-S-T-R-O-N-O-M-Y						
ASTRON	100	206636	EXPLORING UNIVERSE	E		3CR
LEC	1M	206658	MTUWTHF 9.00		HAS	134
LAB	1M	206753	TU 21.00-22.30		HAS	138
	2M	206775	W 21.00-22.30		HAS	138
	3M	206797	TH 21.00-22.30		HAS	138
B-I-O-C-H-E-M-I-S-T-R-Y						
BIOCHM	220	206947	ELEMENTARY BIOCHEM	E		3CR
	1M	206969	MTUWTHF 9.00		TWR1	203
BIOCHM	385	207113	SPECIAL PROBLEMS			1-6
	1M	207135	BY ARRGT			
BIOCHM	700	207280	SPECIAL PROBLEMS			1-6
	1M	207307	BY ARRGT			
B-O-T-A-N-Y						
BOTANY	175	207452	GENETICS & EVOL	E		3CR
	1M	207474	MTUWTHF 10.15		MOR	203
BOTANY	211	207624	PLANT PHYSIOLOGY			4CR
	1M	207646	MTUWTHF 11.30		MOR	203
BOTANY	385	207791	SPECIAL PROBLEMS			5CR
	1M	207818	BY ARRGT			
BOTANY	700	207963	SPECIAL PROBLEMS			5CR
	1M	207985	BY ARRGT			

DEPT	COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE BLDG	CR ROOM
C-I-V-I-L E-N-G-I-N					
C E	140	208139	STATICS		3CR
			SAME AS M&A E 144		
	1M	208151	MTUWTHF 9.00	MRST	134
C E	141	208301	STRENGTH OF MATL I		3CR
			SAME AS M&A E 145		
	1M	208323	MTUWTHF 10.15	MRST	134
C E	142	208478	DYNAMICS		3CR
			SAME AS M&A E 246		
	1M	208490	MTUWTHF 7.45	MRST	134
C E	257	208640	ELEM FLUID MECH		3CR
			SAME AS M&A E 265		
	1M	208662	MTUWTHF 7.45	MRST	132
C E	385	208812	SPECIAL PROBLEMS		3CR
	1M	208834	BY ARRGT		
C E	700	208989	SPECIAL PROBLEMS		3CR
	1M	209000	BY ARRGT		
C-H-E-M-I-C-A-L E-N-G-I-N					
CH E	125	209155	FUNDAMENTALS		3CR
	1M	209177	MTUWTHF 9.00	GOES	157
CH E	126	209327	CH E THERMODYNA		3CR
	1M	209349	MTUWTHF 10.15	GOES	157
CH E	385	209494	SPECIAL PROBLEMS		1-3
	1M	209511	BY ARRGT		
CH E	700	209666	SPECIAL PROBLEMS		1-3
	1M	209688	BY ARRGT		
C-H-E-M-I-S-T-R-Y					
CHEM	110	209838	GEN CHEM	E	4CR
LEC	1M	209850	MTUWTHF 9.00	GOES	PET
LAB	1M	209955	TUTH 1.00-3.15		
CHEM	111	210102	GEN CHEM (SCI)	E	3CR
LEC	1M	210124	MTUWTHF 10.15	GOES	PET
LAB	1M	210229	MW 1.00-3.15		
	2M	210241	TUTH 1.00-3.15		
CHEM	112	210396	GEN CHEM (SCI)	E	3CR
LEC	1M	210413	MTUWTHF 11.30	GOES	PET
LAB	1M	210518	MW 1.00-3.15		
CHEM	160	210663	ORGANIC CHEMISTRY	E	3CR
	1M	210685	MTUWTHF 9.00	TWR1	101
CHEM	162	210835	ORGANIC CHEM LAB		1CR
	1M	210857	MW 1.00-4.30		
CHEM	262	211001	ORGANIC (NON-MAJ)	E	3CR
	1M	211023	MTUWTHF 10.15	TWR1	101
CHEM	264	211178	ORGANIC LAB (NONMAJ)		1CR
	1M	211190	TUTH 1.00-4.30		
CHEM	385	211340	SPECIAL PROBLEMS		1-3
	1M	211362	BY ARRGT		
CHEM	562	211512	ORGANIC (NON-MAJ)		3CR
	1M	211534	MTUWTHF 10.15	TWR1	101
CHEM	564	211689	ORGANIC LAB (NONMAJ)		1CR
	1M	211706	TUTH 1.00-4.30		
CHEM	700	211851	SPECIAL PROBLEMS		1-3
	1M	211873	BY ARRGT		
C-H-I-N-E-S-E					
CHINSE	290	212027	INTENS INTERMED CHIN		8CR
	1M	212049	MTUWTHF 9.00-12.00		
C-L-A-S-S-I-C-S					
CLSICS	610	212194	STUDENT TEACHING		1-12
	1M	212211	BY ARRGT		
CLSICS	700	212366	SPECIAL PROBLEMS		1-3
	1M	212388	BY ARRGT		
CLSICS	701	212538	THE ROMAN CITY		3-6
	1M	212550	BY ARRGT		
C-O-M-P-U-T-E-R & I-N-F S-C-I-E-N-C-E					
COINS	122	212700	INTR PRB SOLV W/COMP		3CR
	1M	212722	MTUWTHF 9.00	GRES	203
COINS	133	212877	COMP CONCP PROG LANG		3CR
	1M	212899	MTUWTHF 10.15	GRES	203
COINS	223	213043	MACH & ASSEMBLY LANG		3CR
	1M	213065	MTUWTHF 11.30	GRES	203
COINS	385	213215	SPECIAL PROBLEMS		1-3
	1M	213237	BY ARRGT		
COINS	409	213382	INTR PRB SOLV W/COMP		3CR
	1M	213409	MTUWTHF 9.00	GRES	203
COINS	523	213554	MACH & ASSEMBLY LANG		3CR
	1M	213576	MTUWTHF 11.30	GRES	203
COINS	700	213726	SPECIAL PROBLEMS		1-3
	1M	213748	BY ARRGT		
COINS	701	213893	ADV TOPCS COMP SCI		6CR
	1M	213910	BY ARRGT		
COINS	790	214069	COINS SEMINAR		2-3
	1M	214081	BY ARRGT		
C-O-M-P-A-R-A-T-I-V-E L-I-T-E-R-A-T-U-R-E					
COMLIT	203	214231	EUROPEAN NOVEL	C	3CR
	1M	214253	MTUWTHF 9.00	HERT	102
COMLIT	385	214403	SPECIAL PROBLEMS		3CR
	1M	214425	BY ARRGT		
COMLIT	700	214570	SPECIAL PROBLEMS		3CR
	1M	214592	BY ARRGT		
E-L-E-C-T & C-O-M-P E-N-G-I-N-E-E-R					
ECE	141	214742	SYST ANALYSIS I		4CR
LEC	1M	214764	MTUWTHF 9.00	ENGE	104
LAB	1M	214869	BY ARRGT		
ECE	275	215013	ADV LAB I		2CR
	1M	215035	BY ARRGT		
ECE	276	215180	ADV LAB II		3CR
	1M	215207	BY ARRGT		
ECE	385	215352	SPECIAL PROBLEMS		3CR
	1M	215374	BY ARRGT		
ECE	700	215524	SPECIAL PROBLEMS		3CR
	1M	215546	BY ARRGT		
E-C-O-N-O-M-I-C-S					
ECON	103	215691	INTRO TO MICROECON	D	3CR
	1M	215718	MTUWTHF 9.00	HERT	118
ECON	104	215863	INTRO TO MACROECON	D	3CR
	1M	215885	MTUWTHF 9.00	MACH	W-13
ECON	203	216039	INTERMED MICROEC TH	D	3CR
	1M	216051	MTUWTHF 11.30	HERT	118
ECON	204	216201	INTERMED MACROEC TH	D	3CR
	1M	216223	MTUWTHF 11.30	MACH	W-13
ECON	385	216378	SPECIAL PROBLEMS		3CR
	1M	216390	BY ARRGT		
ECON	503	216540	INTERMED MICROEC TH		3CR
	1M	216562	MTUWTHF 11.30	HERT	118
ECON	504	216712	INTERMED MACROEC TH		3CR
	1M	216734	MTUWTHF 11.30	MACH	W-13
ECON	700	216889	SPECIAL PROBLEMS		1-3
	1M	216906	BY ARRGT		
E-D-U-C-A-T-I-O-N					
EDUC	227	217055	INTERNATIONAL EDUC		3CR
	1M	217077	MTUWTHF 9.00	GRES	208
EDUC	251	217227	FOUNDATIONS OF EDUC		3CR
	1M	217249	MTUWTHF 9.00	GRES	309
	2M	217261	MTUWTHF 10.15	GRES	309
EDUC	257	217411	INTRO TO URBAN EDUC		3CR
	1M	217433	MTUWTHF 9.00	TWR1	103
EDUC	258	217588	ADV METH IN URBAN ED		3CR
	1M	217605	MTUWTHF 10.15	TWR1	204

COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE BLDG	CR ROOM
277	217750	PRIN OF SCH GUIDANCE		3CR
1M	217772	MTUWTHF 10.15	GRES	208
291	217922	ERLY CHILDHD ED MOVT		3CR
1M	217944	MTUWTHF 11.30	GRES	309
309	218093	METH SCNDRY SCH ENGL		3CR
1M	218110	MTUWTHF 9.00	MOR4	404
310	218265	METH TCH SEC SOC/STD		3CR
1M	218287	MTUWTHF 7.45	HERT	225
312	218437	METH TCH SECNDRY SCI		3CR
1M	218459	MTUWTHF 7.45	HERT	117
355	218609	EDUC STATISTICS I		3CR
1M	218621	MTUWTHF 9.00	TWR1	204
385	218776	PRACTICUM		1-6
1M	218798	BY ARRGT		
386A	218948	SP PROB/FLEX CUR TOP		1-3
1M	218960	BY ARRGT		
386B	219114	SP PROB/LOGIS & AEST		3CR
1M	219136	MTUWTHF 1.00	HERT	111
386C	219281	SP PROB/MULTI ARTS		3-5
1M	219308	TUTH 1.00-5.00	HERT	110
386D	219453	SP PR/PRE-PR ED FLMS		3CR
1M	219475	MTUWTHF 9.00	GRES	308
386E	219625	SP/PRES-DIAG INS SYS		3CR
1M	219647	TUW 1.00-4.00	GRES	349
386F	219792	SP/WK MNPWR & ED POL		4CR
1M	219819	MTUWTHF 9.00	HERT	112
386G	219964	SP PROB/CAREER EDUC		3CR
1M	219986	BY ARRGT		
386H	220133	SP PR/CMPTR LAB STAT		2CR
1M	220155	MTUWTHF 10.15	GRES	349
386I	220305	SP/RSRCH NON-RSH MAJ		3CR
1M	220327	MTUWTHF 10.15	GRES	308
386J	220472	SP PR/MICRO-TCHG LAB SPECIAL SESSION, 7/2 - 7/27		3CR
1H	220494	MTUW 10.15-12.15 THF 10.15-12.15	TWR1 TWR1	203 203
386L	220644	SP/TCHG & FOR LANG SPEC SESSION, 6/26 - 7/20		3CR
1G	220666	MTUWTHF 9.00-11.00	TWR1	201
386M	220816	SP/CUR BLDG INTEGRAT SPEC SESSION, MEETS 6/26 - 7/20		3CR
1G	220838	MTUWTHF 11.00-1.00	TWR1	103
386N	220983	SP/MIN RSRCE TCHG		3CR
1M	221004	MTUWTHF 10.15	HERT	110
386O	221159	SP PROB/CONFLUENT ED		3CR
1M	221171	MTUWTHF 11.30	GRES	208
386R	221321	SP/ELEM METH POTPOUR		1-6
1M	221343	BY ARRGT		
386S	221498	SP/COL ED KIBBUTZ SO		3CR
1M	221515	MTUWTHF 10.15		
386T	221660	SP/NW METH TCH MATH1 SPEC SESSION , 6/26 - 7/17		1CR
1G	221682	TUW 2.15-5.00		
386U	221832	SP/METH TCH MATH, II SPECIAL SESSION, 7/24 - 8/8		1CR
1L	221854	TUW 2.15-5.00		
391	222008	INDEPENDENT STUDY		1-6
1M	222020	BY ARRGT		
527	222175	INTERNATIONAL EDUC		3CR
1M	222197	MTUWTHF 9.00	GRES	208
551	222347	FOUNDATIONS OF EDUC		3CR
1M	222369	MTUWTHF 9.00	GRES	309
2M	222381	MTUWTHF 10.15	GRES	309
557	222531	INTRO TO URBAN EDUC		3CR
1M	222553	MTUWTHF 9.00	TWR1	103
558	222703	ADV METH IN URBAN ED		3CR
1M	222725	MTUWTHF 10.15	TWR1	204
577	222870	PRIN OF SCH GUIDANCE		3CR
1M	222892	MTUWTHF 10.15	GRES	208
591	223046	ERLY CHILDHD ED MOVT		3CR
1M	223068	MTUWTHF 11.30	GRES	309
609	223218	METH SCNDRY SCH ENGL		3CR
1M	223230	MTUWTHF 9.00	MOR4	404

DEPT COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE BLDG	CR ROOM
EDUC 610	223385	METH TCH SEC SOC/STD		3CR
1M	223402	MTUWTHF 7.45	HERT	225
EDUC 612	223557	METH TCH SECNDRY SCI		3CR
1M	223579	MTUWTHF 7.45	HERT	117
EDUC 655	223729	EDUC STATISTICS I		3CR
1M	223741	MTUWTHF 9.00	TWR1	204
EDUC 685	223896	PRACTICUM		1-6
1M	223913	BY ARRGT		
EDUC 686A	224062	SP PROB/FLEX CUR TOP		1-3
1M	224084	BY ARRGT		
EDUC 686B	224234	SP PROB/LOGIS & AEST		3CR
1M	224256	MTUWTHF 1.00	HERT	111
EDUC 686C	224406	SP PROB/MULTI ARTS		3-5
1M	224428	TUTH 1.00-5.00	HERT	110
EDUC 686D	224573	SP PR/PRE-PR ED FLMS		3CR
1M	224595	MTUWTHF 9.00	GRES	308
EDUC 686E	224745	SP/PRES-DIAG INS SYS		3CR
1M	224767	TUW 1.00-4.00	GRES	349
EDUC 686F	224917	SP/WK MNPWR & ED POL		4CR
1M	224939	MTUWTHF 9.00	HERT	112
EDUC 686G	225088	SP PROB/CAREER EDUC		3CR
1M	225105	BY ARRGT		
EDUC 686H	225250	SP PR/CMPTR LAB STAT		2CR
1M	225272	MTUWTHF 10.15	GRES	349
EDUC 686I	225422	SP/RSRCH NON-RSH MAJ		3CR
1M	225444	MTUWTHF 10.15	GRES	308
EDUC 686J	225599	SP PR/MICRO-TCHG LAB SPEC SESSION, 7/2 - 7/27		3CR
1H	225616	MTUW 10.15-12.15 THF 10.15-12.15	TWR1 TWR1	203 203
EDUC 686L	225761	SP/TCHG & FOR LANG SPEC SESSION, 6/26 - 7/20		3CR
1G	225783	MTUWTHF 9.00-11.00	TWR1	201
EDUC 686M	225933	SP/CUR BLDG INTEGRAT SPEC SESSION, 6/26 - 7/20		3CR
1G	225955	MTUWTHF 11.00-1.00	TWR1	103
EDUC 686N	226109	SP/MIN RSRCE TCHG		3CR
1M	226121	MTUWTHF 10.15	HERT	110
EDUC 686O	226276	SP PROB/CONFLUENT ED		3CR
1M	226298	MTUWTHF 11.30	GRES	208
EDUC 686P	226448	SP PROB/TCHG YNG CHD		3CR
1M	226460	MTUWTHF 9.00-11.15	GRES	301
EDUC 686Q	226610	SP PROB/TCHG YNG CHD		3CR
1M	226632	MTUWTHF 1.00-4.00	GRES	301
EDUC 686R	226787	SP/ELEM METH POTPOUR		1-6
1M	226804	BY ARRGT		
EDUC 686S	226959	SP/COL ED KIBBUTZ SO		3CR
1M	226971	MTUWTHF 10.15		
EDUC 686T	227125	SP/NW METH TCH MATH1 SPEC SESSION, 6/26 - 7/17		1CR
1G	227147	TUW 2.15-5.00		
EDUC 686U	227292	SP/METH TCH MATH, II SPECIAL SESSION, 7/24 - 8/8		1CR
1L	227319	TUW 2.15-5.00		
EDUC 702	227464	INDEPENDENT STUDY		1-6
1M	227486	BY ARRGT		
EDUC 910	227636	SCH COUNSELNG THRIES		3CR
1M	227658	MTUTH 9.00 W 9.00-11.00	GRES GRES	307 307
EDUC 915	227808	GROUP ACTIVITIES MID P.M. 6/27-7/3, EVES 7/10-7/17		3CR
1N	227820	BY ARRGT		
2N	227842	BY ARRGT		
EDUC 950	227997	FNDMNTLS OF ED ADMIN		3CR
1M	228018	MW 7.45-10.00 F 7.45	GRES GRES	349 349
EDUC 951	228163	PRIN & METH SUPERVSN		3CR
1M	228185	MTUWTHF 7.45	GRES	307

E-N-G-I-N-E-E-R-I-N-G

ENGIN 104	228335	INTRO TO ENGR B		1-4
1M	228357	MTUWTHF 10.15	ENGE	104

DEPT	COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE	BLDG	CR ROOM
ENGIN	385	228507-SPECIAL PROBLEMS				1-4
	1M	228529 BY ARRGT				
E-N-G-L-I-S-H						
ENGL	152	228674-READING FICTION		C		3CR
	1M	228696 MTUWTHF 9.00			HERT	204
ENGL	221	228846-SHAKESPEARE		C		3CR
	1M	228868 MTUWTHF 10.15			HERT	205
ENGL	360	229012-THE ENGLISH LYRIC		C		3CR
	1M	229034 MTUWTHF 10.15			HERT	204
ENGL	362	229189-TRAGIC DRAMA		C		3CR
	1M	229206 MTUWTHF 1.00			HERT	205
ENGL	382	229351-INDIVID BRIT AUTHORS		C		3CR
	1M	229373 MTUWTHF 9.00			HERT	205
ENGL	384	229523-INDIVID AMER AUTHORS		C		3CR
	1M	229545 MTUWTHF 11.30			HERT	205
ENGL	385	229690-SPECIAL PROBLEMS				1-3
	1M	229717 BY ARRGT				
ENGL	391	229862-SEMINAR				3CR
	1M	229884 TUTH 8.45-11.15			HERT	106
ENGL	700	230031-SPECIAL PROBLEMS				3CR
	1M	230053 BY ARRGT				
ENGL	708	230203-CHAUCER				3CR
	1M	230225 MTUWTHF 11.30			HERT	204
ENGL	737	230370-LITERATURE OF 17TH		C		3CR
	1M	230392 MTUWTHF 9.00			HERT	116
ENGL	745	230542-LIT OF ROMANTIC PERD				3CR
	1M	230564 MTUWTHF 10.15			HERT	116
E-N-T-O-M-O-L-O-G-Y						
ENT	126	230714-GENERAL ENTOMOLOGY		E		3CR
LEC	1M	230736 MWF 10.15-11.30			FERN	H-2
LAB	1M	230831 MW 1.00-4.30			FERN	H-2
ENT	385	230986-SPECIAL PROBLEMS				1-6
	1M	231007 BY ARRGT				
ENT	700	231152-SPECIAL PROBLEMS				1-6
	1M	231174 BY ARRGT				
E-X-E-R-C-I-S-E S-C-I-E-N-C-E						
EXCSCI	278	231324-EXERCISE PHYSIOLOGY				3CR
	1M	231346 MTUWTHF 11.30			BOYD	248
EXCSCI	813	231491-MEAS TH/HUM MVT RES				3CR
	1M	231518 MTUWTHF 9.00				
EXCSCI	823	231663-EXPMNTL EXERC PHYSIO				3CR
	1M	231685 MTUWTHF 7.45				
EXCSCI	843	231835-NEUROMUSCULR FATIGUE				3CR
	1M	231857 MTUWTHF 10.15				
F-O-R-E-S-T-R-Y						
FOREST	225	232001-MENSURATION				3CR
		SPECIAL SESSION, MEETS 5/29-6/15				
	1P	232023 MTUWTHF 8.00-5.00		HOLD		302
		MTUWTHF 8.00-5.00		HOLD		305
FOREST	385	232178-SPECIAL PROBLEMS				1-3
	1M	232190 BY ARRGT				
FOREST	525	232340-MENSURATION				3CR
		SPECIAL SESSION, MEETS 5/29-6/15				
	1P	232362 MTUWTHF 8.00-5.00		HOLD		302
		MTUWTHF 8.00-5.00		HOLD		305
FOREST	700	232512-SPECIAL PROBLEMS				1-3
	1M	232534 BY ARRGT				
F-R-E-N-C-H						
FRENCH	123	232689-INTENSIV REVIEW				3CR
LEC	1M	232706 MTUWTHF 7.45			HERT	113
LAB	1M	232801 MTUWTHF 10.15			HERT	E
FRENCH	130	232956-INTERMED FRENCH				3CR
	1M	232978 MTUWTHF 9.00			SBA	105
FRENCH	144	233122-INTERM FICTION		C		3CR
	1M	233144 MTUWTHF 9.00			SBA	102
FRENCH	359	233299-FR THEATR-20TH C				3CR
	1M	233316 MTUWTHF 9.00			HERT	108
FRENCH	385	233461-SPECIAL PROBLEMS				3CR
		PERMISSION REQUIRED/DEPT HEAD				
	1M	233483 BY ARRGT				
FRENCH	470	233633-GRADUATE READINGS				OCR
	1M	233655 MTUWTHF 9.00			HICK	14
FRENCH	659	233805-20TH C. THEATRE				3CR
	1M	233827 MTUWTHF 9.00			HERT	102
FRENCH	700	233972-SPECIAL PROBLEMS				3CR
		PRMSSN REQ/BENJAMIN ROUNTREE				
	1M	233994 BY ARRGT				
G-E-N B-U-S & F-I-N-A-N-C-E						
GB FIN	201	234148-CORPORATION FINANCE				3CR
	1M	234160 MTUWTHF 7.45			SBA	107
G-E-N B-U-S-I-N-E-S-S						
GENBUS	250	234310-ADMINISTRATIVE STAT				3CR
	1M	234332 MTUWTHF 7.45			SBA	108
GENBUS	260	234487-LAW I				3CR
	1M	234504 MTUWTHF 1.00			SBA	103
GENBUS	264	234659-LAW OF URBAN DEV				3CR
	1M	234671 MTUWTHF 10.15			SBA	103
GENBUS	265	234821-BUS & ITS ENVIRONMNT				3CR
	1M	234843 MTUWTHF 9.00			SBA	107
GENBUS	270	234998-REAL ESTATE				3CR
	1M	235019 MTUWTHF 11.30			SBA	108
GENBUS	272	235164-SEM URBAN STUDIES				3CR
	1M	235186 MTUWTHF 10.15			SBA	108
GENBUS	385	235336-IND STUDY & RESEARCH				1-
	1M	235358 BY ARRGT				
G-E-O-G-R-A-P-H-Y						
GEOG	155	235508-INTRO TO HUMAN GEOG		D		3CR
	1M	235520 MTUWTHF 9.00			MOR4	401
GEOG	385	235675-SPECIAL PROBLEMS				3CR
	1M	235697 BY ARRGT				
G-E-O-L-O-G-Y						
GEOL	101	235847-PHYSICAL GEOLOGY		E		3CR
LEC	1M	235869 MTUWTHF 9.00			MOR4	161
LAB	1M	235964 MW 1.00-5.00			MOR	134
GEOL	388	236118-SPECIAL PROBLEMS				1-
	1M	236130 BY ARRGT				
GEOL	389	236285-FIELD PROBLEMS				2-
	1M	236302 BY ARRGT				
GEOL	700	236457-SPECIAL PROBLEMS				1-
	1M	236479 BY ARRGT				
G-E-R-M-A-N						
GERMAN	110	236629-ELEM GERMAN				3CR
	1M	236641 MTUWTHF 9.00			HERT	114
GERMAN	126	236796-INTENS ELEM GERMAN				6CR
	1M	236813 MTUW 10.15-12.00			HERT	117
		THF 10.15-12.00			HERT	117
GERMAN	161	236968-READINGS IN GERM LIT		C		3CR
	1M	236980 MTUWTHF 10.15			HERT	546
GERMAN	385	237134-SPECIAL PROBLEMS				1-
	1M	237156 BY ARRGT				
GERMAN	409	237306-GRAD ROG COURSE				OCR
	1M	237328 MTUWTHF 9.00			HERT	117
	2M	237340 MTUWTHF 1.00			HERT	117
GERMAN	700	237495-SPECIAL PROBLEMS				1-
	1M	237512 BY ARRGT				
G-R-E-E-K						
GREEK	700	237667-SPECIAL PROBLEMS				1-
	1M	237689 BY ARRGT				

DEPT	COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE BLDG	CR ROOM
H-O-M-E	E-C-O-N-O-M-I-C-S	E-D-U-C			
HEED	685	237839-SP/MGT & FAMLY ECON SPECIAL SESSION, 7/9 - 7/27			3CR
	1J	237851 MTUWTH 9.00-12.00	SK		205
HEED	700	238005-SPECIAL PROBLEMS SPECIAL SESSION, 6/26 - 7/20			3-6
	1G	238027 BY ARRGT			
H-I-S-T-O-R-Y					
HIST	100	238172-WEST THOT TO 1600	C		3CR
	1M	238194 MTUWTHF 2.15	HERT		210
HIST	121	238344-LATIN AMERICAN CIVIL	C		3CR
	1M	238366 MTUWTHF 1.00	HERT		210
HIST	150	238516-DEV AMER CIV TO 1876	C		3CR
	1M	238538 MTUWTHF 9.00	HERT		210
HIST	151	238683-DEV AMER CIV 1876 ON	C		3CR
	1M	238700 MTUWTHF 10.15	HERT		206
HIST	215	238855-HISTORY OF RUSSIA	C		3CR
	1M	238877 MTUWTHF 11.30	HERT		206
HIST	332	239021-THE SOUTH IN AM HIST	C		3CR
	1M	239043 MTUWTHF 11.30	HERT		210
HIST	339	239198-US SINCE PEARL HARB	C		3CR
	1M	239215 MTUWTHF 9.00	HERT		206
HIST	385	239360-SPECIAL PROBLEMS			3CR
	1M	239382 BY ARRGT			
HIST	390	239532-CONTEMPORARY U S	C		3CR
	1M	239554 MTUWTHF 10.15	HERT		210
HIST	515	239704-HISTORY OF RUSSIA			3CR
	1M	239726 MTUWTHF 11.30	HERT		206
HIST	632	239871-THE SOUTH IN AM HIST			3CR
	1M	239893 MTUWTHF 11.30	HERT		210
HIST	639	240040-US SINCE PEARL HARB			3CR
	1M	240062 MTUWTHF 9.00	HERT		206
HIST	700	240212-SPECIAL PROBLEMS			4CR
	1M	240234 BY ARRGT			
HIST	738	240389-TOP U.S. INTELL HIST			4CR
	1M	240406 MTUWTHF 2.15	HERT		201
H-U-M-A-N	D-E-V-E-L-O-P-M-E-N-T				
HUMDEV	270	240551-CHILD DEVELOPMENT			3CR
	1M	240573 MW 9.00-11.30	MOR4		403
HUMDEV	381	240723-LAB SCHOOL MGT			3CR
	1M	240745 BY ARRGT			
HUMDEV	383	240890-STUDENT TEACHING			6CR
	1M	240917 BY ARRGT			
HUMDEV	384	241066-INTERN CHILD-SER PRO			3CR
	1M	241088 BY ARRGT			
HUMDEV	385	241238-SPECIAL PROBLEMS			3CR
	1M	241250 BY ARRGT			
HUMDEV	385J	241400-SPECIAL PROBLEMS			3CR
	1M	241422 BY ARRGT			
HUMDEV	385K	241577-SPECIAL PROBLEMS			3CR
	1M	241599 BY ARRGT			
HUMDEV	385L	241749-SPECIAL PROBLEMS			3CR
	1M	241761 BY ARRGT			
HUMDEV	570	241911-CHILD DEVELOPMENT			3CR
	1M	241933 MW 9.00-11.30	MOR4		403
HUMDEV	700	242082-SPECIAL PROBLEMS			3-6
	1M	242109 BY ARRGT			
I-N-D-U-S-T-R-I-A-L	E-N-G-I-N-E-E-R				
I E	256	242254-DATA PR & INFO HAND			3CR
	1M	242276 MTUWTHF 9.00	MRST		126
I E	260	242426-DES MAN-MACH SYS I			3CR
	1M	242448 MTUWTHF 10.15	MRST		126
I E	271	242593-BASIC PROB FOR ENGRS			3CR
	1M	242610 MTUWTHF 7.45	MRST		126
I E	385	242765-SPECIAL PROBLEMS			3CR
	1M	242787 BY ARRGT			
I E	556	242937-DATA PR & INFO HAND			3CR
	1M	242959 MTUWTHF 9.00	MRST		126
I E	560	243103-DES MAN-MACH SYS I			3CR
	1M	243125 MTUWTHF 10.15	MRST		126
I E	571	243270-BASIC PROB FOR ENGRS			3CR
	1M	243292 MTUWTHF 7.45	MRST		126
I E	700	243442-SPECIAL PROBLEMS			3CR
	1M	243464 BY ARRGT			
I-T-A-L-I-A-N					
ITAL	126	243614-INTENS ELEM ITALIAN			6CR
	1M	243636 MTUWTHF 7.45	HERT		108
		MTUWTHF 10.15	HERT		108
ITAL	385	243781-SPECIAL PROBLEMS			1-3
	1M	243808 BY ARRGT			
ITAL	700	243953-SPECIAL PROBLEMS			1-3
	1M	243975 BY ARRGT			
L-A-T-I-N					
LATIN	610	244129-STUDENT TEACHING			1-12
	1M	244141 BY ARRGT			
LATIN	700	244296-SPECIAL PROBLEMS			1-3
	1M	244313 BY ARRGT			
M-E-C-H-A-N-I-C-A-L	E-N-G-I-N-E-E-R				
M&A E	144	244468-MECHANICS I SAME AS C E 140			3CR
	1M	244480 MTUWTHF 9.00	MRST		134
M&A E	145	244630-MECHANICS II SAME AS C E 141			3CR
	1M	244652 MTUWTHF 10.15	MRST		134
M&A E	163	244802-THERMODYNAMICS			3CR
	1M	244824 MTUWTHF 10.15	GUN		10
M&A E	246	244979-MECHANICS III SAME AS C E 142			3CR
	1M	244991 MTUWTHF 7.45	MRST		134
M&A E	264	245145-THERMODYNAMICS II			3CR
	1M	245167 MTUWTHF 9.00	GUN		10
M&A E	265	245317-FLUID MECHANICS SAME AS C E 247			3CR
	1M	245339 MTUWTHF 7.45	MRST		132
M&A E	385	245484-SPECIAL PROBLEMS			1-3
	1M	245501 BY ARRGT			
M&A E	700	245656-SPECIAL PROBLEMS			1-6
	1M	245678 BY ARRGT			
M&A E	702	245828-THERMODYNAMICS			3CR
	1M	245840 MTUWTHF 10.15	GUN		11
M&A E	790	245995-ENGINEERING PROJECT			3-
	1M	246016 BY ARRGT			
M-A-T-H-E-M-A-T-I-C-S					
MATH	100	246161-MATH IN MOD WORLD	E		3CR
	1M	246183 MTUWTHF 7.45	GRES		201
MATH	110	246333-ELEM TECH MATH	E		3
	1M	246355 MTUWTHF 7.45	GRES		21
	2M	246377 MTUWTHF 11.30	GRES		201
MATH	115	246527-ELEM LIN ALG	E		
	1M	246549 MTUWTHF 11.30	GRES		
MATH	116	246694-BUSINESS CALC I	E		3CR
	1M	246711 MTUWTHF 9.00	GRES		201
MATH	117	246866-BUSINESS CALC II	E		3CR
	1M	246888 MTUWTHF 9.00	GRES		210
MATH	127	247032-CALC LIFE-SOC SCI I	E		3CR
	1M	247054 MTUWTHF 11.30	TWR1		206
MATH	130	247204-PRECALC MATH	E		3CR
	1M	247226 MTUWTHF 7.45	TWR1		206
	2M	247248 MTUWTHF 9.00	TWR1		206
	3M	247260 MTUWTHF 10.15	TWR1		206
MATH	135	247410-CALCULUS I	E		3CR
	1M	247432 MTUWTHF 10.15	GRES		201
MATH	136	247587-CALCULUS II	E		3CR
	1M	247604 MTUWTHF 10.15	GRES		210
MATH	165	247759-MULTIVAR CALCULUS	E		3CR
	1M	247771 MTUWTHF 10.15	GRES		311

DEPT	COURSE	SCHEDULE	TITLE		CORE	CR
	SEC	NUMBER	MEETING TIMES		BLDG	ROOM
MATH	241	247921	APPL ANAL I			3CR
	1M	247943	MTUWTHF 11.30		GRES	311
MATH	385	248092	SPECIAL PROBLEMS			1-3
	1M	248119	BY ARRGT			
MATH	700	248264	SPECIAL PROBLEMS			1-3
	1M	248286	BY ARRGT			
MATH	883	248436	DIRECTED READINGS			1-6
	1M	248458	BY ARRGT			

M-A-N-A-G-E-M-E-N-T

MGT	110	248608	INTRO BUS COMP			3CR
	1M	248620	MTUWTHF 10.15		SBA	105
MGT	201	248775	PRINCIPLES OF MGT			3CR
	1M	248797	MTUWTHF 11.30		SBA	102
MGT	214	248947	PERSONNEL MANAGEMENT			3CR
	1M	248969	MTUWTHF 9.00		SBA	2
MGT	371	249113	BUS POLICY & STRAT			3CR
	1M	249135	MTUWTHF 10.15		SBA	2
MGT	385	249280	SPECIAL PROBLEMS			3-6
	1M	249307	BY ARRGT			

M-I-C-R-O-B-I-O-L-O-G-Y

MICBIO	140	249452	BIOL OF MICROORGNSMS	E		3CR
	1M	249474	MTUWTHF 9.00		MOR4	201
MICBIO	385	249624	SPECIAL PROBLEMS			2-4
	1M	249646	BY ARRGT			
MICBIO	700	249791	SPECIAL PROBLEMS			2-6
	1M	249818	BY ARRGT			

M-A-R-K-E-T-I-N-G

MKTG	201	249963	FUND OF MKTG			3CR
	1M	249985	MTUWTHF 9.00		SBA	111
MKTG	210	250132	BUYER BEHAVIOR			3CR
	1M	250154	MTUWTHF 10.15		SBA	111
MKTG	222	250304	MKTG COMMUNICATIONS			3CR
	1M	250326	MTUWTHF 11.30		SBA	111
MKTG	385	250471	SPECIAL PROBLEMS			1-3
	1M	250493	BY ARRGT			

M-U-S-I-C

MUSIC	101	250643	APPRECIATION-INTRO	C		3CR
	1M	250665	BY ARRGT			
MUSIC	120	250815	PIANO CLASS			1CR
	1M	250837	MTUWTHF 11.30		CHAP	B
MUSIC	301	250982	HYDN MOZART & BTHVN			3CR
	1M	251003	BY ARRGT			
MUSIC	385	251158	SPECIAL PROBLEMS			3CR
	1M	251170	BY ARRGT			
MUSIC	601	251320	HYDN MOZART & BTHVN			3CR
	1M	251342	BY ARRGT			
MUSIC	700	251497	SPECIAL PROBLEMS			3CR
	1M	251514	BY ARRGT			
MUSIC	701	251669	SEMINAR MUSICOLOGY			3CR
	1M	251681	BY ARRGT			
MUSIC	742	251831	RESEARCH IN MUS EDUC			1-6
	1M	251853	MTUWTHF 9.00		COTG	C

N-U-T-R-I-T-I-O-N & F-O-O-D-S

NF	385	252007	SPECIAL PROBLEMS			3CR
	1M	252029	BY ARRGT			
NF	685	252174	HUMAN NUTRITION			3CR
			SPECIAL SESSION, MEETS 6/26-7/20			
	1G	252196	MTUWTHF 9.00-11.00	SK		217
NF	700	252346	SPECIAL PROBLEMS			3-6
	1M	252368	BY ARRGT			

N-U-R-S-I-N-G

NURSE	301	252518	NURSING IN COMMUNITY			6CR
			SPECIAL SESSION, MEETS 6/15-7/31			
	1Q	252530	MF 9.00-12.00		MOR4	405
NURSE	303	252685	ADMIN OF NRSNG CARE			6CR
			SPECIAL SESSION, MEETS 6/18-7/31			
	1F	252702	BY ARRGT			
NURSE	385	252857	SPECIAL PROBLEMS			1-3
	1M	252879	BY ARRGT			

P-H-Y-S-I-C-A-L E-D-U-C-A-T-I-O-N

P E	G02	253023	PE 100 INTER SWIM			1CR
	1M	253045	MTUWTHF 2.15		WOPE	POOL
P E	G20	253190	PE 100 BALLET I			1CR
	1M	253217	MTUWTHF 9.00		WOPE	101
P E	G55	253362	PE 100 GOLF I			1CR
	1M	253384	MTUWTHF 2.15		BOYD	251
P E	G67	253534	PE 100 TEN I & BDTN			1CR
	1M	253556	MTUWTHF 7.45		BOYD	251
P E	G71	253706	PE 100 HATHA YOGA			1CR
	1M	253728	MTUWTHF 9.00		BOYD	237
P E	285	253873	STUDENT TEACHING			1-6
	1M	253895	BY ARRGT			
P E	370	254049	ORG & ADMIN			3CR
	1M	254061	MTUWTHF 9.00		HICK	10
P E	662	254211	HISTORY OF SPRT U.S.			3CR
	1M	254233	MTUWTHF 1.00		HICK	14
P E	700	254388	SPECIAL PROBLEMS			3-9
	1M	254405	BY ARRGT			
P E	722	254550	ATHLETICS/PHILOS INQ			3CR
	1M	254572	BY ARRGT			

P-H-I-L-O-S-O-P-H-Y

PHIL	105	254722	INTRO TO PHIL		C	3CR
	1M	254744	MTUWTHF 10.15		HERT	201
	2M	254766	MTUWTHF 2.15		HERT	205
PHIL	110	254916	ETHICS		C	3CR
	1M	254938	MTUWTHF 3.30		HERT	205
PHIL	125	255087	INTRO TO LOGIC		E	3CR
	1M	255104	MTUWTHF 9.00		HERT	209
PHIL	261	255259	CONT ANALY PHIL		C	3CR
	1M	255271	MTUWTHF 2.15		HERT	118
PHIL	385	255421	SPECIAL PROBLEMS			1-3
	1M	255443	BY ARRGT			
PHIL	561	255598	CONT ANALY PHIL			3CR
	1M	255615	MTUWTHF 2.15		HERT	118
PHIL	700	255760	SPECIAL PROBLEMS			3CR
	1M	255782	BY ARRGT			

P-H-Y-S-I-C-S

PHYSIC	141	255932	INTRO PHYSICS I		E	4CR
LEC	1M	255954	MTUWTHF 9.00		HAS	107
LAB	1M	256053	MTUW 10.15		HAS	204
PHYSIC	163	256203	GENERAL PHYSICS III		E	4CR
LEC	1M	256225	MTUWTHF 9.00		HAS	109
LAB	1M	256320	MTUW 9.00		HAS	44
PHYSIC	385	256475	SPECIAL PROBLEMS			1-3
	1M	256497	BY ARRGT			
PHYSIC	700	256647	SPECIAL PROBLEMS			1-6
	1M	256669	BY ARRGT			

P-O-L-I-T-I-C-A-L S-C-I-E-N-C-E

POLSCI	100	256819	AMERICAN POLITICS		D	3CR
	1M	256831	MTUWTHF 2.15		MACH	W-21
POLSCI	150	256986	COMPARATIVE POLITICS	D		3CR
	1M	257007	MTUWTHF 10.15		MACH	W-27
POLSCI	202	257152	MODERN POL THOUGHT		D	3CR
	1M	257174	MTUWTHF 11.30		MACH	W-21
POLSCI	218	257324	POL PARTIES & ELCTNS		D	3CR
	1M	257346	MTUWTHF 9.00		MACH	W-21

T	COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES	CORE BLDG	CR ROOM
SCI	254	257491	INTERNTL RELATIONS	D	3CR
	1M	257518	MTUWTHF 10.15	MACH	W-21
SCI	385	257663	SPECIAL PROBLEMS		3CR
	1M	257685	BY ARRGT		
SCI	502	257835	MODERN POL THOUGHT		3CR
	1M	257857	MTUWTHF 11.30	MACH	W-21
SCI	518	258001	POL PARTIES & ELCTNS		3CR
	1M	258023	MTUWTHF 9.00	MACH	W-21
SCI	554	258178	INTERNTL RELATIONS		3CR
	1M	258190	MTUWTHF 10.15	MACH	W-21

Y-C-H-O-L-O-G-Y

CH	101	258340	ELEMENTARY PSYCH	D	3CR
	1M	258362	MTUWTHF 11.30	THOM	104
CH	141	258512	PSYCH METHODS	D	3CR
	1M	258534	MTUWTHF 11.30	BART	66
CH	145	258689	STATISTICS IN PSYCH		3CR
	1M	258706	MTUWTHF 9.30	TOBN	307
CH	210	258851	SENSATION & PERCEP	D	3CR
	1M	258873	MTUWTHF 10.15	TOBN	204
CH	262	259027	CHILD PSYCHOLOGY	D	3CR
	1M	259049	MTUWTHF 7.45	TOBN	304
CH	263	259194	ADOLESCENT PSYCH	D	3CR
	1M	259211	MTUWTHF 9.00	HERT	227
CH	301	259366	EDUCATIONAL PSYCH	D	3CR
	1M	259388	MTUWTHF 10.15	TOBN	304
CH	305	259538	HIST & CONTEMP SYSTM	D	3CR
	1M	259550	MTUWTHF 9.00	TOBN	622
CH	385	259700	SPECIAL PROBLEMS		1-3
	1M	259722	BY ARRGT		
CH	386	259877	SPECIAL PROBLEMS		1-3
	1M	259899	BY ARRGT		
CH	510	260046	SENSATION & PERCEP		3CR
	1M	260068	MTUWTHF 10.15	TOBN	204
CH	562	260218	CHILD PSYCHOLOGY		3CR
	1M	260230	MTUWTHF 7.45	TOBN	304
CH	563	260385	ADOLESCENT PSYCH		3CR
	1M	260402	MTUWTHF 9.00	HERT	227
CH	601	260557	EDUCATIONAL PSYCH		3CR
	1M	260579	MTUWTHF 10.15	TOBN	304
CH	605	260729	HIST & CONTEMP SYSTM		3CR
	1M	260741	MTUWTHF 9.00	TOBN	622
CH	700	260896	SPECIAL PROBLEMS		3CR
	1M	260913	BY ARRGT		
CH	871	261062	CLINICAL PRACTICUM		3-12
	1M	261084	BY ARRGT		
CH	872	261234	CLINICAL PRACTICUM		3-12
	1M	261256	BY ARRGT		

-B-L-I-C H-E-A-L-T-H

HL	123	261406	DYN PRSNL & COM HLTH		3CR
	1M	261428	MTUWTHF 11.30	ORA	124
HL	304	261573	SCHOOL HEALTH		3CR
	1M	261595	MTUWTHF 10.15	ORA	124
HL	375	261745	PUBLIC HEALTH STATIS		3CR
	1M	261767	MTUWTHF 9.00	ORA	124
HL	382	261917	FIELD TRAINING		3-10
	1M	261939	BY ARRGT		
HL	385	262088	SPECIAL PROBLEMS		1-3
	1M	262105	BY ARRGT		
HL	604	262250	SCHOOL HEALTH		3CR
	1M	262272	MTUWTHF 10.15	ORA	124
HL	675	262422	PUBLIC HEALTH STATIS		3CR
	1M	262444	MTUWTHF 9.00	ORA	124
HL	700	262599	SPECIAL PROBLEMS		3-6
	1M	262616	BY ARRGT		
HL	702	262761	ADV METH HLTH EDUC		3CR
	1M	262783	BY ARRGT		
HL	782	262933	SUPRVISO FLD TRAING		6-10
	1M	262955	BY ARRGT		

R-H-E-T-O-R-I-C

RHET	100	263109	RHET OF LANG AND WR	B	3CR
	1M	263121	MTUWTHF 7.45	HERT	102
	2M	263143	MTUWTHF 9.00	HERT	224
	3M	263165	MTUWTHF 9.00	HERT	207
	4M	263187	MTUWTHF 10.15	HERT	211
	5M	263204	MTUWTHF 10.15	HERT	207
	6M	263226	MTUWTHF 11.30	HERT	102
RHET	110	263371	LANGUAGE & SPEAKING	B	3CR
	1M	263393	MTUWTHF 9.00	HERT	110
	2M	263410	MTUWTHF 10.15	HERT	107
	3M	263432	MTUWTHF 11.30	HERT	107
RHET	140	263587	VOICES OF IMAG WRIT	B	3CR
	1M	263604	MTUWTHF 9.00	HERT	119
	2M	263626	MTUWTHF 10.15	HERT	212
RHET	145	263771	CRIT & THEATRE ARTS	B	3CR
	1M	263793	MTUWTHF 11.30	HERT	111
RHET	175	263943	RHET OF MODERN MEDIA	B	3CR
	1M	263965	MTUWTHF 9.00	HERT	211
	2M	263987	MTUWTHF 11.30	HERT	222
RHET	385	264131	SPECIAL PROBLEMS		3CR
	1M	264153	BY ARRGT		

R-U-S-S-I-A-N

RUSS	119	264303	RUSSIAN READING		3CR
	1M	264325	MTUWTHF 9.00	HERT	107
RUSS	385	264470	SPECIAL PROBLEMS		1-6
	1M	264492	BY ARRGT		
RUSS	419	264642	RUSSIAN READING		3CR
	1M	264664	MTUWTHF 9.00	HERT	107
RUSS	700	264814	SPECIAL PROBLEMS		1-6
	1M	264836	BY ARRGT		

S-C-H-O-O-L O-F B-U-S A-D-M-I-N

S BA	457	264981	QUANTITVE METH II		3CR
	1M	265002	MTUWTHF 7.45	SBA	103
S BA	522	265157	MKTG COMMUNICATIONS		3CR
	1M	265179	MTUWTHF 11.30	SBA	111
S BA	564	265329	LAW OF URBAN DEV		3CR
	1M	265341	MTUWTHF 10.15	SBA	103
S BA	572	265496	SEM URBAN STUDIES		3CR
	1M	265513	MTUWTHF 10.15	SBA	107
S BA	700	265668	SPECIAL PROBLEMS		3-6
	1M	265680	BY ARRGT		
S BA	702	265830	ACCOUNTING SYSTEMS		3CR
	1M	265852	MTUWTHF 1.00	SBA	6A
S BA	722	266006	MARKETING MANAGEMENT		3CR
	1M	266028	MTUWTHF 9.00	SBA	106
S BA	742	266173	OPERATIONS MNGMENT		3C
	1M	266195	MTUWTHF 10.15	SBA	102
S BA	752	266345	BUSINESS POLICY		3(
	1M	266367	MTUWTHF 11.30	SBA	20
S BA	756	266517	QUANTITVE METH III		3
	1M	266539	MTUWTHF 9.00	SBA	1(
S BA	808	266684	ADV TPCS IN BUS ADM		
	1M	266701	BY ARRGT		
S BA	810	266856	TUT STDY IN BUS ADM		
	1M	266878	BY ARRGT		

S-O-C-I-O-L-O-G-Y

SOCIOL	101	267022	INTRO SOCIOLOGY	D	3CR
	1M	267044	MTUWTHF 9.00	THOM	102
SOCIOL	251	267199	URBAN SOCIOLOGY	D	3CR
	1M	267216	MTUWTHF 10.15	HERT	118
SOCIOL	257	267361	THE FAMILY	D	3CR
	1M	267383	MTUWTHF 11.30	HERT	116
SOCIOL	260	267533	SOCIETY & INDIVIDUAL		3CR
	1M	267555	MTUWTHF 9.00	HERT	201
SOCIOL	278	267705	CRIMINOLOGY	D	3CR
	1M	267727	MTUWTHF 1.00	HERT	116
SOCIOL	385	267872	SPECIAL PROBLEMS		1-3
	1M	267894	BY ARRGT		

DEPT	COURSE SEC	SCHEDULE NUMBER	TITLE MEETING TIMES		CORE	CR BLDG	ROOM
SOCIOL	700	268048	SPECIAL PROBLEMS				1-6
	1M	268060	BY ARRGT				
S-P-A-N-I-S-H							
SPAN	110	268210	ELEMENTARY SPANISH				3CR
	1M	268232	MTUWTHF 7.45			HERT	212
SPAN	146	268387	INTERMED INTENSIVE		C		6CR
	1M	268404	MTUWTHF 9.00-11.00			HERT	202
SPAN	182	268559	ORAL SPANISH				3CR
	1M	268571	MTUWTHF 10.15			HERT	222
SPAN	306	268721	TCHG ENG AS SEC LANG				3CR
	1M	268743	MTUWTHF 9.00			HERT	212
SPAN	310	268898	ADVANCED COMPOSITION				3CR
	1M	268915	MTUWTHF 9.00			HERT	222
SPAN	311	269064	LGE/CUL SPAN IN U.S.				3CR
	1M	269086	MTUWTHF 1.00			HERT	212
SPAN	312	269236	STRCTR OF MOD SPAN				3CR
	1M	269258	MTUWTHF 1.00			HERT	222
SPAN	313	269408	TCHG SPAN TO SP SKRS				3CR
	1M	269420	MTUWTHF 11.30			HERT	212
SPAN	376	269575	HISPAN LIT OF CARRIB				3CR
	1M	269597	MTUWTHF 10.15			HERT	224
SPAN	385	269747	SPECIAL PROBLEMS				3CR
	1M	269769	BY ARRGT				
SPAN	606	269919	TCHG ENG AS SEC LANG				3CR
	1M	269931	MTUWTHF 9.00			HERT	212
SPAN	610	270083	ADVANCED COMPOSITION				3CR
	1M	270100	MTUWTHF 9.00			HERT	222
SPAN	611	270255	LGE/CUL SPAN IN U.S.				3CR
	1M	270277	MTUWTHF 1.00			HERT	212
SPAN	612	270427	STRCTR OF MOD SPAN				3CR
	1M	270449	MTUWTHF 1.00			HERT	222
SPAN	613	270594	TCHG SPAN TO SP SKRS				3CR
	1M	270611	MTUWTHF 11.30			HERT	212
SPAN	676	270766	HISPAN LIT OF CARRIB				3CR
	1M	270788	MTUWTHF 10.15			HERT	224
SPAN	700	270938	PROBLEMS COURSE				1-6
	1M	270950	BY ARRGT				
S-P-E-E-C-H							
SPEECH	182	271104	INTRO TO COMM DIS				3CR
	1M	271126	MTUWTHF 7.45			BART	119
SPEECH	202	271271	SMALL GRP COMMUNICAT				3CR
	1M	271293	MTUWTHF 10.15			HERT	102
SPEECH	223	271443	PROGRAM PROC IN TV				3CR
	1M	271465	TUTH 9.00-11.15			HERT	111
SPEECH	228	271615	MASS MED IN SOCIETY		D		3CR
	1M	271637	TUTH 1.00-3.15			HERT	113
SPEECH	288	271782	CLINICAL PRACTICE				1-3
	1M	271809	BY ARRGT				
SPEECH	289	271954	DEAF & HARD OF HRNG				3CR
	1M	271976	TUTH 9.00-11.15			HERT	113
SPEECH	385	272120	SPECIAL PROBLEMS				1-3
	1M	272142	BY ARRGT				
SPEECH	391	272297	SEMINAR IN MASS COMM				3CR
	1M	272314	TUTH 19.00-21.30			HERT	102
SPEECH	392	272469	SEM IN COMMUN DISORDR				3CR
	1M	272481	MW 9.00-11.15			HERT	111
SPEECH	528	272631	MASS MED IN SOCIETY				3CR
	1M	272653	TUTH 1.00-3.15			HERT	113
SPEECH	588	272803	CLINICAL PRACTICE				1-3
	1M	272825	BY ARRGT				
SPEECH	589	272970	DEAF & HARD OF HRNG				3CR
	1M	272992	TUTH 9.00-11.15			HERT	113
SPEECH	700	273146	SPECIAL PROBLEMS				1-3
	1M	273168	BY ARRGT				
SPEECH	718	273318	SEMINAR PUB ADDRESS				3CR
	1M	273330	MW 1.00-3.15			HERT	113
SPEECH	884	273485	HRING DIAG & ASSES				3CR
			SPECIAL SESSION, MEETS 5/29-6/9				
	1P	273502	MTUWTHF 9.00-1.00			BART	109
S-T-A-T-I-S-T-I-C-S							
STATIS	121	273657	ELEM STATISTICS		E		3CR
	1M	273679	MTUWTHF 7.45			GRES	311
STATIS	316	273829	INTRO TO TH STAT II		E		3CR
	1M	273841	MTUWTHF 9.00			GRES	311
STATIS	616	273996	INTRO TO TH STAT II				3CR
	1M	274017	MTUWTHF 9.00			GRES	311
T-E-X-T-L-S, C-L-O-T-H-G & E-N-V A-R-T-S							
TCEA	710	274162	HUMAN ENVRMT & DESN				3CR
			SPECIAL SESSION, 6/26 - 7/13				
	1G	274184	MTUWTHF 1.00-4.00			SK	119
T-H-E-A-T-R-E							
THEATR	115	274334	INTRO TO THEATRE		C		3CR
	1M	274356	MTUWTHF 9.00			HERT	225
	2M	274378	MTUWTHF 10.15			HERT	119
THEATR	385	274528	SPECIAL PROBLEMS				1-3
	1M	274540	BY ARRGT				
THEATR	700	274695	SPECIAL PROBLEMS				1-3
	1M	274712	BY ARRGT				
THEATR	758	274867	GRAD PRATICUM				1-6
	1M	274889	BY ARRGT				
Z-O-O-L-O-G-Y							
ZOOL	101	275033	INTRO ZOOLOGY		E		3CR
LEC	1M	275055	MWF 9.00			MOR4	349
LAB	1M	275150	TUTH 1.00-4.00			MOR	336
ZOOL	385	275300	SPECIAL PROBLEMS				1-3
	1M	275322	BY ARRGT				
ZOOL	399	275477	SENIOR HONORS				OCR
	1M	275499	BY ARRGT				
ZOOL	700	275649	SPECIAL PROBLEMS				1-6
	1M	275661	BY ARRGT				

Certificate of Domicile and Residence

RESIDENCE REQUIREMENTS
FOR MASSACHUSETTS TUITION RATES

As a state institution, University of Massachusetts offers the privilege of in-state tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the University.

1. A student must present evidence satisfactory to the Treasurer of the University that his or her domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. The student must also have established a bona fide residence in the Commonwealth for a period of not less than one continuous year prior to the date of acceptance at the University, and certify intention to continue to maintain such a residence.

2. The domicile and residence of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation, the student, in addition to the requirements of these regulations respecting domicile and residence, shall present satisfactory proof respecting emancipation. Minors under guardianship shall be required to present in addition to the certification of domicile and residence satisfactory documentary evidence of the appointment of the guardian.

3. No student shall be considered to have gained residence by reason of attendance in the University nor shall a student lose residential preference during continuous attendance at the University unless he or she ceases to be a citizen of the Commonwealth.

4. The domicile and residence of a wife shall follow that of the husband.

5. This form of certification for classification as to domicile and residence status must be submitted by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University.

6. Discretion to adjust individual cases within the spirit of these rules is lodged with the President of the University.

Note: The certificate is required only for new applicants to the University.

Certificate of Domicile and Residence

New applicants claiming the in-state tuition rate established for Massachusetts residents must submit this form properly completed.

Name of Student _____

Statement of Parent or Guardian
(If student is under 21 years old)

I, ,certify that I am the legal parent ( ) guardian* ( ) of and that (he) (she) is domiciled in the Commonwealth of Massachusetts and has maintained a bona fide legal residence herein for a period of not less than one continuous year prior to the date of acceptance at the University; further, that (he) (she) intends to continue to maintain such a residence.

Signature _____

Statement of Student if 21 years or older

I, , certify that I am 21 years or older and that I am domiciled in the Commonwealth of Massachusetts and have maintained a bona fide legal residence herein for a period of not less than one continuous year prior to the date of acceptance at the University; further, that I intend to continue to maintain such a residence.

Signature _____

*If certification is that of guardian, copy of Court appointment must be submitted.

Statement of Town or City Clerk

This is to certify that the records of the City (Town) of

indicate that

is a legal resident of , Massachusetts.

Signed _____

Title _____

Date _____

(Seal)

NOTE: REGULARLY ENROLLED UNIVERSITY OF MASSACHUSETTS STUDENTS (BOTH AMHERST AND BOSTON) WHO HAVE A CERTIFICATE OF RESIDENCE ON FILE DO NOT HAVE TO SUBMIT THIS FORM.

Astronomy

100. EXPLORATION OF THE UNIVERSE (E).
The earth, its structure and age, the moon, the sun, other planets, and the origin of the solar system. Stars and galaxies, their birth and death. The universe, its structure and evolution. Supplemented by hours of evening observation.

Biochemistry

220. GENERAL BIOCHEMISTRY (E).
A broad introduction to the general field of biochemistry for students majoring in chemistry or in the biological sciences, and a background for more advanced or specialized study in this field. Prerequisites, Chem. 166 or equivalent.

Botany

175. GENETICS AND EVOLUTION (E).
Survey of the cell and those fundamental genetic principles which are the basis of evolution. Origin and history of organic evolution. Mechanisms of evolution. Intended for non-science majors.

211. INTRODUCTORY PLANT PHYSIOLOGY.
Differentiation, growth, nutrition, and the communication between plant and environment used to illustrate the means by which plants function. Prerequisites, Botany 100 or 101, and at least one semester of Organic Chemistry.

385/700. SPECIAL PROBLEMS.
By arrangement.

800. MASTER'S THESIS.
By arrangement. *Credit varies.*

900. DOCTORAL DISSERTATION.
By arrangement. *Credit varies.*

Business Administration [Graduate Courses]

457. QUANTITATIVE METHODS II.
Laws and theories of probability and statistics, with applications in business and economics. Topics include probability models, sampling distribution, estimation, hypothesis testing, and decision theory.

564. LAW OF URBAN DEVELOPMENT.
Legal problems generated by the changing urban environment. Topics include the law of race relations, poverty and welfare, land use planning, urban and regional planning. Prerequisite, Gen. Bus. 260 or equivalent.

572. SEMINAR IN URBAN AND REGIONAL STUDIES.
Analysis of the dimensions of urban growth and change, discussion of the reasons behind, and the problems growing out of the economic growth and stagnation of urban areas.

700. PROBLEMS IN BUSINESS ADMINISTRATION.
Independent study and research on selected problems in Business Administration. Permission of instructor and dean required.
Credit, 3-6 each semester.

702. ACCOUNTING SYSTEMS.
Accounting systems and their relationship to other information systems.

722. MARKETING MANAGEMENT.
Marketing concepts of planning, organization, control and decision-making from viewpoint of business executive. Tools available for analysis and control of marketing activities are stressed.

742. OPERATIONS MANAGEMENT.
Analysis of production problems and solution techniques applicable in industrial analysis.

752. BUSINESS POLICY.
Capstone course requiring application of knowledge, theories, and techniques derived from previous courses, using integrative cases and empirical observations to formulate improved policies and plans.

756. QUANTITATIVE METHODS III.
Statistical methods employed in collection, analysis, and interpretation of data. Business applications of sampling, analysis of variance, experimental design, regression analysis, and forecasting models.

800. MASTER'S THESIS.
Credit varies.

808. ADVANCED TOPICS IN BUSINESS ADMINISTRATION.
A section is available in each general or functional field of study, to facilitate investigation of current literature and research effort in these areas.
Credit, 3-6.

810. TUTORIAL STUDY IN BUSINESS ADMINISTRATION.
Individualized secondary or applied research in special areas of guided doctoral level investigation with consent of mentor, when a suitable course in such areas is not available and the studies are related to the career-goal of the student.
By arrangement. *Credit, 3-6.*

900. DOCTORAL DISSERTATION.
Credit varies.

Chemical Engineering

125. FUNDAMENTALS.
Nature and scope of chemical engineering: selected chemical processes; material and energy balances. Prerequisite, Chem. 112 or 114.

126. THERMODYNAMICS.
Fundamental principles. The First and Second laws; properties of single-component systems, thermodynamic cycles, phase and chemical equilibria. Solution methods for complex energy and material balance problems. Prerequisites, Chem. 160, Math. 165/ChE. 125.

Chemistry

110. GENERAL CHEMISTRY (E).
The fundamental chemical laws and theories. A one-semester coverage of general chemistry that meets minimum prerequisite requirements of Chem. 160 and Biochem. 120 or 220. 2 class hours, 2 quiz hours, 1 2-hour laboratory period. *Credit, 4.*

111. GENERAL CHEMISTRY (E).
The first course of a two-semester sequence (111, 112) covering the fundamental chemical laws and theories. For engineers and other students planning to take advanced courses in chemistry. 2 class hours, 1 quiz hour. 1 2-hour laboratory period.

112. GENERAL CHEMISTRY (E).
A continuation of Chemistry 111.

160. ORGANIC CHEMISTRY (E).
A one-semester coverage of organic chemistry. Prerequisite, Chem 110 or 112. Concurrent enrollment in Chem 162 required.

162. ORGANIC CHEMISTRY LAB.
Laboratory applications of the chemistry taught in Chem 160. Concurrent enrollment in Chem 160 required. 1 3-hour laboratory period. *Credit, 1.*

262/562. ORGANIC CHEMISTRY.
The second course of a two-semester sequence (261/561, 262/562), which covers a survey of the principal classes of organic compounds and their reactions with emphasis on the relation between structure and reactivity. Concurrent enrollment in Chem 264/564 is required. Prerequisite, Chem 261/561 or the equivalent of the first semester of a year course in organic chemistry.

264/564. ORGANIC CHEMISTRY LAB.
Continuation of Chem 263/563, which is prerequisite. The experimental techniques of organic chemistry. Concurrent enrollment in Chem 262/562 is required. 1 3-hour laboratory period. *Credit, 1.*

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION.
Credit, 30.

Civil Engineering

140. STATICS.
Force systems, friction, first and second moments. Prerequisite. Integral Calculus concurrently.

141. STRENGTH OF MATERIALS I.
Simple and combined stresses and strains in tension, compression and shear; torsion; stresses and deflections in beams. Prerequisite, Statics.

142. DYNAMICS.
Motions of particles and rigid bodies and the force systems associated with these motions Prerequisite, Statics.

257. ELEMENTARY FLUID MECHANICS.
Fundamentals of fluid mechanics including fluid properties, fluid behavior under static and dynamic conditions, and development of basic fluid flow equations. Prerequisite, Statics.

385/700. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.

Classics

CLASSICS 610. STUDENT TEACHING.
Supervised practice teaching in secondary schools.
By arrangement. *Credit, 1-12.*

CLASSICS 700. SPECIAL PROBLEMS.
Directed study of some problem in classical civilization. By arrangement. *Credit, 1-3*

CLASSICS 701. THE ROMAN CITY.
The topography, monuments, and daily life of selected Roman cities with emphasis on Rome itself. Sociological, economic, and environmental factors in ancient city planning. May involve travel and study in Italy.
By arrangement. *Credit, 3-6.*

GREEK 700. SPECIAL PROBLEMS.
Directed study of some problem in Greek literature.
By arrangement. *Credit, 1-3.*

LATIN 610. STUDENT TEACHING.
Supervised practice teaching in secondary schools.
By arrangement. *Credit, 1-12.*

LATIN 700. SPECIAL PROBLEMS
Directed study of some problem in Latin literature.
By arrangement. *Credit, 1-3*

Comparative Literature

203. THE EUROPEAN NOVEL: MAN VERSUS SOCIETY (C).
In English translation, a number of French, Spanish, German, Russian and English novels of the 17th to 20th centuries, in the context of the consciousness they reflect, describe, and transcend.

385/700. SPECIAL PROBLEMS.
By arrangement.

Computer and Information Science

122/409. INTRODUCTION TO PROBLEM SOLVING USING THE COMPUTER.
An introduction to problem solving and FORTRAN programming for students from all disciplines. Concepts associated with problem solving valid for many types of problems. Use of FORTRAN on the UMASS time sharing system. Mathematical or problem solving sophistication assumed. No credit for graduate students.

133. COMPARATIVE CONCEPTS IN PROGRAMMING LANGUAGES.
Presentation of fundamental concepts in programming languages. Topics include: date structures, scope of names, parameter passing, recursion, block structure, string and list manipulation languages (like SNOBOL or LISP) and business oriented languages (like COBOL or RPG). Related projects. Prerequisites, 122/409 or programming experience.

223/523. ASSEMBLY LANGUAGE PROGRAMMING.
An elementary description of computer hardware, input/output equipment, machine language, machine organization, logical design, and assembly language programming. Lab involves hands-on experience with programs, loaders and assemblers. Prerequisite, COINS 122/409.

385/700. SPECIAL PROBLEMS.
Recent advances and current problems in a specialized field of Computer Science. Topic by arrangement. Prerequisite, permission of instructor. *Credit, 1-6.*

701. ADVANCED TOPICS IN COMPUTER SCIENCE.
A project-type course for second-year graduates which integrates and expands the student's knowledge of the field. Moderately large projects of implementation, design of computers, languages, operating systems, cybernetic simulation, theoretical integration, etc. Prerequisite, permission of instructor. *Credit, 6.*

790. SEMINAR ON COMPUTER AND INFORMATION SCIENCE.
Conferences, reports and lectures on topics not currently covered in regular courses. Prerequisite, permission of instructor.
By arrangement. *Credit, 2-3.*

900. DOCTORAL DISSERTATION.
Credit, 1-30.

Economics

103. INTRODUCTION TO MICROECONOMICS (D).
Introductory analysis of resource allocation and income distribution through microeconomic theory. Specific problems illustrate the use of the theoretical precepts developed.

104. INTRODUCTION TO MACROECONOMICS (D).
An introduction to the economic theory that is used to explain the behavior of price stability, economic growth and balance of payments equilibrium.

203/503. INTERMEDIATE MICROECONOMIC THEORY (D).
Microeconomic analysis of consumers, firms, industries, and markets; rational decision-making under conditions of certainty; balancing forces in a free enterprise economy. Prerequisite, Econ 103.

204/504. INTERMEDIATE MACROECONOMIC THEORY (D).
Formulation and empirical testing of static and dynamic theories of aggregative income, employment, and prices with reference to fluctuations, growth, and economic forecasting. Prerequisites, Econ 103 and 104.

Education

For information about the School of Education Summer Program, including workshops and other learning experiences, please write the following: ATTENTION: Summer Session Information, School of Education, University of Massachusetts, Amherst, Massachusetts, 01002; or call for learning experience information: Education Registrar's Office - 545-1543; or for Summer Workshop information, Education Office of Academic Extension - 545-1584.

386A/686A. SPECIAL PROBLEMS IN EDUCATION: FLEXIBLE CURRICULUM TOPICS IN EDUCATION.
A variety of mini or modular credit learning experiences is offered under this general title. This mechanism, used more extensively during the regular semester under the rubric of Flexible Curriculum, enables the student to participate in a wider variety of experiences than would normally be available in the traditional summer schedule. A supplementary transcript provided by the School of Education will list separately the specific fractional or modular credits that you successfully completed. There are 100 modules of credit in a standard University one-credit course; 300 modules in a standard 3 credit course. Each hour in class will be the equivalent of 8 modules so you would need to attend roughly 38 hours of class to accumulate 300 modules (3 credits). A list of offerings will be available at Registration and then in Rm. 121, School of Education building for the remainder of the Summer Session.

Center for the Study of Aesthetics In Education

386B/686B. SPECIAL PROBLEMS IN EDUCATION: LOGISTICS AND AESTHETICS EDUCATION.
Explorations of ways of creating a material-thinking data bank that will be used in teaching critical analysis in communication skills to inter-city public school children. The data bank will be primarily a lexicon of logical notions and processes collected through group inventories of the child's own inter-city aesthetic experiences.

386C/686C. SPECIAL PROBLEMS IN EDUCATION: INTRODUCTION TO MULTI—ARTS FOR THE CLASSROOM.
Facilitates learning in Human Relations, the arts and other subject areas through the use of multi-arts improvisation. Participants attend workshops, choose readings, observe, participate in teaching activities and develop a final curriculum project.

Center for Foundations of Education

251/551. FOUNDATIONS OF EDUCATION.
Selected problems and issues such as educational aims, societal expectations of the schools, church-state relations, professionalism, academic freedom, curriculum and methodological emphasis, urban education and educational innovations. Fulfills "Foundations" requirement for those students seeking teacher certification.

Center for Higher Education

915. GROUP ACTIVITIES.
A laboratory training experience focusing on personal and small group development. Most class time devoted to "T" group sessions,

providing an opportunity for each participant to: develop a greater insight into himself and an awareness of his impact on people; increase his sensitivity to the feelings of others and how this insight affects him; experience and examine the forces that operate in a group as well as analyze his own effectiveness in assuming roles that are needed in building and maintaining a group; and to relate his "T" group experience to his social interactions outside his "T" group. Also includes large group exercises, readings, discussion of group dynamics and two follow-up sessions. First class meets from 4 to 6:30 on June 25, followed by intensive sessions lasting from June 27 through July 3 with meetings occurring either in the mid to late afternoon or early to late evenings. Two follow-up sessions will take place on July 10 and July 17.

Center for Human Potential

291/591. EARLY CHILDHOOD EDUCATION MOVEMENT.
Contemporary purpose, programs and problems of early childhood education examined from an historical and philosophical perspective. Field work expected.

686P. SPECIAL PROBLEMS IN EDUCATION: COMPREHENSIVE APPROACH TO TEACHING YOUNG CHILDREN.
The training of teachers in the philosophical basis, the theory of development, the theory of pedagogy and the curriculum design of a comprehensive early education model.

686Q. SPECIAL PROBLEMS IN EDUCATION: PRACTICUM IN EARLY EDUCATION METHODS AND TECHNIQUES.
Curriculum development and execution experiences requisite to implementing a comprehensive early education model. Focus on materials development, creating learning experiences, and evaluating them.

Center for Human Relations

277/577. PRINCIPLES OF SCHOOL GUIDANCE.
Information and experience on how counseling services help people understand themselves and others, and how they can function effectively in society. Knowledge from education, psychology, philosophy, history and sociology examined and applied to guidance in personnel programs. Learning is seen as an active process. Extensive reading and some field experiences.

910. SCHOOL COUNSELING THEORIES.
Counseling theory and research evaluation, methodology, philosophies, ethics, problems, and issues of school counseling. Prerequisites: introductory Principles of School Guidance and a minimum of one credit hour practicum experience.

915. GROUP ACTIVITIES.
See 915 under Center for Higher Education.

Center for Humanistic Education

3860/6860. SPECIAL PROBLEMS IN EDUCATION: CONFLUENT EDUCATION: THEORY AND PRACTICE.
West Coast version of humanistic education in the integration of affect and cognition in curriculum and instruction.

Center for International Education

227/527. INTERNATIONAL EDUCATION.
Introduction to international education. Includes the use of education as a tool of development, education in a cross-cultural context, education through international exchange of persons and ideas, and the British system of the open-school integrated day.

Center for Leadership and Administration

950. FUNDAMENTALS OF EDUCATIONAL ADMINISTRATION.
General school administration, relation of public education to the cultural pattern organization in practices in school administration, a simulation of an urban high school principalship using Monroe City materials developed by U.C.E.A. Participants assume the role of a principal in an urban high school; for eight weeks, his problems are their problems.

Center for Media

386D/686D. SPECIAL PROBLEMS IN EDUCATION: PRE-PRODUCTION CREATIVITY OF EDUCATIONAL FILMS.
Planning film that is interesting as well as educative using adaptations of Madison Avenue advertising agency techniques. "Tricks and magic" of film for communicating ideas visually, including cuts, dissolves, wipes, superimpositions, animations, live actions, pop ons, pop offs. Course work is applicable in part to planning video tape and slide presentations. Recommended for teachers and students of all subjects who wish to become more knowledgable and skilled in the planning and using of film in and outside the classroom.

Center for Occupational Education

386E/686E. SPECIAL PROBLEMS IN EDUCATION: PRESCRIPTIVE-DIAGNOSTIC INSTRUCTIONAL SYSTEMS.
Development of skills and knowledge in identifying viable approaches for remedial education for children with special needs. An analysis of the current legislation dealing with evaluation and program development for children with special needs. Learning problems of children identified as having special needs. The Prescriptive-Diagnostic Instructional Systems approach as a means for dealing with these children. Participants will devise mini-units utilizing the Prescriptive-Diagnostic Instructional Systems Design.

386F/686F. SPECIAL PROBLEMS IN EDUCATION: WORK, MANPOWER AND EDUCATION POLICY DEVELOPMENT.
Analysis of the educational, economic, social and political forces which determine the nature of jobs and work in this society. Questions of how to plan for jobs in the future in addition to determining ways to improve the economy, the job-holder and society. Limits of planning for manpower. Credit, 4.

386G/686G. SPECIAL PROBLEMS IN EDUCATION: CAREER EDUCATION.
Current trends in career education and their implications to the schools. An overview of sociological, historical and psychological conditions which have influenced current developments, and exploration of ways to assist in the implementation of career education concepts in public schools.

Center for Educational Research

355/655. EDUCATIONAL STATISTICS, I.
Methods for reducing experimental data to a few convenient descriptive terms and for drawing inferences from these terms. Topics include tabulation and graphing, central tendency (mean, mode, median), variability (range, standard deviation), chi-square, correlation, and linear regression; basic inferential statistics (t-test, F-test, confidence intervals). Concurrent registration in Computer Laboratory is strongly recommended.

386H/686H. SPECIAL PROBLEMS IN EDUCATION: COMPUTER LABORATORY WITH STATISTICAL APPLICATION.
Basic skills of working with the computer. Topics include operation of punched card machinery, operation of time-sharing terminals, using library programs in both a batch and a time-sharing terminal environment, and data management. Exercises closely related to Educational Statistics I topics are assigned to provide practice with computer skills and experience in performing statistical analyses. Credit, 2.

386I/686I. INTRODUCTION TO RESEARCH FOR NON-RESEARCH MAJORS.
For students who wish to become intelligent consumers of research rather than research practitioners. Purposes for research, different kinds of research (i.e., historical, survey, and experimental models) and specific research methodology (drawn from statistics, experimental design, and measurement and evaluation). Situations are conceived within which students can apply techniques treated to practical problems.

Center for Urban Education

257/557. INTRODUCTION TO URBAN EDUCATION.
The entry level course for all Urban Education majors, and as an introductory course for all others interested. Explores the major social and political issues in urban education, with emphasis on the impact of racism on urban school failure; and relates these issues to learning and teaching in urban schools.

258/558. ADVANCED METHODS, MATERIALS AND PROGRAMS IN URBAN EDUCATION.
Develops new and innovative curriculum designs for urban schools. Designed to give

students a realistic sense of what kind of approaches to curriculum development are relevant to inner-city environments. Both seminar and field experience components.

Teacher Education

386J/686J. SPECIAL PROBLEMS IN EDUCATION: MICRO-TEACHING LABORATORY.

Develops an understanding of the micro-teaching concept and potential uses. Includes historical development of micro-teaching concept, operation of a micro-teaching laboratory and equipment, development of micro-teaching materials, role of supervisor in a micro-teaching setting, and utilization of micro-teaching concepts in diverse educational settings. July 2-27 daily, 10 a.m. to noon.

951. PRINCIPLES AND METHODS OF SUPERVISION.
For teachers and administrators; assists pre-service and in-service teachers improve their teaching. Topics include observation, diagnostic, and remediation techniques and supervisory conference. Not designed to help administrators evaluate teachers for tenure, salary increments, etc.

386L/686L. SPECIAL PROBLEMS IN EDUCATION: TEACHING READING AND LANGUAGE ARTS IN THE OPEN CLASSROOM.
A preparation for teaching reading and language arts in the Integrated Day. Informal diagnosis, record keeping, management, and methodology for the open classroom. Emphasis on translating theory and literature into practice. June 26—July 20, 9 to 11 a.m.

386M/686M. SPECIAL PROBLEMS IN EDUCATION: CURRICULUM BUILDING FOR THE INTEGRATED DAY.
Develops curriculum for use in Integrated Day classrooms. Emphasis on translating theory and literature of open education into experiences for children in elementary schools. Topics include management, observation/diagnosis, critical thinking skills, and planning. Prerequisite: concurrent registration in Teaching Reading and Language Arts in the Open Classroom. June 26—July 20, 11 a.m. to 1 p.m.

386N/686N. SPECIAL PROBLEMS IN EDUCATION: METHODS OF MINIMUM RESOURCE TEACHING.
Training and orientation of teachers in skills of making their own teaching tools. Of critical importance to teachers in economically poor communities (Third World, Indian, etc.). Resource skill should be of use to any teacher who is not able to escape to the well-equipped classroom and supply closet.

309/609. PRINCIPLES AND METHODS FOR SECONDARY SCHOOL ENGLISH.
Identification and practice of curricular instructional competencies in secondary school English. Develops a psychological and philosophical base for application to secondary English teaching.

310/610. PRINCIPLES AND METHODS OF TEACHING SECONDARY SOCIAL STUDIES.
Various possible goals and strategies for secondary social studies instruction aimed at helping the prospective teacher develop a rationale for his/her teaching. New developments along with key issues in the social studies field.

312/612. PRINCIPLES AND METHODS OF TEACHING SECONDARY SCIENCE.
Through a consideration of the nature and content of science, learning strategies, and values of self and society, the pre-service science teacher formulates his own philosophy and rationale for education in science.

386R/686R. SPECIAL PROBLEMS IN EDUCATION: ELEMENTARY METHODS POTPOURRI. (8 Different Offerings)
Courses for experienced teachers designed for practical application of innovative teaching practices in the elementary classroom. Offerings available in Science, Social Studies, Mathematics, Language Arts, and Creative Arts. A list of specific courses and hours will be mailed in late May to registrants. Credits, 1-6.

386S/686S. SPECIAL PROBLEMS IN EDUCATION: EXPLORATIONS IN COLLECTIVE EDUCATION IN KIBBUTZ SOCIETY.
Exploration of the structure, ideology, and value system of the Kibbutz society and the structure of its educational system. The principles and practice of collective education from early childhood through high school.

391/702. INDEPENDENT STUDY.
Readings and research in an education related area. An individualized study contract must be completed before August 1.
Credits, 1-6.

385/685. PRACTICUM.
An experiential or field activity in an education related area. An individualized study contract must be completed before August 1. Credit, 1-6.

900. DISSERTATION.
An individualized study contract must be completed before August 1. Credit, 1-6.

Electrical Engineering

141. SYSTEMS ANALYSIS I.
Physical characteristics and mathematical models of system elements; techniques for writing and solving system dynamic equations. Prerequisite, Engrg. 104 and Math 124. 3 class hours, 1 3-hour problem period.
Credit, 4.

275. ADVANCED LABORATORY I.
Projects designed to provide the student with laboratory experience related to his technical electives. Prerequisite, senior standing; 2 3-hour laboratory periods.
Credit, 2.

276. ADVANCED LABORATORY II.
Laboratory Techniques developed in EE 275 used to carry out a concentrated study in the student's area of interest. Prerequisite: EE 275. 2 4-hour laboratory periods.

385/700. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.

Engineering

104. INTRODUCTION TO ENGINEERING B.
The nature of engineering practice, through lectures and problem work. Some generally useful concepts to be developed in more detail in later courses. 3 2-hour lecture, problem, or laboratory periods.

English

152. READING FICTION (C).
An introduction to themes and techniques of fiction through a reading of selected short stories and novels with emphasis on such matters as structure, style and point of view.

221. SHAKESPEARE (C).
Examination of Shakespeare's dramatic art and leading ideas through a study of approximately a dozen plays.

360. ENGLISH LYRIC (C).
The lyric as a personal expression of the poetic imagination within a continuing tradition. Important forms of the lyric, such as sonnet, elegy, and ode; examples selected from the whole range of poetry in English.

362. TRAGIC DRAMA (C).
An examination of plays (mostly Greek, Elizabethan and modern) and critical theories (modern, but with attention to Aristotle and Hegel) in an attempt to sharpen perception of the genre "tragedy".

382. YEATS (C).
Poetry and plays of W. B. Yeats with intensive analysis, discussed against the background of the Irish Renaissance.

384. WALLACE STEVENS (C).
Stevens as a modern American poet. Covers a broad range of his poetry as well as his essays on reality and the imagination.

385/700. INDEPENDENT STUDY.
By arrangement. Credit, 1-3.

391. SEMINAR: RING LARDNER.
The vernacular tradition of American humor as a vehicle for social criticism. Lardner's newspaper columns, short stories, magazine pieces and theatrical sketches studied and related to the social and economic demands of the major publication markets for which he worked.

708. CHAUCER.
Chaucer's Canterbury Tales and the critical problems implicit in his works.

737. LITERATURE OF THE 17TH CENTURY.
Readings in 17th Century prose and poetry from Donne to Marvell; analysis of significant areas of thought and style.

745. LITERATURE OF THE ROMANTIC PERIOD.
Readings in the major poetry, representative essays, and selected critical writings including Blake, Coleridge, Wordsworth, Keats, Shelley, Byron and Hazlitt.

900. DOCTORAL DISSERTATION.
By arrangement.

Entomology

126. GENERAL ENTOMOLOGY (E).
Insects as biological systems. A survey of the field: ecology, development, structure, classification, and evolution of insects. The beneficial and detrimental interrelationships of insects and man. Both field and laboratory work are provided. Lab projects involve problems in rearing and manipulating insects. A collection is required as a part of the field experience.

Forestry and Wildlife Management

225/525. THE ELEMENTS OF FOREST MENSURATION.
The measurement of trees, stands, and forest products: field-office practice in timber estimating and log scaling; collection and compilation of forest inventory data. 3 40-hour weeks. May 29—June 16.

French

144. INTERMEDIATE FRENCH:
FRENCH LIFE AND CULTURE (C).
Stresses the reading of contemporary fiction.

359/659. 20th CENTURY THEATER.
French theater from Scribe to the present.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

General Business and Finance

201. CORPORATION FINANCE.
Corporate financial behavior; appraisal of factors affecting decision-making regarding sources and application of funds; introduction to capital budgeting and cost of capital problem. Prerequisite, Accounting 125, or permission of instructor.

250. ADMINISTRATIVE STATISTICS.
Probability and statistical distributions applied to business management problems; application of Bayes' theorem to sampling for business decision-making under uncertainty.

260. LAW I.
Nature of law and judicial process; the concept of contract; economic functions and consequences of contracts.

264/564. LAW OF URBAN DEVELOPMENT.
The study of legal problems generated by the changing urban environment. Areas of study include the law of race relations, poverty and welfare, land use and land use planning, urban and regional planning. Prerequisite: General Business 260 or equivalent.

265/565. BUSINESS AND ITS ENVIRONMENT.
Theories and doctrines relating the firm to its environment. Aggregate legal, social, political, and economic factors in completing concepts of the role of business in society. Prerequisite, senior standing or permission of instructor. Also listed as Management 265.

270. REAL ESTATE.
A comprehensive survey of real estate principles and practices; mechanics of the real estate market and economic and legal factors that influence it.

272/572. SEMINAR IN URBAN REGIONAL STUDIES.
Analysis of the dimensions of urban growth and change; discussion of the reasons behind, and the problems growing out of the economic growth and stagnation of urban areas. Prerequisite, GB 270 or permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

Geography

155. INTRODUCTION TO HUMAN GEOGRAPHY (D).
The spatial attributes of human societies; population, cultural characteristics, settlement, and economic activity. Selected regional case studies. 2 class hours. 1 2-hour laboratory period, and field trips.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Geology

101. PHYSICAL GEOLOGY (E).
The nature and origin of the landscape features of the earth and their underlying rocks and structures, including the work of rivers, weves, and currents, wind, and glaciers; the role of earthquakes, volcanoes, and the processes of mountain-building. 2 class hours, 1 3-hour leboratory period, and field trips.

388. SPECIAL PROBLEMS FOR UNDERGRADUATES.
By arrangement.

389. FIELD PROBLEMS.
By arrangement.

700. SPECIAL PROBLEMS.
By arrangement.

800. MASTER'S THESIS.
By arrangement.

900. PH.D. THESIS.
By arrangement.

German

110. ELEMENTARY GERMAN.
For the non-German major who hes no previous training in German. Emphasis on understanding and reading. Sequence to be followed: 110, 120, 130, 140.

126. ELEMENTARY INTENSIVE GERMAN.
For non-German majors; all four language skills are emphasized, primarily reading and speaking. Introduction to the cultural background of German-speaking countries. Covers the content of German 110 and 120. Students completing the course may qualify for German 130, 132, or 146. *Credit, 6.*

161. READINGS IN GERMAN LITERATURE (C).
An introductory course, intended to increase reading comprehension and fluency. Based on selected literary texts mainly from the 19th and 20th centuries. Prerequisites, 140 or equivalent.

385. SPECIAL PROBLEMS.
Guided reading and research in areas of specialization. *Credit, 1-3.*

409. GRADUATE READING COURSE.
Designed for graduate students preparing for their M.S. or Ph.D. reading examination. No previous knowledge of German required. *No credit.*

700. SPECIAL PROBLEMS.
Directed study in some special area of literature of philology. Open to Ph.D. candidates only, except by speciel permission. *Credit, 1-3.*

History

100. HISTORY OF WESTERN THOUGHT AND INSTITUTIONS (C).
Historical development of western European countries, their ideas and institutions.

121. HISTORY OF LATIN AMERICAN CIVILIZATION—1825 to PRESENT (C).
An introduction to the history of Latin America: the evolution of Latin America in the nineteenth and twentieth centuries.

150. THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).
A survey of the American national growth to the Civil War.

151. THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).
A survey of the American national growth from the Civil War to the present.

215/515. THE HISTORY OF RUSSIA (C).
From 1801: the impact of modernization on Russia in the nineteenth and twentieth centuries.

332/632. THE SOUTH IN AMERICAN HISTORY (C).
From early settlement to contemporary regional problems.

339/639. UNITED STATES SINCE PEARL HARBOR (C).
Emphasis on political, economic, and social currents since World War II.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

390. CONTEMPORARY UNITED STATES (C).
The first third of the course is devoted to theories and models of history, 1890 to 1963. Latter two thirds of course will be devoted to

contemporary American history since 1963. Seven 500-word letters based upon the readings.

738. TOPICS IN UNITED STATES INTELLECTUAL HISTORY.
Specific aspects of such general topics as the American adaptation of the European heritage, the growth of the concept of Americanism, the emergence of patrician leadership, the achievement of realistic democracy, the triumph of nationalism, the assertion of individualism in a corporate society, and the scientific-humanistic culture conflict.

Home Economics Education

685. SPECIAL PROBLEMS.
Topic: management and family economics. Prerequisite, permission of instructor. July 9-27. M T W TH

700. SPECIAL PROBLEMS.
Topic: home economics education. Prerequisite, permission of instructor. June 26—July 20.

Human Development

270/570. CHILD DEVELOPMENT.
Emphasis on examining three points of view in child study (Freud, Lewin, Piaget). Development of research or practical projects. Prerequisite: permission of instructor.

Industrial Engineering

256/556. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.
Principles and applications of data processing and electronic computer systems for use by Industrial Engineers as a management tool for control and decision-making. Prerequisite, permission of instructor.

260/560. DESIGN OF MAN MACHINE SYSTEMS I.
Introduction to principles of human factors engineering. Anthropometric physiological and psychological data sources. Data gathering and analysis techniques useful to designers and industrial engineers. Occupational health and safety standards. Includes lectures, demonstrations and experiments. Project option.

271/571. BASIC PROBABILITY FOR ENGINEERS.
Probability theory including: sample spaces; discrete and continuous random variables; functions of random variables; marginal and joint probability, density and cumulative distribution functions; and moments. Prerequisite, Math. 124.

385. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement.
Credit, 1-3

Italian

126. INTENSIVE ELEMENTARY ITALIAN.
For motivated students with no previous creditable training in Italian. Intensive training in all language skills. Equivalent of 110, 120. Credit, 6.

Management

110. INTRODUCTION TO COMPUTERS FOR BUSINESS.
The BASIC and FORTRAN computer programming languages; use of the computer for business data processing and problem solving.

201. PRINCIPLES OF MANAGEMENT.
Fundamental principles and practices of the managerial process in business enterprises.

214. PERSONNEL MANAGEMENT.
Principles and policies followed by management in recruitment, development direction, and control of personnel.

371. BUSINESS POLICY AND STRATEGY.
An integrating course embracing all organic management functions. Cases are used as subjects for analysis and systematic decision-making practice. Prerequisite, Management 201 and senior standing.

385. INDEPENDENT STUDY
By arrangement.

Marketing

201. FUNDAMENTALS OF MARKETING.
The role of Marketing in our economic and social structure. The planning, the distribution, pricing and promotion of goods and services to consumer and industrial markets, viewed as internal activities of the firm, and also as they are shaped by environmental forces.

210. BUYER BEHAVIOR.
Analysis of buyer motivation and buying behavior, including explanatory theories of consumer market behavior and models of the decision-making process for winning patronage. Prerequisite. Marketing 201 or permission of instructor.

222/522. MARKETING COMMUNICATIONS.
Development of effective marketing communication strategies based upon an understanding of the characteristics of audiences.

385. INDEPENDENT STUDY.
By arrangement.

Mathematics and Statistics

100. MATHEMATICS IN THE MODERN WORLD (E).
A cultural presentation of some mathematical ideas to demonstrate both the scientific and the humanistic value of the subject. Open to Math majors for non-major elective credit.

110. ELEMENTARY TECHNIQUES OF MATHEMATICS (E).
Including sets, logic, numbers, counting, functions, and graphs. Credit not allowed those who have taken former course Math 111, Math 112, or any calculus course.

115. ELEMENTARY LINEAR ALGEBRA (E).
Designed for and required of students in the School of Business Administration. Topics include systems of linear equations, vectors, matrices, determinants, Markov chains, linear programming, and the application of these topics to business situations. Credit not given for this course after Math 167.

116. CALCULUS FOR BUSINESS I (E).
Functions, limits, differentiation, and applications to business. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra.

117. CALCULUS FOR BUSINESS II (E).
Integration, functions of several variables, and applications to business. Credit given for only one of the courses 117, 119, 132, 136, 138. Prerequisite, Math 116.

127. CALCULUS FOR THE LIFE AND SOCIAL SCIENCES I (E).
Introduction to differential and integral calculus. Applications to the life and social sciences are stressed. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra, analytic geometry.

130. PRECALCULUS MATHEMATICS (E).
Functions and graphs; analytic geometry of lines and conic sections; polynomial, exponential, logarithmic, and trigonometric functions. Primarily for students intending to study calculus but needing extensive preparation in the requisite algebra, trigonometry, and analytic geometry.

135. CALCULUS I (E).
Introduction to differential and integral calculus of functions of a single variable: continuity, derivatives, extrema, curve sketching, the integral, elementary integration techniques. Primarily for students in the sciences. Credit given for only one of the courses 113, 116, 118, 122, 123, 133, 135, 153. Prerequisites, high school algebra, plane geometry, trigonometry, and analytic geometry of lines and conic sections; or Math 130.

136. CALCULUS II (E).
Continuation of Math 135. Limits, partial derivatives, integration techniques, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 124, 125, 134, 136, 154. Prerequisite, Math 135 or Math 122/123 taken in 1971-72.

165. MULTIVARIATE CALCULUS (E).
Functions of several variables, partial derivatives, multiple integrals, theorems of Green, Stokes, and Gauss. Prerequisite, Math 173/183 or Math 132/136/138.

241. APPLIED ANALYSIS I.
Complex analysis including analytic functions, residues, and conformal mappings; superposition of solutions of linear differential equations; orthogonal functions and Fourier series. Prerequisite, Math 174/184 or Math 165/166.

385/700. SPECIAL PROBLEMS.
By arrangement. Credit varies.

883. DIRECTED READINGS.
By arrangement.

Statistics

121. ELEMENTARY STATISTICS.
Nature of statistics; description of data; sample distribution; statistical theories and dispersion procedures; regression and correlation, time series. Not open to students who have completed Stat. 315, Psych. 241 or 245, or Soc. 247.

316/616. INTRODUCTION TO THE THEORY OF STATISTICS II.
Interval estimation, hypothesis testing, analysis of variance, regression, correlation, decision theory. Prerequisite, Stat. 315.

Mechanical and Aerospace Engineering

144. MECHANICS I (Statics).
A vector treatment of the equilibrium of particles and rigid bodies. Topics include: vector algebra, forces, moments, couples, equations of equilibrium, free-body diagrams, graphical techniques, constraints, structures and mechanisms, friction, centroids and moments of inertia, and the method of virtual work. Prerequisites, Math 136, Physics 161.

145. MECHANICS II (Strength of Materials).
Notions of stress, strain, and Mohr's circle. Tension shear and torsion. Plane stress and plane strain; moments of inertia. Shear force and bending moment diagrams. Deflection of beams; indeterminate beams. Castigliano's principle; plastic bending of beams. Mechanical properties of materials. Prerequisite, MAE 144.

163. THERMODYNAMICS.
The laws of thermodynamics are introduced and applied to various energy-transforming devices. Property relations. Emphasis on the science of thermodynamics, providing a background for further study in those areas that involve thermodynamic principles. Prerequisites, Physics 162, Math 165.

246. MECHANICS III (Dynamics).
A vector treatment of dynamics. Kinematics of a particle in two and three dimensions. Dynamics of a particle; momentum, moment of momentum, and work energy. Rigid bodies in plane motion; kinematics and dynamics. Relative motion. Prerequisite, MAE 144.

264. THERMODYNAMICS II.
Application of the laws of thermodynamics to energy conversion devices. Introduction to irreversible thermodynamics. Prerequisite, MAE 163.

265. FLUID MECHANICS. Also CE. 257.
Vector approach to the fundamentals of fluid dynamics, including the topics of fluid statics, kinematics of fluids, potential flow, vorticity, dimensional analysis. Introduction to viscous fluids and compressibility. Prerequisite, MAE 163. Required CE and MAE course.

385. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

700. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING.
Special investigation or research problems, the scope to be varied to meet specific conditions. Prerequisite, as required by the problem. *Credit, 1-6.*

702. THERMODYNAMICS.
Review of classical thermodynamics and conventional energy conversion systems. Introduction to kinetic theory of gases, and statistical thermodynamics. Selected topics in chemical thermodynamics. Prerequisite, graduate standing or permission of instructor.

790. ENGINEERING PROJECT.
A research, design, or development project. Written preparation and oral defense of a project proposal giving objectives, literature survey, and proposed plan. Written preparation and oral defense of a final report giving results and conclusions. May be repeated for credit. Prerequisite, graduate standing. *Credit, 3-6.*

Microbiology

140. BIOLOGY OF MICRO-ORGANISMS (E).
General considerations of the microbial world, including history, structure, growth, ecology, physiology, pathogenesis, and microbial genetics. Lectures supplemented with visual aid material.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Music

101. INTRODUCTION TO MUSIC (C).
Open to all students not majoring in music. Previous musical training not required. Basic music materials, principles of design, and cultural significance of representative works from the ninth century to the present.

120. PIANO CLASS.
Piano class on electronic instruments.

301/601. MUSIC HISTORY: HAYDEN, MOZART AND BEETHOVEN.
Reading, listening, score study. Music of their contemporaries may be included.

701. SEMINAR IN MUSICOLOGY.
Materials and methods of systematic and historical musicology. Specialized topics investigated each semester. The application to different problems of various subjects such as acoustics, aesthetics, analysis. May be repeated for credit with varying content, as advised.

716. ANALYSIS OF MUSIC LITERATURE. 1890-PRESENT.
Representative compositions from each period. Analysis by score and sound of the various musical forms and media. Offered on a rotation basis of period courses.

742. RESEARCH IN MUSIC EDUCATION.
Individual research projects in selected areas of Music Education.

Nursing

301. NURSING IN THE COMMUNITY.
Application of basic concepts of public health and public health nursing to the care of individuals, families and community groups. Correlated practicum provides experience in care of selected individuals, families and groups served by official and non-official public health nursing services. Enrollment limited; permission of instructor required. Students must provide transportation. June 15—July 31 *Credit, 6.*

303. ADMISISTRATION OF NURSING CARE.
The professional's role in evaluating, planning and organizing nursing care which is relevant to specific conditions and responsive to changing demands. Patterns of organization in a variety of clinical settings, with opportunity to apply principles to the nursing team. Prerequisite Nursing 210 or 392. Enrollment limited to 20. Permission of instructor required. June 15—July 31
Credit, 6.

385. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Nutrition and Food

385/685. HUMAN NUTRITION.
Absorption, utilization, and interrelationships of nutrients. Critique of methods of determining nutrient requirements. Prerequisite, introductory course in nutrition and biochemistry, or permission of instructor. June 26—July 20

700. SPECIAL PROBLEMS.
By arrangement.

800. MASTER'S THESIS.
By arrangement.

900. DOCTORAL DISSERTATION.
By arrangement.

Philosophy

105. INTRODUCTION TO PHILOSOPHY (C).
An introduction to some of the most important of the general questions, ideas, theories, and methods of inquiry which have given direction to Western thought.

110. ETHICS (C).
An examination of classical and contemporary theories concerning policy formation and the justification of personal decisions and ways of life.

125. INTRODUCTION TO LOGIC (E).
An inquiry into the nature of critical thinking, including the functions of language, the structure of deductive arguments, and a glimpse at inductive methods.

261/561. CONTEMPORARY ANALYTIC PHILOSOPHY (C).
Analysis of Russell, Carnap, Wisdom, the

later Wittgenstein, Austin, Strawson, Quine.

385. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.

700. SPECIAL PROBLEMS.
By arrangement.

800. MASTER'S THESIS.
By arrangement.

900. DOCTORAL DISSERTATION.
By arrangement.

Physical Education and Exercise Science

100. PHYSICAL EDUCATION.
Skills courses in sport, dance, and other forms of physical activity available to all students in the University.
Credit, 1.
Under P.E. 100. specific courses include:
G 02. INTERMEDIATE SWIMMING.
G 20. BALLET I.
G 55. GOLF I.
G 67. TENNIS I.
G 71. YOGA.

PE/Educ. 285. STUDENT TEACHING.
By arrangement. *Credit varies.*

370. ORGANIZATION AND ADMINISTRATION.
Discussion of administrative theory and practice as they relate to physical education in the schools.

662. HISTORY OF SPORT IN THE UNITED STATES.
Sport in America from earliest times to the contemporary period. Emphasis will be placed on the social, political and economic factors which affected the development of sport. Prerequisite, PE 561.

700. SPECIAL PROBLEMS.
Individual research on a topic not covered by any existing courses. Normally confined to an extension of the content of an existing course rather than an introduction to a new area of study.
By arrangement. *Credits*, 3-9.

772. ATHLETICS: A PHILOSOPHIC INQUIRY.
A critical analysis of those historical, sociological, and psychological factors which have influenced the concept of athletics and caused issues in programs associated with this concept.

278. PHYSIOLOGY OF EXERCISE.
Application of basic physiological concepts of physical education, emphasizing physiological effects and adjustments accruing from participation in physical activity. Prerequisite, Zool. 135. 2 class hours, 1 2-hour lab.

813. MEASUREMENT THEORY AND HUMAN MOVEMENT RESEARCH.
The theory of the construction of evaluative instruments in human movement with emphasis on a critical examination of existing measurement devices. Prerequisites, Ex. Sci. 274 and 712.

823. EXPERIMENTAL EXERCISE PHYSIOLOGY.
Experimental investigation of the physiological effects of exercise. Prerequisite, Ex. Sci. 621.

843. NEUROMUSCULAR FATIGUE.
Analysis of fatigue and recovery processes in gross human motor activity. Prerequisites, Ex. Sci. 621, 742, 813, and Stat 551 and 561.

800. MASTER'S THESIS.
By arrangement. *Credit varies.*

900. DOCTORAL DISSERTATION.
By arrangement. *Credit varies.*

Physics

141. INTRODUCTORY PHYSICS I. (E).
Mechanics, sound, heat; electricity, magnetism, light and modern physics, using trigonometry and algebra, but not calculus. Intended for pre-medical, pre-dental, pre-veterinary and some science major students. Prerequisites, Math. 121 previously or concurrently. *Credit*, 4.

163. GENERAL PHYSICS III (E).
Electromagnetic radiation, optics, atomic and nuclear physics. Prerequisites, Math. 136; Physics 162. *Credit*, 4.

385. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Political Science

100. AMERICAN POLITICS (D).
Introduction to constitutional principles and public policy making in American national government. Democratic theory, major national political institutions, electoral behavior, and selected public policy questions.

150. COMPARATIVE POLITICS (D).
Introduction to political structures, processes, and comparative national development in parliamentary, one-party, and other political systems. The relationship of cultural values to institutions; emphasis on such forces of change as democracy, industrialization, and revolution.

202/502. MODERN POLITICAL THOUGHT (D).
The development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present.

218/518. POLITICAL PARTIES AND ELECTIONS (D).
American political processes. Emphasis on parties, pressure groups, and public opinion.

254/554. INTERNATIONAL RELATIONS (D).
The nation-state system and conceptions of national interest in modern world politics. Emphasis on forms and distribution of power, making of foreign policy, and adjusting of international conflict.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Psychology

101. ELEMENTARY PSYCHOLOGY (D).
The basic approaches and concepts of modern psychology. Examples of perception, conditioning, cognitive processes, social behavior, tests and measurements, and personality. The heuristic value of these concepts and approaches in considering some of the problems of society.

141. PSYCHOLOGICAL METHODS (D).
Introduction to the ways questions about behavior are formulated and then tested through experiments. Lectures and laboratory experiences involving concepts from many areas of psychology are used to expose psychology majors to the procedures utilized in designing, conducting, and reporting experiments. Prerequisite, Psych. 101.

145. STATISTICS IN PSYCHOLOGY.
Introduction to statistical principles and techniques as applied to psychological data.

210/510. SENSATION AND PERCEPTION (D).
Methods, data and theories of the functioning of various sensory systems. Topics include a survey of basic sensory processes in the cutaneous senses, audition, vision, gustation, and olfaction; and higher perceptual processes in selected senses. Prerequisite, Psych 101.

262/562. CHILD PSYCHOLOGY (D).
Psychological development of the child, including language, emotions, intelligence, social behavior, motivation, and personality. Not open to psychology majors. Prerequisite, Psych. 101.

263/563. PSYCHOLOGY OF ADOLESCENCE (D).
Consideration of the development, and emotional, social and intellectual adjustment of the individual during the adolescent years. Prerequisite, Psych. 101.

301/601. EDUCATIONAL PSYCHOLOGY (D).
Psychological facts and principles of development, learning, and measurement as applied to educational situations. Prerequisite, Psych. 101.

305/605. HISTORICAL AND CONTEMPORARY SYSTEMS (D).
General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems. Prerequisite, Psych 101.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

871-872. CLINICAL PRACTICUM.
By arrangement. *Credit*, 3-6.

Public Health

123. DYNAMICS OF PERSONAL AND COMMUNITY HEALTH.
Development of understanding and attitudes relative to personal, family and community health needs. Attention to mental and physical well being, drugs, sexuality, communicable and chronic diseases and health services.

304/604. SCHOOL HEALTH.
Consideration of the principles, concepts, methods, and dynamics of the organization of a school health program at the elementary and secondary level. Stress planning and teaching in problem areas, (i.e. sex education, mental health and drugs). Prerequisite, junior or senior standing or permission of instructor.

375/675. PUBLIC HEALTH STATISTICS.
Principles of statistics applied to the evaluation of public health practices.

382. SUPERVISED FIELD TRAINING.
A field training program with an official health agency, approved by the department, under faculty supervision.
By arrangement. Credit, 3-10.

385. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students.
By arrangement. Credit, 1-3.

700. SPECIAL PROBLEMS IN PUBLIC HEALTH.
Special investigational or research problems in public health for advanced students. The scope of the work can be varied to meet specific conditions.
By arrangement. Credit, 3-6.

702. ADVANCED METHODS IN HEALTH EDUCATION.
Health education efforts that have influenced community health. Individual study, programming and research methods. Prerequisite, permission of instructor.
By arrangement.

782. SUPERVISED FIELD TRAINING (Internship).
For students majoring in public health. Supervised field observation and professional experience in selected public health agencies. Assignments in either associate functions or internship. Departmental staff; consultants in public health agencies.
By arrangement. Credit, 6-12.

800. MASTER'S THESIS.
By arrangement. Credit, 3-10.

Rhetoric

100. LANGUAGE AND WRITING (B).
How we choose words and styles to express ourselves and our world, with particular attention to the written language. Varied opportunities for written expression, on different subjects for different purposes and audiences. Emphasis on responsible choice in the language used in both academic and everyday lives.

110. LANGUAGE AND SPEAKING (B).
Choosing and managing materials and ideas in speaking situations. Interplay of communication, spoken language, and personal development.

140. VOICES OF IMAGINATIVE WRITING (B).
Various kinds of verbal imaginative expressions in our culture—rock lyrics and modern poems, short fiction, drama—with a view to helping students become more articulate and critical as readers and more resourceful and daring as writers. Exercises in critical reading or analysis are balanced by frequent "creative" writing activities in various genres, by "playing" at self-expression and self-definition.

145. CRITICISM AND THE THEATRICAL ARTS (B).
An opportunity for students to sharpen their critical judgements about theatre. Aims at development of well-reasoned judgements of theatrical art, using as subject matter current local offerings in theatre, film and dance, as well as participation in some laboratory projects.

175. THE RHETORIC OF MODERN MEDIA (B).
The functions of oral discourse (to inform, persuade, and entertain) in terms of mass media influence. Emphasis on how media affect the style and content of oral discourse. Includes viewing and listening, as well as discussion and written evaluation of media content.

Slavic Languages and Literatures

119/419. RUSSIAN READING COURSE I.
Intensive study of Russian grammar. Emphasis on developing reading ability only. No previous language training required.

385/700. SPECIAL PROBLEMS.
By arrangement. Credit varies.

Sociology

101. INTRODUCTION TO SOCIOLOGY (D).
The fundamental terminology of sociology and intensive discussion of selected topics from a sociological point of view.

251. URBAN SOCIOLOGY (D).
A comparative analysis of cities and of urbanization with special reference to demographic characteristics or urban populations, urban ecology, and urban social structure.

257. THE FAMILY (D).
The development of the customs of courtship and marriage and the contemporary family. The basic causes of changes and trends of the family.

260. SOCIETY AND THE INDIVIDUAL (D).
Sociological social psychology, examining individual and group behavior in the context of structured social arrangements. Topics include socialization, motivation, the social control of behavior, attitudes and behavior, the self-concept, and some aspects of collective behavior. Materials are drawn from a variety of perspectives, ranging from behavioral social psychology and field theory to symbolic interaction and ethnomethodology. Prerequisite, Soc. 101.

278. CRIMINOLOGY (D).
The nature of crimes and the factors underlying criminal behavior. The machinery of justice: the law, courts, police systems, and correctional institutions.

385/700. SPECIAL PROBLEMS.
By arrangement. Credit varies.

Spanish

110. ELEMENTARY SPANISH.
For students with no previous creditable training in Spanish. Intensive practice in language skills. To fulfill the language requirement, upon completion of the course most students are required to continue by taking Spanish 130 or 140.

146. INTERMEDIATE SPANISH—INTENSIVE.
An intensive intermediate course with emphasis on Spanish conversation and literature. Credit, 6.

182. ORAL SPANISH.
Oral aspects of the language; pronunciation, vocabulary building, speeches, discussions, debates. Grammatical elements required for correct and fluent use of American and Peninsular Spanish. Prerequisite, Spanish 181 or permission of the department.

700. PROBLEM COURSE.
Directed study in some phase of linguistics or literature.
By arrangement.

Related Courses in The Bilingual-Bicultural Institute

The following courses related to Spanish are offered as part of the Bilingual-Bicultural Institute.
306/606. TEACHING OF ENGLISH AS A SECOND LANGUAGE.
310/610. ADVANCED COMPOSITION.
311/611. LANGUAGE AND CULTURE OF SPANISH SPEAKING GROUPS IN UNITED STATES.
312/612. STRUCTURE OF MODERN SPANISH.
313/613. TEACHING OF SPANISH TO SPANISH SPEAKERS.
376/676. HISPANIC LITERATURE OF THE CARIBBEAN (PUERTO RICO).

Speech

182. INTRODUCTION TO COMMUNICATION DISORDERS.
The types and causes of communication disorders; emphasis on speech disorders.

202. SMALL GROUP COMMUNICATION.
The theory and practice of small group communication. An introduction to the nature of discussion, the process of group communication, the rational processes of discussion, the use of evidence, the theory and techniques for effective participation, leadership group dynamics, and public discourse.

223. PROGRAM PROCESS IN TELEVISION. The basic program process in television from original idea to finished program. Training and procedures involved in the techniques of television production. Experience in creating and producing television programs. Evaluation of program forms.

228/528. MASS MEDIA IN SOCIETY (D). Mass media as a major force in the American society. Emphasis on cultural, economic, political and social effects. Prerequisite: Speech 121.

288/588. CLINICAL PRACTICE.
Supervised experience in therapy with individuals having articulatory type disorders. May be repeated once. Prerequisites, Speech 181 and 182.
By arrangement. *Credit, 1-3.*

289/589. COMMUNICATION PROBLEMS OF DEAF & HARD OF HEARING.
The physical, psychological, social, and educational problems and needs of the hearing handicapped. Prerequisite, Speech 250/550.

385. SPECIAL PROBLEMS.
Independent study of a special problem for qualified students.
By arrangement. *Credit, 1-3.*

392. SEMINAR IN COMMUNICATION DISORDERS.
Seminar in cleft palate. The etiology, surgical management, and therapeutic management of patients with velo-pharyngeal incompetence. Prerequisites: Speech 181, 182, 283, 284, 287/587.

700. SPECIAL PROBLEMS.
Independent study in special subjects. No more than 9 credits may be applied toward the M.A. *Credit, 1-3.*

718. SEMINAR IN PUBLIC ADDRESS.
Problems in interpersonal communication. Communication behavior in interpersonal situations as opposed to mass communication or public settings. The development of role-taking and communication skills, social perception and the assessment of others, the strategic character of interpersonal behavior, the development of the "self" through communication, and the function of opinion leaders in social change. Attention to non-verbal as well as verbal variables.

800. MASTER'S THESIS.
Credit, 3-6.

884. HEARING DIAGNOSIS AND ASSESSMENT.
Intensive advanced auditory diagnostic and assessment procedures for ascertaining the etiology, type of impairment, site of lesion, medical and rehabilitation management. Prerequisite, Speech 285. May 29—June 9

900. DOCTORAL DISSERTATION.

Textiles, Clothing and Environmental Arts

710. SEMINAR: HUMAN ENVIRONMENT AND DESIGN.
Prerequisite, permission of instructor. June 26—July 13

Theatre

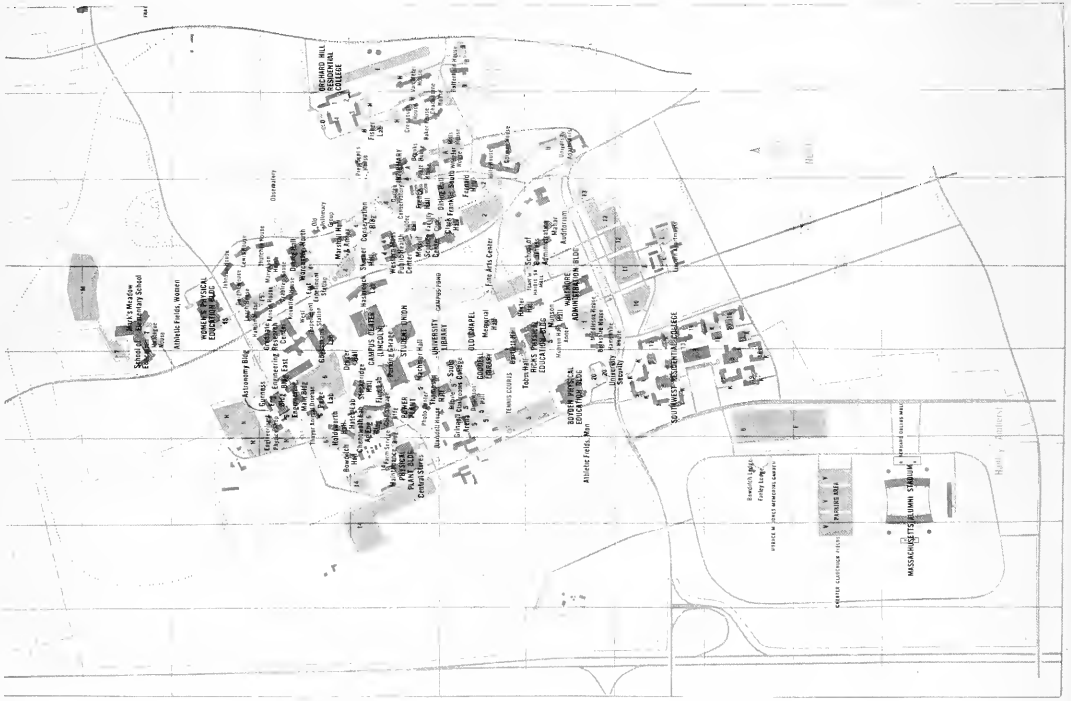
115. INTRODUCTION TO THE THEATRE (C).
Introduction to the art of the theatre: a survey of its aesthetics, elements, forms, and contributing artists; its influences and place in our culture.

385/700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*

Zoology

101. INTRODUCTORY ZOOLOGY (E).
Principles of zoology including cell structure and metabolism, heredity, development, behavior, evolution, ecology, and the anatomy and physiology of the major groups in the animal kingdom. Provides background for understanding current biological problems.

385, 399, 700. SPECIAL PROBLEMS.
By arrangement. *Credit varies.*



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1973-74 Undergraduate Course and Faculty

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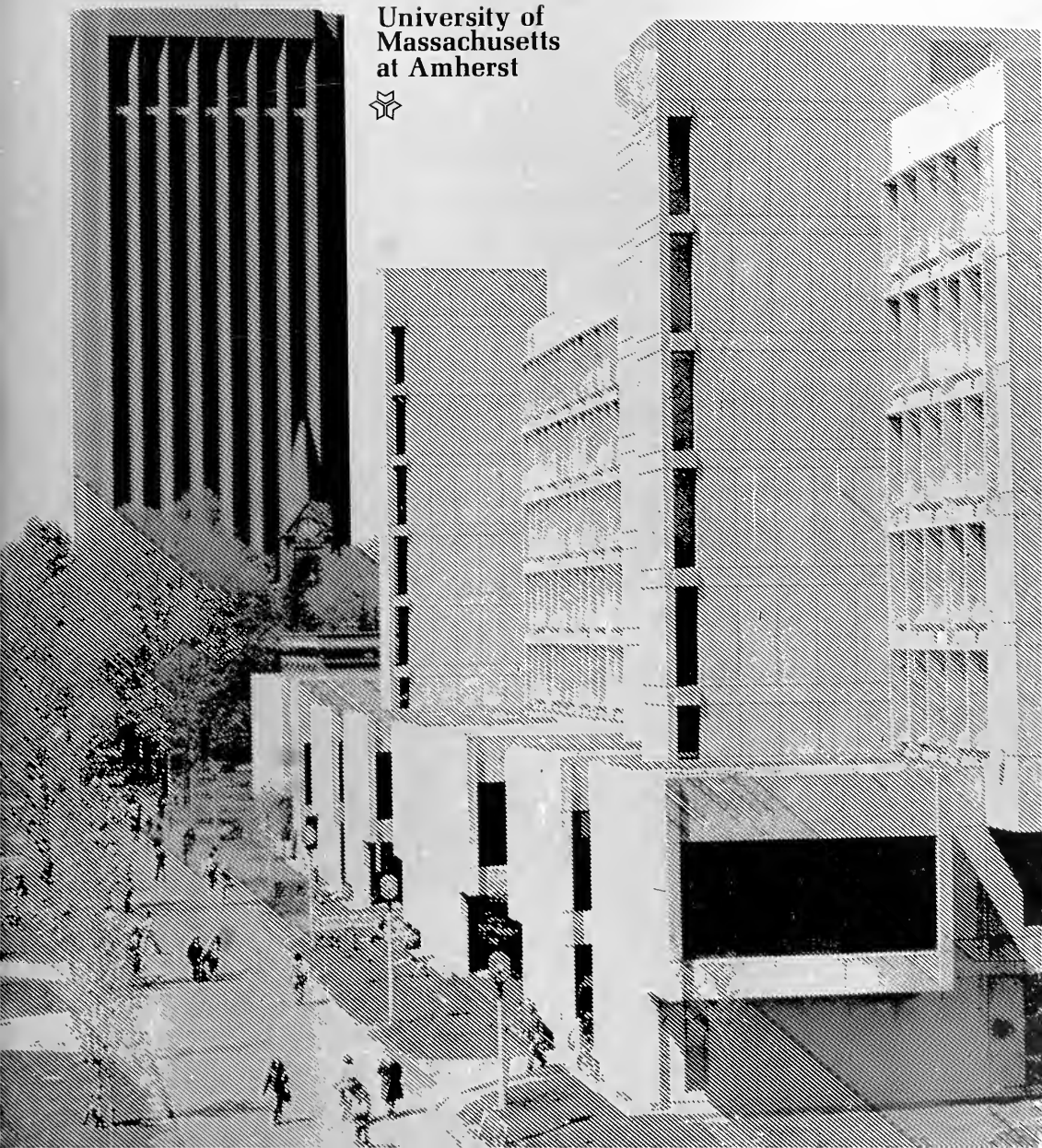


This Course and Faculty Directory issue of the University Bulletin, in effect the catalog of the University of Massachusetts at Amherst, includes material published in the *General Information Bulletin*. All students are responsible for observing the rules and regulations thus published, as well as those published in *University Directions*. The University reserves, for itself and its departments, the right to change its announcements or regulations whenever such action is deemed appropriate or necessary.

It is the policy of the University of Massachusetts that any and all acceptance of students for admission be without regard to sex, creed, race, color, or national origin.

APRIL 1973

The University Undergraduate Catalog for the 1973–74 academic year is part of the One Hundred and Ninth Annual Report of the University of Massachusetts and as such is Part II of Public Document 31, Section 8, Chapter 75, of the General Laws of Massachusetts.

Table of Contents

For General Information Section (See Index also.)

Academic Calendar

Adopted by Faculty Senate, May 11, 1972

1973

Registration Day 1, Undergraduate	Tues.	Sep. 4
Registration Day 2, Graduate	Wed.	Sep. 5
Registration Day 3, Undergraduate	Thur.	Sep. 6
First day of classes	Fri.	Sep. 7
Holiday	Mon.	Oct. 8
Holiday	Mon.	Oct. 22
Monday class schedule will be followed	Wed.	Oct. 24
Counselling period begins (classes not suspended)	Mon.	Nov. 12
Counselling period ends	Sat.	Nov. 17
Thursday class schedule will be followed	Tues.	Nov. 20
Thanksgiving recess begins after last class	Wed.	Nov. 21
Classes resume	Mon.	Nov. 26
Last day of classes	Wed.	Dec. 12
Reading Day	Thur.	Dec. 13
Final examinations begin	Fri.	Dec. 14
Last day of final examinations, semester ends	Sat.	Dec. 22

1974

Registration Day 1, Undergraduate	Mon.	Jan. 28
Registration Day 2, Graduate	Tues.	Jan. 29
Registration Day 3, Undergraduate	Wed.	Jan. 30
First day of classes	Thur.	Jan. 31
Holiday	Mon.	Feb. 18
Monday class schedule will be followed	Thur.	Feb. 21
Spring vacation begins after last class	Sat.	Mar. 23
Classes resume	Mon.	Apr. 1
Holiday	Mon.	Apr. 15
Monday class schedule will be followed	Fri.	Apr. 19
Counselling period begins (classes not suspended)	Mon.	Apr. 22
Counselling period ends	Sat.	Apr. 27
Last day of classes	Fri.	May 17
Reading Day	Sat.	May 18
Final examinations begin	Mon.	May 20
Holiday	Mon.	May 27
Last day of final examinations, semester ends	Wed.	May 29
Commencement	Sat.	June 1

Associated Dates: Rosh Hashanah Sept. 27-28; Yom Kippur Oct. 6; Easter April 14.

General Information

The University of Massachusetts is the state university of the Commonwealth, founded under provisions of the 1862 Morrill Land Grant Act. Incorporated as Massachusetts Agricultural College in 1863, the institution became Massachusetts State College in 1931, and the University of Massachusetts in 1947. Rooted in the liberal arts tradition, the institution has grown steadily from the four teachers, four buildings, and handful of students at its opening session in 1867 to the present state university system of three major campuses.

Situated in the Connecticut River Valley, the Amherst campus consists of approximately 1,200 acres of land and 150 buildings, including classroom and laboratory facilities as well as residence halls and other units.

To augment the Commonwealth's university-level facilities, the University of Massachusetts at Boston was opened in September, 1965. The University's Medical School at Worcester, founded in 1962 by an Act of the Legislature, enrolled its first class in 1970.

The total resources of the University are dedicated to giving all qualified students full opportunities to develop their capabilities for service in a growing society.

Admissions

Applications for admission to the University at Amherst may be obtained from the Admissions Office in Amherst. Applications for the Boston campus may be obtained from the Admissions Office in Boston. See the final pages of this Bulletin for addresses.

When to File
High school seniors are advised to file their applications in the fall of the senior year. Unless the applicant has a superior record, an application should not be submitted until the first set of marks is recorded in the fall.

Deadline Dates
Applications must be received and complete no later than:
In-State—March 1
Out-of-State—February 1
Foreign—February 1.

Tests Required
The Scholastic Aptitude Tests (SATs) may be taken on any of the scheduled dates, although the November testing date is preferred. The March and May dates are too late for seniors, but are appropriate for juniors taking the tests for guidance purposes.

The Amherst campus applicant is required to submit results of the SATs given by the College Entrance Examination Board. Although Achievement tests are not required, the University strongly recommends that each applicant submit results of three Achievement tests, one of which should be English Composition. The other two may be the applicant's choices.

The Boston campus applicant must submit scores of the SATs and three Achievement tests including English Composition.

Postgraduate and out-of-state students are required to submit scores of the SATs and three Achievement tests including English Composition. *Foreign students* must submit results of SATs and TOEFL (Test of English as a Foreign Language).

ALL COLLEGE BOARD TEST REPORTS MUST BE SENT DIRECTLY TO THE UNIVERSITY FROM THE COLLEGE BOARD TESTING CENTER. The applicant should be sure to request that the scores be sent to the campus to which application has been made and to give the correct College Board number for the campus chosen. No action can be taken on an application until official scores have been received by the University.

Preparatory Studies
The applicant's secondary school preparation must indicate the capacity of the student to handle the quality of scholastic work which the University has established as its standard of achievement. A prerequisite for admission is the satisfactory completion of a four-year high school course or its equivalent. A minimum of sixteen units should be offered, distributed according to the following recommendations:

English	4
College Preparatory Mathematics	3*
Foreign Language (two years of one language)	2
U.S. History	1
Laboratory Science	1

*Preferably two years of algebra and one of plane geometry.

The minimum of five other units should be offered in the areas of mathematics, science, foreign language, history and social studies, or free electives (not more than four units).

The student planning to major in physical sciences or mathematics should, if possible, offer two years of algebra, one year of plane geometry, and one-half year of trigonometry. Preparation in analytic or solid geometry, chemistry, physics, and introductory calculus is also strongly recommended.

The student planning to pursue an engineering curriculum should offer two years of algebra, one year of plane geometry, and one-half year each of trigonometry and solid geometry. Chemistry and physics are also advised. Any student deficient in the mathematics requirements should plan to make it up during the summer prior to entrance or should expect to take five years to complete the college course.

Several of the University's schools and colleges do stipulate intermediate language proficiency as a graduation requirement. The student planning to major in such areas will find at least three years of secondary school language preparation advantageous.

The exceptional candidate whose secondary preparation is not within the framework of the above recommendations may be considered for admission. Suitability for admission will be based on other intellectual aptitudes and achievements and readiness for the University curriculum.

Nonresident Candidates
The University of Massachusetts is limited to a 5 percent nonresident quota with thousands applying for the few vacancies available, making admission highly competitive for nonresidents of Massachusetts. See "Residence Status," p. 10.

Transfers
Any student who has been previously enrolled in a college is considered a transfer and must file a transfer application form. The University considers for transfer only those applicants who have completed a minimum of two years of work at another institution.

Priority is given to transfer candidates from Massachusetts who complete a two-year transfer program at any of the Commonwealth's state or city supported community and junior colleges. Remaining transfer vacancies are filled on a competitive basis by candidates seeking transfer from other institutions. Transfer vacancy for the out-of-state resident is extremely limited.

A minimum of 45 semester credits must be taken in residence at the University in order to receive a bachelor's degree.

Applications must be received and *complete* prior to April 1 for fall semester consideration, and prior to November 1 for spring semester consideration. It is the student's responsibility to be sure that all transcripts, including the most current, have been forwarded to the admissions office before the stated deadline dates. Decisions are made late in the semester prior to proposed entrance.

Campus Visitations
Amherst: The University recognizes the importance of a firsthand acquaintance with the colleges the applicant may be considering, and hopes that all applicants will find it possible to visit the campus for their own information and satisfaction. An interview,

however, is not part of the admission procedure. It is physically impossible for the admissions staff to interview all applicants; therefore, a personal conference will be scheduled only if the candidate or the candidate's guidance counselor has a question which cannot be readily resolved by correspondence.

Group information sessions are conducted on certain scheduled weekdays only. Candidates who wish to come to a group session should contact the admissions office and request the scheduled group session dates. The admissions office is not open on Saturdays.

Guided tours by student guides are available throughout the year. Tour information may be obtained from the University Guide Service at the Campus Center.

Notification of Decisions

In most cases the applicant will be notified by mid-April of the action taken on his application. The applicant who presents a strong academic record, enthusiastic school recommendations, and satisfactory College Board scores will receive earlier notification. This early notification should reassure the well qualified applicant regarding college entrance and enable the student who has selected the University to settle his plans. An applicant accepted at an early date, however, is under no pressure to make a final decision in regard to choice of college before the Candidate's Reply Date. In this way the burden of multiple applications on high school guidance counselors and college admissions officers may be lessened.

Veterans' Applications

A veteran must submit a regular freshman or transfer application, whichever is appropriate, and submit results of Scholastic Aptitude Tests taken within the past two years.

Veterans' Affairs

All University matters involving veterans' affairs should clear through the veterans' coordinator in the Financial Aid Office.

An eligible dependent of a veteran who is entering the University for the first time should present a Certificate of Eligibility at registration. This may be obtained from the nearest Veterans Administration office. Board, room, and fees must be paid in advance whether the student is enrolled under the G.I. Bill or not.

A veteran's dependent who is transferring to the University from another institution or who has done summer work at another institution should present a supplemental Certificate of Eligibility at registration. This may be obtained through the veterans' office at the institution last attended.

Physical Exam

Physical examination by his or her personal physician is required of each entering freshman, re-entering student, and student participating in athletics. Physical report forms for this examination will be mailed to each student with the bill for the first semester and must be completed and returned to the University Health Services ten days before the opening of the semester. Evidence of a successful smallpox vaccination and active tetanus immunization is required.

Residence Status

As a state institution the University offers a low rate of tuition to every student entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the Board of Trustees.

A student must present evidence satisfactory to the Treasurer of the University that his domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. This means that he must have established a bona fide residence in the Commonwealth with the intention of continuing to maintain it as such.

The domicile of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation the student, in addition to the requirements of these regulations respecting residence, shall present satisfactory proof of emancipation. A minor under guardianship shall be required to present, in addition to the certification of the domicile of the guardian, satisfactory documentary evidence of the appointment of the guardian. No student shall be considered to have gained residence by reason of his attendance in the University, nor shall a student lose residential preference during his continuous attendance at the University. The residence of a wife shall follow that of the husband.

The prescribed form of application for classification as to residence status must be submitted by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University. Discretion to adjust individual cases within the spirit of these rules is lodged with the Chancellors of the University.

Freshman Orientation

Every student entering as a freshman must attend a two-and-one-half-day orientation program at a specified time during the summer prior to entrance. The program consists of academic placement testing, counseling, and preregistration for courses to be taken during the coming semester and orientation to social and academic opportunities available to undergraduates. Each student is assigned a faculty adviser who will help in the selection of courses and planning of a class schedule. On the final day of each of these periods, a special program is held for parents so that they may learn more about the University.

Each freshman attending the summer orientation program on the Amherst campus will pay a nonrefundable fee of $30 to cover the cost of meals, housing, testing, and counseling. Every incoming transfer student must attend a summer preregistration program on the Amherst campus. A $15 nonrefundable fee is required of each transfer to cover the costs of preregistration, counseling, and lodging.

Grading

Enrollment in and graduation from the University involve both quality and quantity of work. The quantity of work is measured by the credits obtained by successful completion of courses. The quality of work is measured by grades.

Each grade is equated with a quality point as noted below. The quality point average required for continued enrollment and for graduation is set by the Faculty Senate. The cumulative average required for graduation is 2.0. Minimum number of credits required for graduation is 120.

Grades are reported according to the following letter system: Grades of A, AB, B, BC, and C are given for satisfactory work; grades of CD, D, and F are given for unsatisfactory performance. A grade of CD or D in a single course indicates little aptitude or application on the part of the student in that particular subject. Grades of CD, D, and F in a number of courses are indicative of work below standard for college work.

A—EXCELLENT—Outstanding accomplishment, showing distinction in intellectual achievement. This grade is not automatically assigned to those students who have received the highest ranks in a class.

AB—INTERMEDIATE—A and B.

B—GOOD—Performance of consistently high quality.

BC—INTERMEDIATE—B and C.

C—ACCEPTABLE—Performance which fulfills essential course requirements in quality and quantity and which meets the accepted standard for graduation from the University.

CD—INTERMEDIATE (below graduation standard)—C and D.

D—PASSING (but not satisfactory)—Performance which falls below the standard for graduation but for which course credit is granted.

F—FAILING—Performance undeserving of course credit.

INC.—INCOMPLETE (subject to conditions).

P—PASS—Indicates passing grade in special Pass/Fail registration. Quality points per semester hour will be assigned as follows:

A, 4.0; AB, 3.5; B, 3.0; BC, 2.5; C, 2.0; CD, 1.5; D, 1.0; F, 0; P (not included in computation of grade averages).

The semester grade point average, as well as the cumulative average, is determined by dividing the total points earned by the total credits carried.

In computing grade point averages the following will not be included:

1. Grades not earned at the University.
2. Courses satisfied by advanced placement.
3. A pass/fail course which has been successfully completed.

Any student whose semester quality point average falls below cumulative requirement is warned of his status by the Registrar and informed of the regulations governing academic termination of enrollment. A student who achieves a high average is placed in one of three honors groups, as follows: First Honors: 3.8 or higher; Second Honors: 3.4 to 3.7 inclusive; and Third Honors: 3.0 to 3.3 inclusive.

Classification of Undergraduate Students

Degree Candidates

FULL-TIME STUDENTS
Any student carrying 12 or more credits must be an accepted degree candidate and be assigned to a graduating class.

REDUCED-LOAD STUDENT
A full-time student may obtain exemption from the minimum load requirements set by the Faculty Senate only with the approval of the academic dean and the recommendation of the appropriate one of the following: Health Services, Area Director, Office of Nonresident Student Affairs, or Counseling Center. Such exemption is ordinarily not granted except upon the basis of health or critical personal or academic problems.

A Reduced-Load Student is considered a full-time student in *all* benefits, fees, and obligations. Although a reduced-load student carries less than the minimum load, the appropriate semester and cumulative quality point requirements for retention do apply and the semester counts as one of the maximum of ten toward graduation.

NONCLASSIFIED DEGREE STUDENT
A student who is admitted to degree status on the same basis as a full-time student but with the expectation of only part-time pursuit of the degree is considered a *Nonclassified Student*, and is given a classification of "NC." For initial enrollment an NC student is processed as an incoming freshman or transfer student and is assigned to a major department for appropriate counseling and preregistration advising.

A Nonclassified Student is not entitled to student benefits other than departmental support. To be eligible for continued enrollment, the nonclassified student must maintain a cumulative average equal to the graduation average of the University. The category "Nonclassified" is an original admissions category and is not designed as a category into which a full-time student may revert for purposes of part-time study.

Nondegree Students

SPECIAL STUDENT
A transient student accepted for one or two courses on a *noncontinuing* basis is assigned to this category (Class designation "SP"). No evaluation of transfer credentials or course advising is offered to the student in this category, nor is entitlement to any student benefits. Continuance is not automatic, but at the discretion of the appropriate admissions officer. A minimum of the graduation average of the University is required for an "SP" to continue. The Special Student category is an original admissions category and is not intended as a category into which a full-time student may revert for purposes of part-time study.

Advisory System

Each freshman selects a tentative educational objective and is assigned a faculty adviser within that academic area.

In the second semester of the freshman year, each student is given an opportunity to change to a new department or to remain in his current department. In succeeding semesters, a student may change to another major department by execution of a Major Change Card (available in the Registrar's Office).

It is the function of his adviser to help the student in adjusting himself to the work and life of the University. Academic progress reports issued by the Registrar's Office are sent to the adviser periodically, and the student is expected to report to the adviser from time to time to discuss current academic standing.

The University also forwards reports of academic standing to the parents. Both student and parents are encouraged to consult with the adviser whenever there are problems regarding studies or personal adjustments to college life.

Superior Students

The University regularly provides the superior student with challenging educational programs extending from the freshman through the senior year. These include Advanced Placement and Special Honors Programs.

Many entering students are able to achieve advanced standing and credit for college-level courses successfully completed in their secondary schools as part of the College Entrance Examination Board Advanced Placement Program or an equivalent. The University also administers a number of its own advanced placement tests. A student who demonstrates proficiency in a basic college subject may bypass the beginning course and go on to advanced work in the subject. Also, up to thirty semester hours of credit may be granted a student of high standing who can fulfill some course requirements through independent study.

The College Honors Program provides special guidance and courses for students of superior ability. Students are selected for the program as freshmen or sophomores. The Senior Honors Program recognizes merit and gives highly qualified students time and opportunity for independent study under closer, more personal direction than is ordinarily provided in the University curriculum. Students who complete their work satisfactorily are eligible for graduation with honors.

Housing

Policy

Recognizing the educational advantages of both classroom instruction and extracurricular experiences, to which residence-hall living can contribute a great deal, the Board of Trustees of the University has adopted a policy which requires undergraduates to be housed in University residence halls.

Exemptions

Exempt from this policy are married students; students who have reached twenty-one years of age on or before the first official day of classes; members of fraternities and sororities who have been authorized to reside in their respective houses (within approved maximum capacities); and students who commute from the homes of their parents or spouses.

A student living in a University residence who seeks permission to live off campus should submit the request to the appropriate Area Director. All others should submit similar requests to the Housing Office before appearing on campus for registration.

Room Assignments

Residence halls are opened to sophomores, juniors, and seniors on the day before registration. Upperclass students have the opportunity to select rooms in the spring of the preceding year. Rooms are assigned in order of receipt of proper application. Notification of assignment is made in mid-August.

Freshmen are notified three to five days before registration of the date they should arrive on campus to participate in Freshman Week activities. An effort is made to assign roommates to freshmen on the basis of different geographical areas and similar interests.

Housing Plans

The University recognizes the desirability of providing a variety of living arrangements; hence, it offers three basic systems: "Traditional" residence halls, residential colleges, and suite- or apartment-style residence halls. All three plans offer opportunities for intellectual, cultural, and social activities, and all three include some coeducational units, in which the sexes are separated by floors or wings.

The Central and Northeast Residence Areas consist of twenty-one residence halls housing 4,000 students. A "traditional" residence hall is a house with a long-standing tradition of fellowship, unity, and loyalty. The traditional hall, by its very nature, provides opportunity for meaningful friendship in a relaxed atmosphere.

The Orchard Hill Residential College, housing approximately 1,300 students in four coeducational residence halls, represents a planned and conscious attempt to make these residences more private, more quiet, and more academic in tone than most residential units. Each of the units within the college has student personnel and faculty as advisers who provide cultural as well as academic assistance and who coordinate the collegiate aspect of the academic program. *The Southwest Residential College*, which houses 5,500 students in both high-rise and low-rise buildings, operates on the assumption that a "college" within a university may function to provide more effective

small-group identities and a maximum of contact between the students and members of the faculty.

Special sections of selected courses are designated for residents of both residential colleges. Music and dramatic events, special lectures, and discussions take place in residence halls. Faculty Fellows of the college and students participate equally in the planning of these. Students of the colleges are welcome to participate in as many of these activities as they find to their advantage.

The Sylvon Residence Areo offers suite-type dormitories, affording students an opportunity to build close living relationships within small groups by sharing quarters in a suite- or apartment-style arrangement.

Room Furnishings

Most residence hall rooms are provided with beds, mattresses and mattress covers, dressers, desks, desk chairs, closets, and mirrors. In addition, most residence halls have study lounges, kitchenettes, laundry facilities, and vending machines. The residence halls within the residential colleges are provided with draperies and lounge chairs.

Each student is expected to provide pillow, linen, and blankets. A local rental service can supply a weekly change of bed linen and towels; blankets and pillows may also be rented.

Most residence halls are equipped with room telephones. Students who choose to live in these residence halls are charged an additional fee per semester for the basic telephone service.

Residence-Hall Staff

AREA DIRECTORS

Each residence area is administered by an Area Director, to whom all staff personnel in a residence hall report; Area Directors, in turn, report to the Vice-Chancellor for Student Affairs. Area Directors plan and direct all student personnel administrative activities for the residence halls in a given campus residential area; supervise the professional staff and student assistants in the residence halls; advise elected officers and committee chairmen in the residence halls; and provide individual and group advising.

HEADS OF RESIDENCE AND RESIDENCE DIRECTORS

The Heads of Residence and Residence Directors are responsible to the Area Directors. They work jointly with the counselors and Housing Office in the operation of residence halls. They provide leadership and support to the residence hall staff; facilitate the work of elected house government officers and committee chairmen, serving as resource persons and discussing University expectations with them; provide individual and group advisement out of concern for the welfare of students within the residence halls; and carry out administrative responsibilities associated with the operational aspects of residence halls.

COUNSELORS

Counselors receive direct supervision from the Heads of Residence and general supervision from the Area Directors. Their duties include helping to establish a climate in which students will feel free to seek assistance and in which the educational goals of the University are emphasized; counseling individual students in personal, social, and academic matters; working jointly with the Heads of Residence and house government in providing for the daily operation of the residence halls; interpreting and maintaining regulations with respect to student life on campus; and assisting the Heads of Residence with administrative tasks in the residence halls.

Room Rent

It is Board of Trustees' policy that "charges established . . . shall not be refundable to a student after he has occupied his assigned accommodation except upon certification of the Dean of Students that such student has withdrawn from the University because of involuntary entry into military service or other reason of extreme emergency, the refund in such event to be the balance of the charge paid over that applicable to the period of actual occupancy plus one week." Further information, for which students are held responsible, is contained in University Directions.

Residence halls are constructed, equipped, and maintained, at no cost to the taxpayers, through funding provided by bonds issued by the University of Massachusetts Building Authority. Room rents are fixed so as to provide a fund sufficient to pay building and operating costs, i.e., to amortize the bonds. In order to meet payments on the various residence hall bond issues and to assure the minimum possible room rent, the University must maintain maximum occupancy of residence halls. This requires that a student be held financially responsible for room rent once registering for and occupying a room in a residence hall.

Room Security Deposit

A student who lives in a University residence hall must pay a $100 room security deposit over and above the regular room rent. The deposit shall be paid upon initial entrance to the University and shall be refunded as follows:

a. Upon graduation from the University;
b. Upon voluntary withdrawal from the University, release of assigned housing, or intention not to re-register filed in writing with the Registrar (provided such notice is filed *forty-five days prior to the registration date of the next semester);*
c. Upon involuntary call into military service; or
d. Upon academic dismissal from the University.

A student forfeits the deposit if, having reserved housing, he or she does not occupy it, unless written notice in accordance with regulation on voluntary withdrawal (above) has been given and accepted, or upon dismissal from the University for disciplinary reasons.

Apartments for Married Students

The University owns and operates three groups of apartments for faculty and married graduate and undergraduate students: University Apartments, Lincoln Apartments, and North Village Apartments. As they become available, these apartments are offered to applicants according to a predetermined order of priority and assignment procedure. It is suggested that married students apply for Lincoln Apartments and North Village Apartments as soon as possible. Due to many previously received applications, however, it may be unlikely that an apartment can be assigned by the desired occupancy date. Applications and specific information may be obtained from the Off-Campus Housing Office, Whitmore Administration Building.

Off-Campus Housing

A card file of off-campus house, apartment, and room

rentals is maintained by the Off-Campus Housing Office. Also provided is information about local realtors, garden apartment developments, classified newspaper rentals, and persons seeking roommates. Every effort is made to assist students to obtain off-campus housing; however, a personal visit is usually necessary for the student to review rental listings because of daily changes in the card file and because all off-campus arrangements must be made by the parties involved. Brochures and other information may be obtained from the Off-Campus Housing Office, Whitmore Administration Building.

Insurance
It is not possible for the University to carry insurance which will compensate students or their families for losses suffered on the campus due to such hazards as fire, theft, or water damage. For most families such insurance is highly desirable, either as an extension of present home insurance or as a special contract.

Food Services
The University Food Services cater the food requirements of the University, except those services offered by the Campus Center Complex. Five dining commons serve students on a five-day meal ticket contract. All freshmen, sophomores, and juniors residing in University residence halls are required to purchase the five-day meal ticket. Either a ten-meal or a fifteen-meal ticket, which is valid for either two or three meals per day, Monday through Friday, may be selected. Students over twenty-one years old prior to the start of the semester are exempt from the plan. Students who are members of fraternities or sororities may be permitted to board at their respective fraternities or sororities, upon receiving written permission from their respective student personnel deans. Those not required to board on campus may eat at a dining commons on a cash basis; they may purchase one of the regular meal tickets for ten or fifteen meals per week, or they may purchase a five-day single-meal ticket at a lower rate. Weekend meal tickets are also available. Snack-bar services are available at Worcester Commons and Hampden Dining Commons during regular hours of operation.

Expenses

Amherst Campus
Expenses are approximately $2,000 per year for the normally economical student. First-year costs are usually greater than those of the other three years, and there are fewer opportunities for earnings. Therefore, a student is advised to have a definite plan for meeting the expenses of the first year before entering. The following estimate of a year's expenses, based chiefly upon last year's costs, includes only those items which are strictly University-related and does not include amounts for clothing, laundry, travel, etc. These costs vary slightly from year to year. Tuition for residents of Massachusetts is $250 per year; for others, $850. The University reserves the right to change any fees without advance notice.

ESTIMATED ANNUAL EXPENSES—AMHERST

Tuition (Residents of Massachusetts)	$ 300.00
Room Rent in University Residence Halls	675.00*
Telephone (Where Available)	40.00
Board at University Dining Halls (Five Day Plan—Approx)	640.00
Athletic Fee	30.00
Physical Education Fee	20.00
Campus Center Fee	60.00
Fine Arts Fee	6.00
Student Activities Tax (Approx)	40.00
Student Health Service Fee	77.00
Student Medical/Surgical Insurance (12 Months' Coverage—Optional)	40.00
Books, Stationery, Laboratory and Other Supplies (Approx)	200.00
	$2,128.00

INITIAL PAYMENT FOR FRESHMEN—AMHERST

Tuition (Residents of Massachusetts)	$ 150.00
Room Rent in University Residence Halls	337.50*
Telephone (Where Available)	20.00
Board at University Dining Halls (Five Day Plan—Approx)	320.00
Athletic Fee	15.00
Physical Education Fee	10.00
Campus Center Fee	30.00
Fine Arts Fee	3.00
Student Activities Tax (Approx)	20.00
Student Health Service Fee	38.50
Student Medical/Surgical Insurance (12 Months' Coverage—Optional)	40.00
Books, Stationery, Laboratory and Other Supplies (Approx)	100.00
	$1,084.00

*There are other annual rates of $615, $680, and $700.

Boston Campus
The direct costs involved in attending the University of Massachusetts at Boston are appreciably lower than those for attending the University of Massachusetts at Amherst. Major difference is the cost for room and board; since the University of Massachusetts at Boston was created as a non-residential college, its students live and board at home or under non-college arrangements. Certain other expenses which are obligatory at the University of Massachusetts at Amherst are not required for the University of Massachusetts at Boston students.

The following schedule of tuition and fees includes only those items which are strictly college-related and does not include amounts for clothing, laundry, travel, etc. Expenditure for books, stationery, and other supplies is estimated to be $200 per year for all full-time students.

SCHEDULE OF TUITION AND FEES—BOSTON

	Full-time	*Part-time*
Tuition (residents of Massachusetts)	$ 300	$ 15/credit hour 150/semester maximum
Tuition (non-residents)	1100	55/credit hour 550/semester maximum
Student Activities Fee	30*	20*
Student Medical/ Surgical Insurance, 12 months' coverage (optional)	30*	30*
Student Health Fee	28	14

* subject to change

The initial payment for first semester expenses, required of freshmen at the time of fall registration, is $194 for students who are legal residents of Massachusetts and $624 for non-resident students.

Explanation of Fees and Payments

IN-STATE TUITION

As a state institution, the University offers the privilege of in-state tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the policy established by the Trustees and detailed under "Residence Status," page 10.

ATHLETIC FEE
Funds received from this charge are used to support comprehensive men's and women's intercollegiate programs as well as intramural programs.

PHYSICAL EDUCATION FEE
Income from this fee is used to support the required physical education program, intramural athletics, and general recreation.

CAMPUS CENTER FEE
Funds received from this charge are used to support the Student Union and the Campus Center and meet the operating costs of their various activities.

FINE ARTS FEE
Funds received from this fee are used to support a varied and comprehensive program of fine arts events for the cultural enrichment and enjoyment of the undergraduate body.

STUDENT ACTIVITY TAX
This tax supports student government and an extensive and varied range of cultural and social activities for students. In addition, payment entitles each student to admission to many campus events and includes a subscription to the daily student newspaper, the annual yearbook, the student handbook, and a student guide to the campus.

HEALTH SERVICES FEE
Funds received from this charge are used to support the medical, psychiatric, and health services provided by the staff of the Health Center.

MEDICAL-SURGICAL INSURANCE
This is an *optional* plan intended to supplement the care received by students at the Health Center. It provides hospital, medical and surgical care on a twelve-month basis for injuries or illness during the school year, holidays, summer vacation, and other times when the student is off campus. Students who register for the fall semester have only one opportunity to enter or reject this program each year, at the time of payment of the fall semester bill. It is also offered on the spring semester bill for new spring registrants only. Married students desiring family coverage under the plan now in existence at the University are advised to contact the Student Health Services. All candidates for and members of intercollegiate athletic teams ore required by the Athletic Department to subscribe to the supplementary insurance plan.

COMMENCEMENT FEE
A commencement fee of $10 is assessed students in September of their senior year, as commencement exercises and events are intended to be self-supporting.

SPECIAL UNDERGRADUATE STUDENTS
The Special Student tuition rate is $15.00 per credit for Massachusetts residents, up to a maximum of $150.00, and $55.00 per credit for nonresidents, up to a maximum of $550.00. Every student must pay a $1 identification card fee yearly, and a student taking three or more courses a semester must pay a Campus Center fee and a health fee.

CREDIT BY SPECIAL EXAMINATION
Any student receiving credit by special examination must pay $5 per credit before the examination may be taken. This fee is nonrefundable.

SCHOLARSHIP PAYMENT
Known scholarships are shown on the fee bills. If such items are not shown, deductions may not be made from the bill until satisfactory evidence has been presented to the Bursar's Office by the recipient.

Payment Due Date
In accordance with University policy, all charges for tuition, fees, board and room rent in University Residence Halls are due and payable prior to the date of registration of each semester. Bills will be rendered in advance with due date shown and payment may best be made by mail. No student may register until all University charges are paid.

Late Payment and Registration
Any student who does not make payment of his semester charges by the date specified may be required to pay a late payment fee of $5.

Refunds

TUITION AND FEE REFUNDS
A student who leaves the University for any reason, except as specified below, before a semester is completed will be granted a pro rata refund of tuition and fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given a full refund of tuition and fees. The $15 matriculation payment required of new students is not refundable.

Refunds are first applied to reimburse scholarship or loan funds (up to the full amount), and any remaining amount is refunded to the student or parent. A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

Refund Schedule

Regular Term

a. Within the first two weeks from the beginning of semester or term (Registration Day)—80%.
b. During the third week—60%.
c. During the fourth week—40%.
d. During the fifth week—20%.
e. After the fifth week—no refund.

Summer Session

a. During the first week—60%.
b. During the second week—20%.
c. After the second week—no refund.

ROOM RENT AND BOARD REFUNDS
A student who has made an advance payment of room rent will be granted a full refund of prepaid room rent if he or she fails to attend any part of the next semester or term or does not reside in a residence hall or other housing. Prepaid board will be refunded on a special per diem basis.

A new policy of Room Rent Refunds was placed in effect by the Board of Trustees beginning with the Spring Semester 1973. According to the new policy, "student room rent refunds shall be refundable according to the following instructions: Any student who occupies his/her assigned accommodations and subsequently leaves the University prior to the end of the first full class week shall automatically be charged a minimum of $100 for his/her room. Any student who leaves the University during the second through fifth weeks shall be charged $100 plus 20% of the remaining balance for each week or part thereof. No refunds will be made after the fifth week of the academic semester. Refunds will be made during the refund period only to students who officially withdraw from the University through the Registrar's Office and according to the Registrar's official withdrawal date. The Dean of Students' Office will be authorized to make exception to the above only for reasons of involuntary entry into military service or for reasons of 'extreme emergency'. Any exception made, however, shall not apply to the $100 minimum charge which shall be levied in all cases automatically."

Student Personnel Services

Student Personnel Services comprise a number of agencies with primary concern for students' nonacademic (out-of-the-classroom) activities—residence halls, health, counseling, student activities, security, admissions, records, nonresident student affairs, career planning, financial aid, and related services.

The Dean of Students directs and supervises the activities of all Student Personnel Services in order that they might serve most effectively to meet the broad educational goals of the University.

The Associate Dean of Students is responsible for the general administration of all residence halls and the activities program of men and women undergraduates. The Associate Dean's Office includes in its staff grouping the Housing Office, Coordinator of Student Activities, Campus Center Manager, the Area Directors, and all Heads of Residence.

The Assistant Dean of Students—Coordinator of Student Activities administers and coordinates all student activities, ranging from individual needs to organized clubs, the Classes, the Campus Center Governing Board, and the Student Senate. The base of operation is the Student Activities Office, which is composed of the Recognized Student Organizations (RSO) financial and accounting service and the Program Office, whose personnel advise and assist in the planning and execution of student projects and programs.

The Office of Nonresident Student Affairs is responsible for administrative liaison with and development of programs for nonresident students—commuters, fraternity residents, and sorority residents. The Greek Area Coordinator and Fraternity Manager are located in these offices.

The Housing Office has responsibility for the supervision of residence hall room assignments and room changes and serves as a central source of information for off-campus housing listings.

The Campus Center Manager administers and coordinates the management policies for the Student Union-Campus Center. The duties include close coordination with the Campus Center Governing Board, serving on various committees concerned with student services, and supervision of the Campus Center staff and services. Major areas of responsibility include the University Store, Campus Center Food Services, Student Union Lobby and Games Area, Campus Center overnight accommodations, Parking Garage, and Print Shop.

The Director of International Programs, located in the Office of the Provost, assists and coordinates international programs, including the study abroad programs of the University of Massachusetts. Students can obtain information from the Office of International Programs on a range of overseas study programs, including those operated by other American colleges and universities and by foreign institutions. This office also has information on low-cost international travel, international student identity cards, financial aid for study abroad, and work opportunities overseas. Students planning to go abroad for work, study, or travel should consult the Director in making these plans. The Director also coordinates Marshall and Rhodes Scholarships.

The Foreign Student Adviser offers assistance to foreign students, faculty, and staff and should be consulted in regard to all matters pertaining to their offi-

cial immigration status while in the United States. In addition, the adviser may be consulted regarding any other problems which a person from another country may encounter while at the University. These questions may include help in finding housing, help with financial matters including the authorization of foreign student loans, relations with American students and the community, and personal problems. He further attempts to help in coordinating community service projects, such as speaking engagements, trips to the United Nations, host families, and International Club activities. The Foreign Student Office is part of the International Programs Office.

The Admissions and Financial Aid Office is responsible for all administrative procedures with respect to undergraduate admissions to the University, including liaison with high school guidance counselors, Community College staff personnel, and other admissions officers for transfer students; it also passes on readmission of returning and re-entering students and admissions standards set in coordination with the Vice-Chancellor for Academic Affairs and academic departments. The admissions deans also serve as advisers to the various academic-year classes.

The Registrar's Office is responsible for registration (enrollment) and matriculation of undergraduate students at the University; administrative procedures relating to course loads, courses of study, withdrawals, grade reports, and transcripts; and maintaining the permanent academic record cards.

The Office of Transfer Affairs is a resource center for all matters pertaining to the transition process of students entering the University from other institutions of higher education. (Nearly one-fourth of all newly entering students are transfers. The major portion of transfer students come from the state-supported Community Colleges.) This Office also coordinates with the Community College system the mechanisms for admission, credit evaluation, financial aid, and orientation, and is concerned with the adjustment process for transfers. It works with the other Student Personnel Services at both the Community College and the University in an attempt to assist the transfer in making a smooth and comfortable adjustment to the University.

The Counseling Center's basic aim is to support the student's efforts to develop into a mature, useful, self-fulfilled member of society. The Center's day-to-day work with the student client involves psychological counseling on personal, social, educational, and vocational problems.

All individual counseling contacts with members of the Counseling Center staff are strictly confidential. No information is released to members of the University community, to parents, or to outside agencies (such as graduate schools, law enforcement agencies, or draft boards) without the student's explicit authorization in advance. When the need arises, the Counseling Center staff also administers psychological tests for assessing the student's abilities, interests, and personality. Such tests are interpreted to the student as part of the counseling process.

The Career Planning and Placement Service responsibilities include vocational counseling and the administration of the affairs involved in aiding students to seek appropriate positions and careers. While this service provides vocational and career counseling for all undergraduates, the emphasis is on aid to seniors in planning their futures following graduation and providing them with the best means for finding permanent employment. The office arranges for employers from business, industry, government, schools, and other areas to visit the campus to interview prospective graduates during the school year.

Cumulative student personnel records, occupational information and industrial literature and preparation of credentials (including personal resumes and recommendations), in addition to counseling and guidance, are provided to aid seniors and registered graduates in accomplishing their career objectives.

Teacher Certification—Employment in public schools requires teachers' certification. Students enrolled in an approved program through the School of Education meet the specified requirements for the Commonwealth of Massachusetts. Others, not so enrolled, should review their programs with the Educational Placement Officer prior to their senior year to make sure that requirements will be met upon graduation. Questions concerning certification locally and in states other than Massachusetts, specialized certification, documents that must be supplied, supply and demand, existing and projected vacancies, and the like, may also be directed to the Educational Placement Officer.

Health Services

The University Health Services provide guidance for the development of optimum physical, emotional, and social welfare in the University community.

In the Health Center are located an outpatient department, with supporting X-ray, laboratory, and physical therapy facilities, and an inpatient service for the care of students who need hospitalization.

Hospitalization for conditions requiring more specialized care than is available in the Health Center can be arranged at the Cooley Dickinson Hospital in Northampton.

Any care rendered on the campus by members of the staff of the Health Services is provided without additional charge to anyone who has paid the student health fee. The provision for care off campus can be arranged by the Health Services, but the cost of this care is a responsibility of the student. A supplementary insurance program has been developed to provide for most hospital and surgical care not available at the Health Center. This optional program can be elected in September only. The insurance provides coverage for twelve months. *All candidates for and members of intercollegiate athletic teams are required to subscribe to this supplementary insurance plan.*

The health status of participants in the athletic program, both intramural and intercollegiate, is under Health Services supervision, and care is available for injuries resulting from these activities.

Recognition of the specific emotional needs of students in an educational environment has led to the provision of an active mental health program including diagnostic and limited treatment services.

The student is urged to consult a member of the Health Services staff as soon as any indication of a physical or emotional disorder is evident. It is much easier for the staff, and less time-consuming for the student, to rectify minor difficulties before they have become sources of disability.

Any student who is under medical supervision prior to entrance is urged to have the personal physician write the Health Services, giving reports and instructions in appropriate detail. In brief, the Health Services attempt to provide each student with a coordinated and comprehensive program of health supervision formerly provided by the family physicians.

All visits and information gained as a result of visits to the Health Services are treated as confidential. No such information will be released without the permission of the student.

The Health Education staff concerns itself with helping to develop attitudes and behavioral patterns which will promote healthful personal and community living.

The Environmental Health and Safety staff operates to ensure a safe and healthful environment for all who live or work on campus. Food services, housing, radiation use, building and traffic safety, and fire control are major areas of activity.

Student Activities

Campus Center Complex

The Campus Center Complex is composed of the Murray D. Lincoln Campus Center, the Parking Garage, and the Student Union. It houses the offices of the Assistant Dean of Students and his Student Activities staff; the Campus Center Manager and his staff; and the University Ombudsman.

Service departments of the complex include the University Store; the Campus Information Center; the Cashier's Office; automatic U.S. Post Office; barber shop; games area; music library and listening lounge; and overnight accommodations with parking facilities and food services (four cafeterias and the Top of the Campus restaurant and cocktail lounge). Meeting rooms, lounges, reading rooms, and art galleries are available for student and general campus use.

The Campus Center Governing Board, comprised of undergraduate and graduate students and alumni, determines policy for the operation of the Center. The Program Council, a standing committee of the Board composed wholly of students, selects, plans, and executes all Center activities in art, music, dance, movies, special events, etc. Any student may apply for membership.

Construction and operating costs are met from student fees and income generated from general operation, particularly of the Food Service Department, the University Store, and overnight accommodations. In effect, a portion of every dollar generated within the Complex is recycled back into the Center to benefit the student body in one form or another, that is, through building services, Program Council activities, the assistance of professional staff, etc. Full use of income for these and other positive purposes is, of course, a major factor in maintaining student fees at a reasonable rate.

The Campus Center hosts programs sponsored by the Division of Continuing Education, the alumni of the University, and many service organizations. The Complex is also used heavily for conferences, institutes, workshops, and short courses.

Student Activities Office

In addition to serving as the headquarters for Recognized Student Organizations (RSO), the Student Activities Office in the Campus Center provides resource material and counsel on program planning, organizational work and leadership training, entertainment selection and procurement, service and aid projects for campus and community, special interest activities, and recreation, as well as counsel on budgeting, purchasing, contracting, and other business procedures. The Student Activities Office also provides banking, bookkeeping, and auditing services for student organizations.

More than fifty professional organizations exist on campus as a means of extending classroom interest through closer contact with members of the faculty and representatives of the professions. Student government offers a forum for debate on matters of importance to the entire University community. There are several student publications and a student FM radio station. Approximately 400 student organizations range in interest from political, religious, and cultural to social, professional, and recreational.

The University expects that no student will be excluded from membership in any club, society, fraternity, sorority, or other organization for reasons of race, religion, or national origin. Campus groups belonging to national bodies which openly or covertly endorse such discrimination would be in violation of this University principle.

Student Government
The Student Government Association (SGA) works for fundamental academic and social reform on campus while providing a variety of services to students. These services include draft counseling, a lecture-note program, book loans, the bus service, the course description guide, the attorney for students, and funding for a wide variety of student groups and services. The SGA is working toward full student self-determination in social and academic life.

All undergraduates are members of the SGA and are eligible to join its activities. The Student Senate is the legislative arm of the SGA. The seven area governments determine policies in the separate residential areas. The SGA President coordinates the activities of the SGA and represents the student body to the administration and faculty. The President becomes, ex officio, a member of the University Board of Trustees.

The student role in running the University has increased greatly in recent years. Students interested in University reform should contact the SGA President.

Student Organizations
There are more than 450 recognized student organizations at the University of Massachusetts, Amherst. Among these are:

Campus Publications

The Daily Collegian. Daily newspaper published by undergraduates.

Index. University yearbook.

Spectrum. Magazine of essays, short stories, poetry, and art.

Music Organizations
Campus music organizations provide experience in musical and allied activities for performers and technicians with various kinds of interest and ability.

The University Symphony Orchestra, the bands, and the choral organizations are in the Department of Music. Membership is open to all students, faculty, alumni, and others in the community.

Theatre
The University of Massachusetts Theatre, an activity of the Theatre Program, schedules several productions, workshops, and other theatre activities each year. The productions serve as the laboratory for all students electing the theatre concentration in the Department of Speech; however, all phases of work on these productions are open to all students regardless of school or major.

Debate
The University Debate Union is an academic and co-curricular activity of the Department of Speech. Each year, debate teams research and debate an intercollegiate proposition dealing with an important national or international problem. The debaters attend tournaments at colleges and universities throughout the United States.

Student Honor and Service Societies

Adelphio. Men's honor society (senior and junior classes).

Mortor Boord. National honor society for senior women.

Moroon Key. Men's sophomore honorary-service society.

Scrolls. Women's sophomore honorary-service society.

Revelers. Group of upperclassmen who promote and encourage freshman interest in campus activities.

Alpho Phi Omego. National service fraternity.

Gamma Sigmo Sigmo. National service sorority.

Delto Sigmo Rho-Tau Koppo Alpho. National honorary forensic fraternity.

Belchertown Volunteers. Group of students who, each Saturday, go to Belchertown State School for the retarded to provide exercise, companionship, and social events for the patients.

Northompton Volunteers. Group of students who provide services similar to those of the Belchertown Volunteers at Northampton State Hospital.

Northern Educotional Service. Urban tutoring service provided by students who are trained on campus.

Room to Move. Drug counseling drop-in center, cooperating with the Health Services.

Guide Service
The University Guide Service, ARCON, disseminates information about the University and conducts tours for visitors and official guests. The guides, fraternity men and sorority women of the junior class, are required to uphold the highest standards of responsibility and leadership.

Professional and Special Interest Clubs
Approximately fifty professional clubs, established in connection with the various major courses of study, stimulate students' professional interest in their chosen fields and afford opportunity for discussion of technical subjects of mutual interest.

Special interest groups cover an even wider range of interests, in many cases offering learning experiences in subjects not included in the academic areas of the University (e.g., religion, politics, sports, hobbies, etc.). A partial list includes Free University, Young Socialists Alliance, Flying Redmen, Precisionettes, Amateur Radio Club, Student Afro-American Society, Students for a Democratic Society, Volunteer Fire Department, National Ski Patrol, Outing Club, Ski Club, SCUBA Club, Equestrian Club, Crew Club, Bike Club, Square Dance Club, Music Theatre, Residential Area Governments, and a variety of other organizations.

Fraternities
Men's social fraternities include Alpha Tau Gamma (Stockbridge School), Beta Kappa Phi, Delta Chi, Kappa Sigma, Lambda Chi Alpha, Phi Mu Delta, Phi Sigma, Phi Sigma Kappa, Pi Lambda Phi, Sigma Alpha Epsilon, Sigma Phi Epsilon, Tau Epsilon Phi, Theta Chi, and Zeta Nu. Women's social fraternities include Alpha Chi Omega, Chi Omega, Iota Gamma Upsilon, Kappa Alpha Theta, Kappa Kappa Gamma, Lambda Delta Phi, Pi Beta Phi, Sigma Delta Tau, Sigma Kappa and Sigma Sigma Sigma. Coed fraternities include Boomtown and Sigma Alpha Mu. A Greek Council consisting of the presidents and one representative of these fraternities is the area government for this residential area. The

Greek Council provides service to all its member organizations, the University, and the community, as well as dealing with general matters pertaining to fraternity life. A cooperative organization—The Fraternity Managers' Association—pools the financial resources of twenty of the fraternities for the purposes of effecting orderly, economical purchasing and accounting procedures. A professional fraternity manager administers the association's program, while the Greek Area Director's Office administers all other matters pertaining to fraternity life. Each of the fraternities owns its own house, and the members are responsible for the daily maintenance, financial management, meal planning, governing, and organizing of special events or programs.

Fine Arts Council

The Fine Arts Council is composed of five undergraduates and five faculty members appointed by their respective Senates. The Council meets regularly with its full-time staff to plan a varied, balanced series of professional events for the University community. Presently included are the Celebrity Series, five pairs of outstanding classical artists and large ensembles; the Chamber Music Series, five single concerts by leading small ensembles; three distinguished dance ensembles in extended residencies; two theatre residencies; and numerous special events. The Council's 1972-73 Third World Cultural Series focused on the art forms of third world peoples.

The Fine Arts Council also supports the University Art Gallery and the University Music Theatre. The University Art Gallery in Herter Hall provides outstanding traveling shows as well as faculty and student exhibitions in all media throughout the academic year. The University Music Theatre (formerly The Operetta Guild) is a student-operated organization producing fully staged works form the lyric theatre. Inquiries may be directed to the Fine Arts Council office in Herter Hall.

The Fine Arts Council program emphasizes extended residencies, which allow the visiting artist and students to meet on an informal basis. A full schedule of Fine Arts Council activities may be obtained by contacting the Council's ticket office, 125 Herter Hall.

Athletics

The University values the educational advantages of a well organized intercollegiate and intramural sports program. In intercollegiate athletics, the University is represented by teams in football, soccer, cross country, basketball, swimming, wrestling, indoor and outdoor track, hockey, golf, tennis, baseball, lacrosse, gymnastics, skiing, and crew.

The University also sponsors a broad program of intramural activities, in which all students are encouraged to participate. Team sports available each year include touch football, powder puff football, basketball, bowling, volleyball, soccer, badminton, softball, horseshoes, handball, bicycle racing, and tug-o'-war. Individual activities include cross country, squash, paddleball, wrestling, wrist wrestling, swimming, table tennis, weight lifting, and tennis.

The University is a member of the Yankee Conference, the National Collegiate Athletic Association, the Eastern College Athletic Conference, and the New England College Athletic Conference.

Alumni Association

The Associate Alumni is the general alumni organization of the University, with headquarters at Memorial Hall, erected by alumni and friends in honor of those men of the University who died in World War I. *The Alumnus* magazine is published by the University five times a year. According to its bylaws, the association is constituted for the purpose of promoting the general usefulness of the University; of cultivating mutual regard among its graduates and former students; and of strengthening their attachment to their Alma Mater. Under sponsorship of the University of Massachusetts Building Authority, composed of alumni who volunteered their services, nineteen residence halls, two faculty apartment centers, and a Student Union Building have been constructed on the campus. The governing body of the Associate Alumni consists of its officers and a board of directors. Six directors are elected each year and serve a term of four years.

Religious Activities

The University gives support to the religious life of its students in various ways. It affords the use of University facilities for student groups of all faiths. It cooperates with the official agencies of the three faiths most largely represented at the University by recognizing the contributions of their privately supported chaplains and by giving them facilities and privileges for their work.

On campus, the religious life of Catholic students is enriched by activities and daily and Sunday services at the Newman Center. Jewish students participate in services and activities sponsored by the B'nai B'rith Hillel Foundation. Protestant students are served by the United Christian Foundation, an ecumenical ministry providing counseling services as well as opportunity for involvement in service and social action.

Other religious groups such as the Baha'i Club, the Christian Science Organization, the Inter-Varsity Christian Fellowship, the Lutheran Club, and the Orthodox Club also meet regularly on campus and students interested in their programs are welcome to attend. The Campus Religious Council provides a cooperative interrelationship among the campus religious groups and serves the whole University community by sponsoring book and clothing drives, the Religious Handbook for Freshmen, and ecumenical discussion and action.

The local Protestant and Catholic churches of Amherst provide opportunities for Sunday worship, and Sabbath services for Jewish students are held on Friday evenings. Students are encouraged to attend the services of their respective faiths. Several denominations sponsor active student programs centered in the local churches, and students are welcome to attend events and join groups sponsored by the denominations.

Motor Vehicles

All student, faculty, and staff motor vehicles must be registered with the Parking Office, Hampshire House, Room 103.

Any student may be permitted to have a motor vehicle on campus provided it is registered with the Parking Office and complies with published University regulations. Copies of the University regulations concerning motor vehicles should be obtained at the Parking Office, Hampshire House, Room 103.

Visitors are requested to use the new multi-level Campus Center Parking Garage unless another lot is suggested. A University bus service, free of charge, covers the campus and environs.

All parking areas are under roving security surveillance. Visitors may secure information at the Parking Control Booths or at the Security Building. Inquiries concerning parking should be directed to the Parking Coordinator, University of Massachusetts, Amherst, Massachusetts 01002.

Financial Aid

All information relative to financial assistance is available through the Financial Aid Office, Room 232, Whitmore Administration Building. Financial assistance includes scholarships, loans, grants, and employment.

Application Deadline
The deadline for filing an application for financial aid is March 1. Applications received after this date are late and may not be considered. A new application must be filed every year, whether or not the applicant has received aid previously.

Application procedures vary for single, married, and emancipated students. Detailed procedures to be followed by students and their parents are available on request from the Financial Aid Office.

Loans

UNIVERSITY LOANS
Through the generosity of friends of the University, loans are available for a limited number of students of good scholarship of the three upper classes to assist in the paying of tuition or other college expenses. All loans are secured by notes endorsed by responsible parties as collateral.

In general, loans taken out by seniors must be repaid before graduation; otherwise, they are due before the beginning of the next school year. Loans automatically become due upon recipients' withdrawals from the University.

On most of the funds, interest is charged at the rate of 3 percent to maturity and 5 percent thereafter. No loan under this plan will be granted in excess of $200 in any one year.

HIGHER EDUCATION LOAN PLAN
The student may obtain a loan of up to $1,500 per year from the bank of his choice through the Higher Education Loan Plan. Certification of attendance and other information relative to the student's overall record will be submitted to the bank prior to the granting of the loan.

NATIONAL DEFENSE STUDENT LOAN PROGRAM
A student may borrow up to $1,000 per year under this program. Interest at 3 percent begins nine months after completion of the program; the loan is to be repaid within ten years. Because of the amount available this program is necessarily limited and selective.

Employment
Under the College Work-Study Program, a student who meets established financial-aid criteria can be assigned to a part-time job on campus or to a job with a nonprofit agency in his community during the summer months.

Benefits for Veterans and Their Dependents
Details involving veterans' benefits should be cleared through the Veterans' Coordinator in the Financial Aid Office.

Veterans or their dependents eligible for educational benefits under the Veterans Bill, P. L. 358; the Disabled Veterans Bill 894; or the War Orphan Bill 634, should present a Certificate of Eligibility at registration. This may be obtained through the nearest Veterans Administration office.

Military Service
The Financial Aid Office provides information on draft status and assistance in verifying the status of any student transferring to the University.

Through this office, a student may register for the draft within thirty days of his eighteenth birthday; it is unnecessary for him to return to his local Board to register.

Scholarships
Scholarships are of two types: One is a straight monetary award; the other is a work scholarship called an Undergraduate Assistantship, in which the recipient is required to do work of an academic or educational nature (about eight hours per week) under faculty or staff supervision.

Monetary awards may be granted to members of all undergraduate classes; Undergraduate Assistantships are awarded only to members of the sophomore, junior, and senior classes. Scholarships are awarded only to needy and deserving students whose scholastic records are satisfactory. The scholastic requirement for both types of aid is a 2.8 cumulative quality-point average or a 2.0 to 2.8 average with an average of at least 3.0 in the fall semester.

A scholarship award is paid in installments at the beginning of each semester in the form of a credit on the recipient's bill. If the scholarship student withdraws from the University, any refund of University fees or charges must first be applied to the scholarship fund to reimburse the fund for the full amount of the scholarship received by the student for the semester.

General Services and Programs

University Library System
The University Library System is composed of the main University Library, a new 28-story building scheduled to open in 1973, and several branch libraries, of which the two principal ones are the Morrill Biological Sciences Library and the Physical Sciences Library.

Present holdings include over one million books, periodical volumes, and governmental documents, and over 250,000 microforms. The University currently receives more than ten thousand periodicals, which are housed in the main Library or the branch libraries according to subject matter. Holdings and their locations are listed in both the card catalog and the *Pioneer Valley Union List of Journal and Serial Holdings*, a computer-produced book which also includes the serials of Amherst, Smith, and Mount Holyoke Colleges and the Hampshire Inter-Library Center. A computer project to provide on-line access to all University serial holdings is currently underway.

A library handbook and information series is available at the reference desk of the University Library and in the branch libraries. Librarians are available in the University Library and the two principal branch libraries to assist the University community in using the Library and its collection.

HAMPSHIRE INTER-LIBRARY CENTER
The University Library is a participating member of the Hampshire Inter-Library Center, a cooperative facility for the acquisition, storage, and servicing of research materials, especially journals, documents, and scholarly sets. Incorporated in 1951 to augment library resources in the area, HILC is jointly operated by the libraries of the five Connecticut Valley colleges and the Forbes Library of Northampton, Massachusetts. The collection numbers about 35,000 bound volumes; approximately 1,000 journals are received currently.

Guided Tours
Through the University Guide Service, ARCON, guided tours are available during the regular academic year on weekdays from 1:30 to 3:30 p.m. Saturdays from 9:00 a.m. to 12:30 p.m., and Sundays from 1:00 to 3:00 p.m.

The University Press
A member of the Association of American University Presses, The University of Massachusetts Press is dedicated to publishing outstanding scholarly and artistic works. Manuscripts are approved for publication by a committee appointed by the Faculty Senate. The Press was founded in 1964.

Scholarly Journals
The Massachusetts Review is a national and international quarterly of the arts, literature, and public affairs, published independently with the support and cooperation of Amherst, Hampshire, Mount Holyoke, and Smith Colleges, the University of Massachusetts and its Alumni Association, and others. It is now in its thirteenth year of publication.

The English faculty also edits and publishes three scholarly journals: *English Literary Renaissance* on English literature in the age of Shakespeare and Mil-

ton (1485-1665); *Early American Literature* on the colonial and Puritan periods (1760-1880); and *RSVP*, a journal on Victorian English periodical publications. Graduate students in that department publish *MSE*, Massachusetts Studies in English. The quarterly *Polity* is published by the Department of Political Science. Students in the School of Engineering publish the *Engineering Journal*.

Language Laboratories
The James W. Butler Language Laboratories provide special study facilities to students enrolled in foreign language courses. Three of the labs, equipped with student-controlled tape recorders and monitoring facilities, can accommodate up to ninety students in three elementary classes. Another room, with twenty booths, is available to students who make use of the Open Library Usage service for independent study.

A fifth lab was designed and equipped for intermediate and advanced language students. Its twenty-eight booths are furnished with dialing pads which enable its users to listen to any program tape available in the banks of the Random Access Library (RAL). It is anticipated that in the future these tape-machine banks can be reached over telephone lines.

Lesson tapes and RAL program masters are produced, transcribed, and programmed in the Recording Studio and the Transcription Center. A highly trained technical staff is available at all times.

Office of Public Affairs
The Office of Public Affairs serves as liaison between the campus community and the general public, and as an internal information center for the benefit of faculty, students, and administration. Its primary function is to provide accurate information about the University's current and projected programs and thus to foster understanding of the institution's mission as a nationally recognized facility of higher education, research, and public service. The office assigns specific responsibilities to three departments—Publications, News, and Photographic Services and also to Radio Station WFCR. Through these departments the office supplies information to all communications media as well as to agencies of government, schools and other educational institutions and foundations, professional societies, research organizations, extension agencies, and to individuals who request data of various kinds.

Office of Budgeting and Institutional Studies
The Office of Institutional Studies collects, analyzes, and disseminates information about the Amherst Campus—students, faculty, and programs—as well as University-wide concerns. The office also conducts research about various aspects of higher education, both in terms of the internal activities at Amherst and the external relationships with other institutions. The office stands ready to aid members of the campus community in understanding the nature and operation of the University, and provides these members those services needed for the planning, improving, and implementing of their programs and activities.

Cooperative Extension Service
The Cooperative Extension Service, affiliated with the College of Food and Natural Resources and the School of Home Economics, was established by federal and state legislation to help people identify and solve their farm, home, rural, and urban community problems. It is a cooperative educational program planned, conducted, and financed jointly by the county governments, the University, and the United States Department of Agriculture.

Massachusetts Agricultural Experiment Station
The Massachusetts Agricultural Experiment Station, established by state and federal legislation, is associated with the College of Food and Natural Resources. The purpose of the Station is to conduct research bearing directly on the problems of the agricultural industry and the welfare of consumer groups. It is financed by federal appropriations and state offset funds. Research is conducted at the Cranberry Experiment Station in East Wareham, the Suburban Experiment Station at Waltham, the Horticultural Research Center in Belchertown, the College Farm in South Deerfield, and on the Amherst campus. The Environmental Forestry Research Center of the United States Forest Service has been established on the campus in cooperation with the Experiment Station.

Other Facilities and Services
Audiovisual Center
Cooperative Fishery Unit
Cooperative School Service Center
Cooperative Service Bureau
Cooperative Wildlife Research Unit
Institute of Agricultural and Industrial Microbiology
Labor Relations and Research Center
Massachusetts Population Research Institute
Northeast Regional Media Center for the Deaf
Polymer Research Institute
Program in Urban and Regional Problems
Technical Resource Service
University Computing Center
Water Resources Research Center

Academic Honor Societies
Phi Beta Kappa (arts, humanities, and sciences)
Phi Kappa Phi (all fields of study)
Sigma Xi (pure and applied science)
Sigma Gamma Epsilon (earth sciences)
Omicron Nu (home economics)
Phi Tau Sigma (food science)
Phi Eta Sigma (freshman men, all fields of study)
Tau Beta Phi (engineering)
Beta Gamma Sigma (commerce and business administration)
Alpha Lambda Delta (freshman women, all fields of study)
Eta Kappa Nu (electrical engineering)
Alpha Zeta (agriculture)
Xi Sigma Pi (forestry)
Alpha Pi Mu (industrial engineering)
Kappa Delta Pi (education)
Phi Sigma Alpha (political science)

Overseas Study
The Amherst campus offers a wide variety of overseas study and international exchange programs. The International Programs Office may be consulted for all specific information on these and other overseas study opportunities. Information on summer programs is given in the Bulletin of the Summer Session as well.

Freiburg Program. In cooperation with the University of Freiburg, Germany, the University of Massachusetts operates its year-long Freiburg Program. The University of Massachusetts has a permanent facility in Freiburg, the University of Massachusetts Freiburg Center,

which serves as the headquarters of the Freiburg Program. Students enrolled in the Program are regularly enrolled students of the University of Freiburg, and take courses in a wide range of social science and humanities courses. The Freiburg Program is not restricted to students concentrating in German, but admits students in philosophy, music, English, history, comparative literature, and other fields. Enrollment is limited to graduate students and superior upper division undergraduates with fluency in German.

Field Program in Anthropology, Europe. A four- or seven-month field program in anthropology in Europe is offered by the Anthropology Department to graduate and advanced undergraduate students in anthropology during the spring or spring and summer. Location of the program in Europe in any given year depends upon the selection of the faculty director. Prerequisites for participation in the program include a working knowledge of the language required for field research and prior coursework in both field methods and the culture area where research is to be conducted. A limited number of stipends are available to offset costs of international travel and maintenance while in the field.

Semester Program, New University of Ulster, Coleraine, Northern Ireland. Primarily for undergraduate students majoring in education. A small number of students go each semester for study in Northern Ireland. The New University of Ulster is Britian's newest university and has about 2,000 students.

Grenoble Program. The University of Massachusetts Semester in Grenoble Program is offered in cooperation with the Comité de Patronage des Etudiants Etrangers of L'Université de Grenoble and is open to approximately forty students. The three levels of courses offered facilitate the acceptance of students of varied interests and levels of proficiency in French. Students with little or no prior knowledge of the language may pursue studies in the French language and civilization at the elementary level. Majors and other proficient students pursue courses in language, literature, and civilization at the middle or upper level depending on placement by examination upon arrival at Grenoble. Students may choose to live with French families, in "foyers," or in inexpensive hotels catering to students.

Academic Year Program, Keele University, England. Through an exchange program, several undergraduates may spend their junior or senior years at Keele University, Staffordshire, England. The program is open to superior students concentrating in social sciences, humanities, and science.

Academic Year Program, Chelsea College of Physical Education, England. This is a junior-year program for undergraduate women majoring in physical education. A good academic record is required.

Academic Year Program, University of Victoria, British Columbia. An undergraduate student exchange program with the University of Victoria, British Columbia, Canada, permits several undergraduates each year to spend their junior or senior years at that university. Courses of study include drama, social sciences, humanities, education, and science.

Summer Programs. Summer study programs, concerning which information may be secured from the International Programs Office and the *Summer Session Bulletin*, include offerings in Bologna, Italy; Madrid, Spain; Freiburg, Germany; Pau, France; Oxford, England, and St. Vincent, West Indies, the latter in anthropology.

Graduate School

Graduate work leading to the Doctor of Philosophy degree may be taken in the following fields: Agricultural and Food Economics, Animal Science, Anthropology, Astronomy, Biochemistry, Botany, Business Administration, Chemical Engineering, Chemistry, Civil Engineering, Comparative Literature, Computer and Information Science, Economics, Electrical Engineering, English, Entomology, Environmental Engineering, Food and Agricultural Engineering, Food Science and Technology, Forestry and Wood Technology, Geology, Hispanic Languages and Literatures, History, Human Movement, Industrial Engineering and Operations Research, Linguistics, Mathematics, Mechanical Engineering, Microbiology, Nutrition and Food, Ocean Engineering, Physics, Plant Pathology, Plant Science, Political Science, Polymer Science and Engineering, Psychology, Sociology, Soil Science, Speech, Wildlife and Fisheries Biology, and Zoology.

A cooperative Ph.D. program involving Amherst, Hampshire, Mount Holyoke, and Smith Colleges and the University is also available in all the departments of the biological sciences and the departments of Chemistry, French, Geology, Germanic languages and literatures, Hispanic languages and literatures, Philosophy, and Physics.

The School of Education offers several specialized programs leading to the Doctor of Education degree for those employed in the educational field. The requirements for this degree follow closely those outlined for the Doctor of Philosophy. Residency must be met by attendance on campus for two consecutive semesters.

The following departments offer major work leading to a master's degree: Agricultural and Food Economics, Animal Science, Anthropology, Art History, Astronomy, Biochemistry, Botany, Business Administration, Chemical Engineering, Chemistry, Civil Engineering, Comparative Literature, Computer and Information Science, Dramatic Arts, Economics, Education, Electrical Engineering, English, Entomology, Environmental Engineering, Fine Arts, Fisheries Biology, Food and Agricultural Engineering, Food Science and Technology, Forestry and Wood Technology, French, Geology, Germanic Languages and Literatures, Hispanic Languages and Literatures, History, Home Economics, Human Development, Industrial Engineering and Operations Research, Labor Studies, Landscape Architecture, Linguistics, Management Science, Marine Sciences, Mathematics, Mechanical Engineering, Microbiology, Music, Nursing, Nutrition and Food, Ocean Engineering, Philosophy, Physical Education, Physics, Plant and Soil Sciences, Plant Pathology, Political Science, Polymer Science and Engineering, Psychology, Public Administration, Public Health, Regional Planning, Slavic Languages and Literatures, Sociology, Speech, Statistics, Wildlife, Wood Technology, and Zoology.

Holders of undergraduate degrees desiring further information should write for a Graduate School Bulletin to Graduate Admissions Office, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002.

Summer Session

The Summer Session at the University, of eight weeks' duration in 1972, is open to freshmen who wish to

begin their college education immediately upon graduation from high school, to seniors completing requirements for September graduation, to other regular University undergraduates, and to special students currently enrolled in other colleges. Graduate courses are provided for area teachers and graduate students who wish to continue their work during the summer. Some courses are offered for professional workers in specialized fields. A bulletin describing the entire summer program is available from the Registrar's Office in April of each year.

Students who begin their college careers in the summer are advised to plan their programs carefully with the aid of advisers. Normally, it is wise to plan to take the required courses during the summer and to take electives and major courses during the fall and spring semesters. Sequential required courses are generally offered during both of the main semesters, so that work begun in the summer can be completed during the fall semester.

Five College Courses

Amherst, Hampshire, Mount Holyoke, and Smith Colleges and the University of Massachusetts/Amherst combine their academic activities in selected areas for the purpose of extending and enriching their collective educational resources. Certain specialized courses not ordinarily available at the undergraduate level are operated jointly and are open to all. In addition, any qualified student in good standing at any of the institutions may take a course without cost at any of the others, if the course is significantly different from any available to him on the home campus. The course must have a bearing on the educational plan arranged between the student and the adviser. Approval by the student's adviser and the Academic Dean of the College (Provost at the University) at the home institution is required. Permission of the instructor is required for students from other campuses if permission is required for students of the institution at which the course is offered.

Students should apply for interchange courses at least six weeks prior to the beginning of the semester since they may find some courses already filled after that time. Free bus transportation among the five institutions is available for interchange students.

Students interested in such courses will find current catalogs of the other institutions in departmental offices, the University Library, or the Office of the Registrar. Applications may be obtained from the Office of the Provost.

Regional Student Program

The University participates in a regional cooperative program administered by the New England Board of Higher Education. This program, known as the Regional Student Program, permits qualified residents of the New England states to study with in-state tuition and admission privileges at any of the state universities, the Lowell Technological Institute, and the public two-year colleges and technical institutes in a wide variety of study areas.

The purpose of the program is to expand opportunities for higher education for New England residents by making available on an equal basis to all those courses not commonly offered at every institution. This practice tends to reduce duplication of courses and thus to utilize most efficiently the higher educational facilities in each state.

Detailed information about this exceptional program can be obtained from any guidance counselor or from the New England Board of Higher Education, 20 Walnut Street, Wellesley, Massachusetts 02181.

Continuing Education

The Division of Continuing Education at the University is responsible for helping to meet the educational needs of all part-time undergraduate students; for managing all conferences, institutes, workshops, short courses, and clinics on the Amherst campus and throughout the Commonwealth sponsored by the University; and for designing special educational programs for citizens of the Commonwealth and the region who are not regular full-time students at the University. The Division has its own undergraduate degree program, designed for part-time students who wish to design a curriculum more appropriate to their educational goals than those offered by the traditional undergraduate departments. The Bachelor of General Studies requires one hundred and twenty hours of credit, up to seventy-five of which may be transferred from other institutions. Students may be admitted to evening courses or to day courses on a space-available basis after consultation with an adviser in the Division of Continuing Education. Undergraduate part-time students who meet the requirements for any standard University undergraduate degree may have this degree awarded through the Division of Continuing Education in addition.

The Division serves as an educational doorway between the University and potential clients and stands ready to assist anyone in the Commonwealth with an educational problem with which the University might assist. Inquiries may be directed to the Director of the Division, 920 Campus Center.

University Without Walls

The University Without Walls program at the University is one of twenty-two UWW units across the country developed under the sponsorship of the Union for Experimenting Colleges and Universities. The program enables students to earn a B.A. or B.S. from the University of Massachusetts through a totally individualized learning program allowing independent study, internships, field experiences, credit for significant past learning experience, and other self-directed projects outside the classroom and campus. It welcomes participants of all ages and diverse backgrounds and interests, especially those who would not normally have access to the University but who are highly motivated and self-disciplined enough to succeed in directing their own learning projects. Upon admission to the program, students choose a faculty sponsor and adviser and prepare a learning contract outlining learning objectives, activities to meet those objectives, and evaluation procedures. Students must negotiate 120 credits in order to receive a degree, including University Core Requirements (33 credits) and residence credits (45 credits). Further information and applications may be obtained from the University Without Walls, 320 Arnold House.

University Year for Action

The University Year for Action program is a full-year, full-time program which offers undergraduates significant service opportunities for attacking poverty in connection with community agencies while earning normal college credit. Students accepted into the pro-

gram become volunteers in Action (a new federal agency comprising Peace Corps, VISTA, and several other federal volunteer programs). They work full time in a community agency, located either in a major city of Western Massachusetts or in a rural area; it may be a CAP agency, a community center, a legal assistance program, a correctional institution, or an educational project. Community agencies provide field direction and supervision, while the University provides instruction, academic credit, and program management.

The University Year for Action program represents a new model for education, a model of effective service to the larger community and of a reciprocal exchange of resources, needs, and personnel.

Details concerning eligibility, application procedure, pay, tuition, fees, and other information are available at the Action office, 513 East Pleasant Street, Amherst.

Handicapped and Disabled Veteran Students

The University is developing a program for handicapped students. Efforts have been made to eliminate as many architectural barriers as are necessary to meet the needs of our handicapped students. Although some barriers remain, most handicapped students can move over most of the campus without serious problems. Elevators exist in most buildings and ramps are conveniently placed to allow entry.

An area of particular concern is special academic services. The University is in the process of coordinating efforts to offer special academic advising and will be ready to meet the needs of handicapped students in the near future. Special scheduling is available if the proper amount of time is allowed.

Handicapped students and returning disabled veterans are urged to contact the Admissions Office so that they may work toward coordinating individualized programs for qualified students.

Pre-Law Advising Program

The Pre-Law Advising Program was instituted to provide students with information on the nature of legal education, admission to law school, and career opportunities in the legal profession. Law schools do not prescribe any particular method of preparation or program of courses for admission; consequently, there is no Pre-Law major at the University. Interested students are urged to register with the Pre-Law Adviser. Current catalogs from every accredited law school in the United States and other materials pertaining to the legal profession are available in this office.

Schools, Colleges, and Departments

Special programs include:

Honors Program
Bachelor's Degree with Individual Concentration
Pre-Law Advising Program

Undergraduate major programs are available in the following areas:

College of Food and Natural Resources

Agricultural Business Management
Agricultural Engineering
Animal Sciences (Also Pre-Veterinary)
Entomology
Environmental Design (Park and Open Space Administration, Pre-Landscape Architecture, and Pre-Planning)
Fisheries Biology
Food Marketing Economics
Food Science and Technology
Forestry
Hotel, Restaurant, and Travel Administration
International Agricultural Studies
Natural Resource Economics
Natural Resource Studies
Plant Industry (Agronomy, Horticulture, and Turf Management)
Plant Pathology
Plant Science
Wildlife Biology
Wood Science and Technology

Areas of concentration within those listed may be chosen with the approval of the department head or the Dean.

College of Arts and Sciences

Afro-American Studies
Anthropology
Art
Astronomy (Five College Cooperation Program)
Biochemistry
Botany
Chemistry
Classics (Five College Cooperation Program)
Comparative Literature
Economics
English
French
Geography
Geology
German
History
Italian
Journalistic Studies
Latin (Five College Cooperation Program)
Mathematics
Microbiology
Music
Philosophy
Physics
Political Science
Pre-Dental Studies
Pre-Medical Studies
Pre-Veterinary Studies
Psychology
Russian
Sociology
Soviet & East European Studies
Spanish
Speech
Zoology

School of Business Administration

Accounting
Business Administration and Economics
Business Administration and Quantitative Methods
General Business
General Management
Financial Management
Marketing
Personnel Management and Industrial Relations
Production Management
Public Relations Management
Retailing
Systems Management
Urban and Regional Studies

School of Education

Education
Elementary Education

School of Engineering

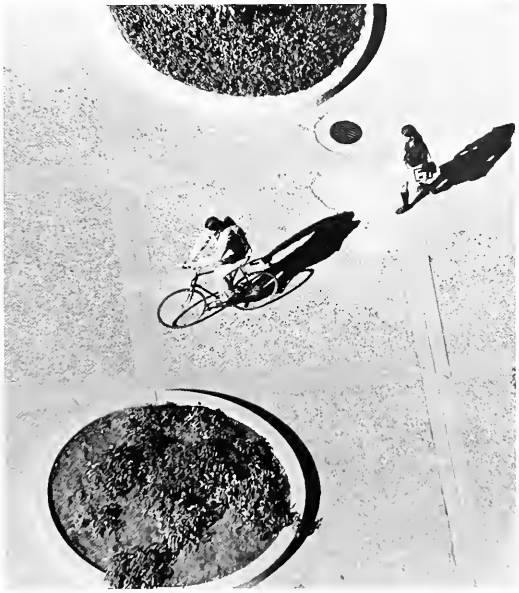
Chemical Engineering
Civil Engineering
Electrical Engineering
Industrial Engineering
Mechanical Engineering

School of Home Economics
Child Development
Dietetics and Institutional Administration
Fashion Merchandising
Foods in Business
Secondary Education and Extension

School of Nursing
Basic Nursing

School of Physical Education
Physical Education for Men
Physical Education for Women
Recreation

Department of Public Health
Community Health and Health Education
Environmental Health
Medical Technology



COLLEGE OF ARTS AND SCIENCES

The College has programs of study leading to four bachelor's degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music. All departments offer a program leading to the B.A. degree. The B.S. degree may be earned only if the major is mathematics, science, or psychology. The B.F.A. programs have a strong emphasis in art and the Bachelor of Music programs reflect an emphasis in music. All of the degree programs combine a study in depth in one area with supporting study in the other two of the three main divisions: (a) Fine arts and humanities, (b) Social and behavioral sciences, and (c) Natural science and mathematics. Courses appropriate to the distribution requirements in these three areas are noted in University Catalogs by the respective codes (C), (D), and (E).

A program of study which conforms with the following five provisions qualifies the student who completes it for the appropriate degree. Advanced placement and transfer credits may be applied toward any or all of these qualifications; but at least half of the major program must be completed in residence.

1. A basic proficiency or experience in communicative skills must be achieved by completing six credits in rhetoric; the two rhetoric courses must include at least one of Rhetoric 100 or 110.

2. For the B.A. and B.S. degrees only, a basic proficiency or experience with foreign language must be demonstrated by (a) completion of a foreign language course at the college fourth-semester level, (b) a satisfactory performance on an achievement or placement test, (c) four entrance units in one foreign language or three units in one and two units in another foreign language, (d) a year in a school in which English is not the basic language, or (e) an approved substitution of language-related study if there is clearly demonstrated difficulty in language study which has been approved by the foreign language board.

3. Distribution is achieved by completion of courses in each of the two divisions of the College other than the one in which the major falls. With the understanding that work in the major is applicable to one or more of these divisions, this qualification is stated for all three divisions and all degrees as:

Division	Core Code	Number of Courses for B.A.	B.S.*	B.F.A.	B. MUS.
Fine Arts and Humanities	(C)	4	3	4	4
Social and Bahavioral Sciences	(D)	4	3*	3	3
Natural Science and Mathematics	(E)	4	4*	4	4

*To qualify for a B.S. degree, at least 60 credits must be earned in science, mathematics, and/or psychology courses; distributional courses may be part of this minimum of 60.

4. An approved major program of the College must be completed. The traditional departmental major programs are the most common, and they are described in the following pages. A few others are specified and administered by standing committees of the faculty and are described below. Several other interdisciplinary programs are being worked on at this time. All major programs have these features in common: (a) faculty guidance, (b) a coherent program of study made up of

at least 24 credits, at least 15 of which must be in upper division courses in this College, and (c) the student has at least 12 completely free electives.

Advisory System:

When a student elects a special major, or is admitted to a specialized degree program, he is assigned a faculty adviser from that major. The faculty adviser helps the student choose his program of study and also serves as a communication link between the student and the Registrar's Office. The student may choose a specific major on entrance or he may postpone this choice until his fourth semester. Until he chooses a specific major, he is listed as a College of Arts and Sciences major, and the College of Arts and Sciences Information and Advising Center (CASIAC) serves as the student's adviser. Faculty members from a broad selection of disciplines form the staff of CASIAC, and the student may continually meet with the same staff member or he may talk with whomever is on duty at the time. A primary goal of the Center is to help the student choose a major which is consistent with his interests and potentialities.

A student has considerable freedom in choosing his program of study and his major. However, a few of the major programs require sequences of courses which extend over seven or eight semesters. A student who does not take the right courses in his freshman year may have to use a summer session or extra semesters to accommodate these sequences if his ultimate major is Astronomy, Biochemistry, Chemistry, Mathematics or Physics, or if he is in the Bachelor of Music or Bachelor of Fine Arts program. Some standard freshman year programs are:

Bachelor of Fine Arts:

Rhetoric	Physical Education
Introduction to Art	and two of the following:
Studio Art	Math or Science
	Humanity
	Social Science

Social Science (B.A. or B.S.):

Rhetoric	Physical Education
Social Science	and three of the following:
	Foreign Language
	Humanity or Fine Art
	Math or Science
	Second Social Science

Mathematics (B.A. or B.S.):

Rhetoric	Physical Education
Math (Calculus)	and two of the following:
Science	Foreign Language
	Social Science
	Humanity

Bachelor of Music:

Rhetoric	Physical Education
Music Theory	and two of the following:
Music Literature	Math or Science
	Social Science
	Humanity, other than Music

Humanity (B.A.):

Rhetoric	Physical Education
Humanity or Fine Art	and three of the following:
	Foreign Language
	Social Science
	Math or Science
	Second Humanity

Science (B.A. or B.S.):

Rhetoric	Physical Education
Chemistry or Physics*	and two of the following:
Math (Calculus, if prepared)	Foreign Language
	Humanity
	Social Science
	Second Science

*Chemistry majors elect Chemistry 113; Biology and Geology majors elect Chemistry 111; and Physics and Astronomy majors elect Physics 181.

Latin American Studies

Undergraduates interested in Latin America may enroll in the Latin American Studies Program. The Program does not constitute a major and is designed to supplement the work done in a regular discipline. However, those students who fulfill the requirements of the Program will be awarded the Certificate in Latin American Studies attesting to their attainment in area and language studies. To earn a certificate a student must 1) satisfactorily demonstrate a practical working knowledge of Spanish or Portuguese and elementary proficiency in the other, 2) satisfactorily complete four courses focused on Latin America, and 3) participate in the Interdisciplinary Seminar on Latin America. The requirements of the Program are to be met partly through courses that fulfill existing requirements of the College and partly through the careful use of electives.

The Committee on Latin American Studies administers the Program and advises interested students. Members of the Committee are: P. Barreda-Tomas (Hispanic Languages and Literatures); R. A. Potash, Chairman (History); D. Proulx (Anthropology); F. B. Sherwood (Economics); and H. A. Wiarda (Political Science).

Pre-Dental, Pre-Medical, and Pre-Veterinary Programs

A student planning to enter a dental, medical, or veterinary school should select a major department in the field of most interest to him. This will usually be in the College of Arts and Sciences but may be in other colleges or schools. Pre-veterinary students frequently select a major in the College of Food and Natural Resources. Preparation for the professional schools requires relatively few specific courses beyond those necessary to obtain the bachelor's degree and can be completed within the four-year curriculum of most departments in the University.

A liberal education is felt to be one of the best backgrounds for entering the medical or dental field. Although many students may be inclined to concentrate in the sciences, this will not necessarily improve the opportunity for entrance into a professional school. Rather, the field of concentration should be determined by the student's strong secondary interests; i.e., he should choose that area most likely to lead to a satisfying alternative career.

Minimum preparation for the pre-professional student should include one year of inorganic, one year of organic, and one semester of analytical chemistry, three semesters of biology, one year of college mathematics, and one year of physics. Certain additional courses in biology, chemistry, or mathematics, as well as a foreign language may be required by some dental, medical, and veterinary schools. Students should consult their advisers as well as professional school catalogs in regard to specific requirements of particular schools. Freshmen who intend to include the pre-professional courses in the curriculum should discuss their plans with the summer counseling adviser, as some

change in the normal course sequence may be desirable.

Students, who by their work in the first year demonstrate a potential for success, may, in their third semester, apply to the Pre-Professional Advisory Committee for entrance into the pre-medical, pre-dental, or pre-veterinary major. This program is designed to give qualified students the opportunity to broaden their background by providing for increased flexibility in the curriculum of the last two years. These students will have advisers specifically for this program, will be interviewed in the sophomore and junior years, and, upon application to medical school, will be given a written evaluation by the pre-medical committee. However, admission into a pre-medical, pre-dental, or pre-veterinary program is not a prerequisite for application to the professional schools. Many students prefer to complete a full major in an academic department; these students should also apply for entrance into the pre-professional program, and they will be interviewed and evaluated in the same manner as those who are accepted as majors.

A file of dental, medical, and veterinary school catalogs and other pertinent material is maintained in the committee office, Room 409, Hasbrouck Laboratory. Students are encouraged to visit this office for further information concerning preparation for careers in dentistry, medicine, and veterinary medicine.

Individual members of the advisory committee are available for counsel to all interested students at any stage of their program and whether or not they have been accepted into the curriculum as majors. The committee membership for 1972-73 consists of the following: B. C. Crooker, Chairman (Physics), S. Balagura (Psychology), H. E. Bigelow (Botany), E. L. Davis (Botany), R. S. Feldman (Psychology), E. J. McWhorter (Chemistry), J. H. Nordin (Biochemistry), G. J. Oberlander (Chemistry), W. B. O'Connor (Zoology), R. E. Smith (Veterinary and Animal Sciences).

Afro-American Studies, W. E. Du Bois Department Of

The first responsibility of the department is to offer a major in Afro-American studies which is interdisciplinary in scope. The department has the parallel responsibility of leavening and affecting the quality and focus of the educational experience of all Black students regardless of their major field of study; thus it is responsible for the designing of courses and sequences of courses which are of general interest and of specific relevance to students in disciplines other than Afro-American studies.

The major in Afro-American studies is recommended only to students intent on a career in teaching or advanced scholarship in Afro-American studies or in one of the relevant professional disciplines. The maximum of 60 required major credits is spread over many disciplines with a heavy emphasis on History, Sociology, Political Science and Literature. This means that within the scope of the major there are included courses which correspond to and fulfull requirements of offerings in other departments. The student is required to take at least 24 credits within one discipline, and a minimum of 24 within the other disciplines of the department. The major is designed to give the student a specialist's training in one area of the Black experience reinforced by a general and theoretical knowledge of other relevant areas of scholarship.

Anthropology

In its study of mankind in terms of origins, ways of life, physical and cultural differentiation, and contemporary problems, anthropology bridges the social and biological sciences. Its courses are offered with the aim of providing both a foundation for specialized graduate study in all four subfields of anthropology (archaeology, physical anthropology, social and cultural anthropology and linguistic anthropology) and also the understanding of mankind that can be of value to anyone regardless of particular interests.

Anthropology majors must take Anthropology 104 plus at least one more of the following: Anthropology 102, 103, or 105. All majors are also required to elect a minimum of 21 credits above the 100 level in anthropology which, in combination with the introductory courses, must total at least 30 credits for graduation. With his adviser's approval, an anthropology major may be allowed to take as part of this requirement non-duplicating courses in anthropology given at one of the cooperating Valley institutions. The maximum allowable credits in anthropology for graduation is 45. Also required is at least one course in the social sciences outside of anthropology and foreign language proficiency through the intermediate (140) level. Professor Donald Proulx is Chief Adviser for Anthropology.

Art

The Art Department's three major programs contain eight distinct areas of specialization. The three programs provide objectives ranging from a broad background of extensive coverage to highly specific professional investigations.

The B.A. degree program is designed to provide an aesthetic and historical knowledge of the visual arts and an opportunity to develop creative ability in several media. While all programs are subject to the University and College of Arts and Sciences core requirements, the B.A. degree program requires a greater involvement than the B.F.A. degree program in courses not directly within the Art Department. The B.A. degree program offers three majors: Art History, Studio Art, and the Combination Major of both studio art and art history. All B.A. degrees in the Studio or Combination Major areas require a minimum of 39 art credits, consisting of five elementary courses: Art 115, 100, 102, 120 and 122; and eight upper division courses (numbered 200 and above), two of which must be art history electives. The B.A. degree in Art History requires six credits at the introductory level, plus twenty-four upper division credits, which will include at least one seminar (300 level course). It is recommended that a student begin as early as possible with the historical survey (Art 111-113). This can, however, be substituted by any combination of Art 111, 113, 115, or a departmentally approved course. At the upper division level, a student should include courses in at least one non-western and three western areas from the following offered by the department: Primitive, Far Eastern, Indian, Islamic, Ancient, Medieval, Renaissance, Baroque, Modern and American. As the declaration of a major is prerequisite to the selection of a faculty adviser, it is best to declare an Art History major within the freshman or sophomore years.

The other two programs are of a professional nature and lead to a Bachelor of Fine Arts degree. Accept-

ance to all B.F.A. degree programs is effected during the sophomore year or after having completed 12 studio credits in art, through the submission of a portfolio to a faculty selection committee. Admission is based on the criteria of demonstrated ability and high academic standard. Transfer students may make arrangements to submit a portfolio during their sophomore year at another institution, otherwise the transfer students' portfolios should be submitted early in the Junior year. Before acceptance, during the first two years, the student experiences a foundation program of several courses in drawing, two and three dimensional design, and the general history of art. Because of its contemporary nature and relevance it is required that Modern Art 287 be taken as early as possible by B.F.A. program candidates. The B.F.A. degree program in Studio Art provides professional intensive coverage of one chosen medium: ceramics, painting, printmaking or sculpture, to be selected by the end of the sophomore year after acceptance through the submission of a portfolio. After selecting an area of specialization, it is the student's responsibility to notify the Art Department and the faculty members teaching in the major area. It is advisable for each student to have a faculty member in their major area assigned as adviser to their B.F.A. degree program. The B.F.A. degree program allows greater latitude of core requirements for further concentration within the Art Department. This program builds the best foundation for graduate study in Studio Art. It involves minima of 63 credits in Studio Art, 12 credits in Art History, and 48 credits in other disciplines. B.F.A. degree candidates will be reviewed by a committee of three art faculty members at the end of the Junior year. Approval by the committee constitutes permission to embark on a Degree Project during the Senior year. During the Senior year a student may elect from 6 to 12 credits in a Degree Project directed toward the exploration of personal objectives in the specific major area. All senior B.F.A. Studio Art majors must select a faculty member in their major area to direct their Degree Project and act as chairman of their B.F.A. Degree Project Committee. The Degree Project must be evaluated and approved by this committee which consists of the chairman and two other art faculty members. The Degree Project should include a statement of intent describing what the project will consist of and what the student plans to do, a technical section describing any pertinent technical information, an evaluative conclusion, and a collection of color transparencies of the actual work completed. The format is identical to that prescribed for a University Master Thesis and is bound in a 9" x 12" black ring binder.

The B.F.A. degree in Art Education program provides the student with a strong background in studio work, and the necessary courses in education and student teaching, which enable the graduate to be certified as an art teacher in the Commonwealth of Massachusetts. This certification permits the teacher to work on both elementary and secondary levels. Through a reciprocal arrangement teachers certified in Massachusetts may be qualified to teach in several other states. Student teaching is done for a full semester and usually at schools located in the vicinity of Amherst. Currently, through the Off Campus program conducted by the School of Education, students may also do student teaching in off campus sites. These range from California to England and from Quebec to Florida. The program's requirements include minima of 33 credits in Studio Art, 9 in Art History, 6 in Art Education, 15 for teacher's certification (including sixteen weeks of observation and student teaching in either the elementary or secondary level), and 51 in other academic disciplines. Art Education majors are required to take introductory courses in each major studio area early in their program.

Asian Studies

There are majors leading to the B.A. in both Chinese and Japanese language and literature in which students may place emphasis on either modern or classical language. Students following either major receive a substantial foundation in reading, speaking, and understanding the language, as well as a basic knowledge of the respective literatures. Majors are encouraged to acquire a background in the history, government, society, religion, and arts of China and Japan—a background essential for an understanding of the cultures and literatures of the Chinese and Japanese people.

In addition to courses offered in language and literature in the Asian Studies Program, various departments in the University and the Five College system offer courses dealing with specific aspects of China, Japan and other parts of Asia. Consult offerings of the Departments of Anthropology, Art, Comparative Literature, Geography, History, Political Science, and Sociology.

Undergraduates interested in Asian Studies may wish to enroll in the University's Asian Studies Certificate program. The program does not constitute a major and is designed to supplement the work done toward a bachelor's degree in a regular discipline. Students who fulfill program requirements are awarded the Certificate in Asian Studies attesting to their attainment. Requirements for the Certificate are a total of 24 credits selected from the Asian Studies course list. There are no language requirements for the Certificate; however, any student interested in the serious pursuit of Asian Studies is strongly urged to acquire competence in an Asian language.

Astronomy

(Also see Physics)

The Five College Department of Astronomy is administered jointly with Amherst, Hampshire, Mount Holyoke, and Smith Colleges. The elementary courses for nonmajors are taught separately at each campus but all advanced courses are given on a joint basis for students from the five participating institutions. Five College courses are identified in the Undergraduate Catalog by ASTFC. The Astronomy Program at the University is also a part of the Department of Physics and Astronomy. The graduate program in astronomy is developed in close cooperation with the program of physics.

The Five College Astronomy Department offers undergraduate courses which furnish 1) specialization for those students planning graduate study in astronomy, 2) a more general major for students interested in careers in teaching, scientific journalism, technical editing, or similar areas for which astronomy may form the basis for a suitably broad science background, and 3) a background for all students who are interested in astronomy for its cultural and scientific value. Professor T. T. Arny is the Chief Adviser for Astronomy.

Students who plan to go to graduate school should obtain a firm foundation in physics and mathematics and should plan to finish satisfactorily Physics 184 or 163, Mathematics 174 or 186, and Astronomy 122 by

the end of the sophomore year. During the junior and senior years a student must complete Physics 255-256 and Physics 251-252, Mathematics 343, and three courses selected from Astronomy 237, 238, 343, 344, and independent study. It is also strongly recommended that the student take Mathematics 341, Physics 271-272 and/or 285-286, and obtain a good reading knowledge of German, French or Russian.

More flexibility in planning courses is available to those majors for whom the B.A. or B.S. will be a terminal degree in astronomy. In some circumstances Physics 142 and Astronomy 101-102 will be acceptable lower division courses. A minimum of three upper division astronomy courses and nine additional credits of upper division astronomy or physics must be satisfactorily completed. These may include Astronomy 231 and 234 but should be chosen in consultation with the Chief Adviser. In some cases advanced courses in the history or the philosophy of science may be desirable.

Those students wishing a B.S. rather than a B.A. degree need a total of 60 credits of science courses. The credits required beyond those explicitly needed for the astronomy major may be chosen from any science or behavioral science courses.

Independent and honors work are encouraged for all majors. Opportunities for theoretical and observational work are available in cosmology, cosmogony, radio astronomy, planetary atmospheres, relativistic astrophysics, laboratory astrophysics, gravitational theory, infrared balloon astronomy, stellar astrophysics, spectroscopy, and exobiology. Facilities include the Laboratory for Infrared Astrophysics, balloon astronomy equipment (16-inch telescope, cryogenic detectors), the Five College Radio Observatory, access (under supervision) to the 120-foot NEROC radio antenna, and a modern 16-inch Cassegrain reflector. Opportunities for summer research are also frequently available including an exchange program with the Observatory of Bonn University. Original publications often result from undergraduate research.

SAMPLE PROGRAM I

Rhetoric	Astro 237
Math 123 (135)	Phil 230
Elective	Physics 200
Elective	Elective
Elective	Elective
Rhetoric	Astro 234
Math 124 (136)	Astro 386
Physics 161	Elective
Elective	Elective
Elective	Elective
Physics 162	Astro 385
Math 173 (185)	Physics 254
Elective	Math 200
Elective	Ed. Psych
Elective	Elective
Physics 163	Ed. Block
Math 174 (186)	
Elective	
Astro 122	
Elective	

SAMPLE PROGRAM II

Rhetoric	Physics 251
Math 123 (135)	Physics 255
Physics 181 (161)	Math 341
Elective	Elective
Elective	Elective
Rhetoric	Physics 252
Math 124 (136)	Physics 256
Physics 182 (162)	Math 343
Elective	Astro 238
Elective	Elective
Elective	Physics 271
Math 173 (185)	Physics 285
Physics 183 (163)	Astro 343
Astro 122	Elective
Elective	Elective
Elective	Physics 272
Math 174 (186)	Physics 286
Physics 184	Astro 344
Elective	Elective
Elective	Elective

Note: Electives include courses needed to satisfy college and University distribution requirements.

Biochemistry

The biochemistry major provides a curriculum for those students who have an interest in both biology and chemistry and who wish to achieve a balanced and mutually supporting education in these two areas. Formal education in biochemistry is started with the general biochemistry course in the junior year and continued by requiring advanced tutorial and/or honors programs in the senior year. Professor T. Robinson is Chief Adviser.

For students who, early in their college years, already plan on graduate school and a professional career in biochemistry, this major would be an obvious choice. At present, most students arrive in graduate school to study biochemistry with no background in the subject and must spend a full year before they even have the background for deciding on an area of interest. This major would be valuable for students going into many areas of molecular biology.

For pre-medical, pre-dental, and pre-veterinary students a major in biochemistry would have many attractions. It is well-known that undergraduate experience in biochemistry and related fields can soften the difficult first year of medical school. Furthermore, a movement toward flexibility in the medical curriculum has been developing. A student who majors in biochemistry can look forward to exemption from biochemistry at growing numbers of medical schools with consequent free time for elective research, other courses, etc.

An undergraduate major in biochemistry could be valuable for future junior college and secondary school science teachers who may be expected to have competence in several areas of science. Finally, students who are merely undecided between chemistry and biology may find that a major in biochemistry will provide them with the background for a decision. The curriculum outlined below is flexible enough to allow a student to change his major to biology or chemistry as late as the end of the sophomore year without finding that he has deficiencies to be made up. In addition, the informal discussions during the freshman and sophomore years will provide him with guidance in his final choice of major.

The sample curriculum outlined below conforms to college requirements and closely follows recommendations made at the 1965 Symposium on Pregraduate Education in Biochemistry of the American Society of Biological Chemists.

First Year: Chemistry 113-114, Mathematics 123-124, Elementary Biology I-II, German 110-120, Rhetoric 100 or 110.

Second Year: Chemistry 165-166 or 261-262, Chemistry 167 or 263-264, Mathematics 174, Physics 141-142, German 130, 140 and English, Humanities I or II.

Third Year: Biochemistry 223-224, Biochemistry 225-226, Chemistry 210 (I)—Elem. Biol. Sci. (II), Chemistry 281-282 or 285-286, Social Sciences (I, II), Humanities (I, II), Computer Science (II).

Fourth Year: Two advanced courses in chemistry or biology, Advanced Biochemistry (including lab.) 5 cr. (e.g., Bio. 388 or 399), Social Science (I or II).

Botany

The Botany Department has a strong commitment to undergraduate education at several levels:

First, Botany majors are assured a thorough grounding in basic concepts in such fields as plant morphology, plant physiology, ecology, and genetics and cytology, as well as being offered a variety of other courses in more specialized areas. Students are encouraged to take at least one semester of Special Problems, which involves laboratory research in close cooperation with a member of the Faculty. This overall program equips the student especially well for teaching and research in biological sciences in high schools, universities, industry and experimental stations.

Second, the options available to those Botany majors also seeking certification for secondary school teaching provide not only an adequate training in basic botany, but exposure to material considered to be especially useful for teaching.

Many of the courses offered in the above two curricula are, of course, open and valuable to majors in other areas of science, such as Geology, Forestry, Agriculture, etc.

Third, the Botany Department offers courses without prerequisites designed for non-science majors. These courses, which include Natural History of Man, Genetics and Evolution, Plants and Environment, etc., provide a broad, although in no way superficial, approach to biological principles, and can be used to fulfill science core requirements.

Students majoring in Botany are required to complete the following courses: Chemistry 111-112.

Chemistry 261-262, 263-264 or Chemistry 160 + either Chemistry 281 or Biochemistry 220 or Botany 212.

Physics 141-142.

Mathematics—2 semesters of calculus, or one semester of calculus + one semester of either statistics or computer science or probability.

Zoology 240.

Botany—100, 211, 221, 228, 281, 291, 125 or 303-304, 311 (under some circumstances, and at the discretion of the Botany Department, equivalent courses may be substituted for any of these required Botany courses).

Students planning to teach in secondary school must fulfill the above Chemistry, Physics, Mathematics and Zoology requirements, and must also take the following courses:

Either Microbiology 140 or 250 or any Zoology course with a Zoology 101 prerequisite.

Botany 100 or 101 or 103, 125 or 303-304, 126, 211, 228, and at least 9 additional credits in 200- or 300-level Botany courses.

Additional requirements for certification are Psychology 303 and Education 251 in the junior year, and Education 285, 310 and 311 which are required in one semester in the senior year.

Chemistry

The prime purpose of the Department of Chemistry is to offer sound preparation for graduate study in chemistry. Accordingly, emphasis is placed upon intellectual accomplishment and broad understanding rather than on terminal training for specific chemical tasks. The program also affords sound preparation for work in chemical industry, chemical institutes, or governmental laboratories. A slightly modified program permits preparation for secondary school teaching. Professor G. Richason is the departmental Chief Adviser.

Students planning to major in chemistry should take Chemistry 113, 114; German 110, 120 (recommended, but Russian may be substituted); Mathematics 123, 124; and Physics 161 in the freshman year. It is recommended that the student elect one or more courses in biological science such as Botany 100, Zoology 101, Microbiology 140, 150, 250 or Entomology 126.

The sophomore year should include Chemistry 165, 166, 167, 168; Mathematics 174; Physics 162, 163 (Physics 141, 142 may be taken but provide less background than the 161, 162, 163 sequence); German 130, 148.

The junior chemistry major takes Chemistry 210 and 285 during the first semester; and 269, 286, and 287, second semester. Chemistry 288 is to be taken during the first semester of the senior year.

To complete requirements for the B.S. degree with a major in chemistry and to qualify for certification to the American Chemical Society the student must take Chemistry 213 and 246, and two additional courses selected from the listing below. One of these two additional courses must be selected from either the "Physical Group" or the "Organic and Biochemistry Group," and with one of the courses being a laboratory course.

Physical Group: 290, 295, 388, Honors (and certain advanced physics and mathematics courses by approval of the Head of Department).

Inorganic, Analytical, and Radiochemistry Group: 213, 215, 244, 246, 388, Honors.

Organic and Biochemistry Group: 271, 272, 388, Honors; Biochemistry 223, 224.

Students in secondary education may use the Education Block to substitute for the two additional courses.

A student may qualify for the B.S. degree in chemistry (but not for certification to the American Chemical Society) without completing Chemistry 269, 213, or 246. However, the curriculum must then include four courses selected from the above listing. One of these must be a laboratory course, and two different groups must be represented by the selection. Students in secondary education may use the Education Block to substitute for two of the courses in the above groups.

A less vigorous program qualifies the student for a B.A. in chemistry. Students may satisfy requirements for the B.A. degree by completing the following: Chemistry 113, 114; 165, 166, 167, 168; 210; 281, 282; and two courses from the above listing, one of which must be a laboratory course. The same supporting courses are required as listed for the B.S. curriculum, except that German or Russian is not required, nor is the second year of calculus.

Classics

The study of ancient Greek and Roman civilization and culture, the oldest of humanistic disciplines, occupies a position central to all the humanities and still forms a broad base for the disciplines of history, English, philosophy, art history, comparative literature, and religious studies. It can provide a meaningful core in every student's education.

Courses labeled "Classics" on the 100 and 200 levels are offered for purposes of general education. They require no knowledge of Latin or Greek; all readings are done in English translation. Courses of this sort are offered in Greek and Roman civilization, ancient mythology, and Greek and Latin literature in translation. There is also a special language skills course in Greek and Latin elements in English designed to increase the student's knowledge and understanding of English vocabulary by study of the roots, prefixes, and suffixes incorporated into English from Greek and Latin. A full range of courses is offered in the Latin language and its literature. The offerings in Greek may be supplemented with courses at the neighboring colleges. Arabic, Armenian, Hebrew, Persian, and Turkish are presently being offered in the Classics program.

Students majoring in Classics arrange their own individual programs of study in close consultation with a faculty adviser. Emphasis may be placed on Greek and/or Latin language and literature, ancient history, ancient art and archaeology, ancient philosophy, ancient religion, mythology, the Classical tradition, or a comparative study of ancient and modern literatures. Courses may be chosen from those available in the Classics Department, from related courses in other departments at the University, and from appropriate departments at the neighboring colleges, Amherst, Smith, and Mount Holyoke.

A major in Classics can be designed to serve any of the following purposes:

1) to provide a meaningful humanistic core in a liberal arts education,

2) to provide training for professional careers in teaching Latin and Classics on the elementary or secondary school levels, or

3) to provide preparation for graduate work in the field leading to a Ph.D. in Classics and teaching on the college level.

Requirements for the Classics major:

I. Prerequisites to the major: Latin 110, 140 (or four years of secondary school Latin), 150, 160 or Greek 110, 140, 150, 160. (Recommended collateral courses: Classics 100 and 102.)

II. The major: At least 10 upper-level courses (= 30 credits) in Greek, Latin, Classics, ancient history, ancient art, ancient philosophy, ancient religion, mythology, the Classical tradition, or appropriate courses in comparative literature. The courses chosen should constitute a coherent program of studies. No work in the ancient languages is required beyond the 160 level.

For more information, consult Professor Edward Phinney, Herter 402 (545-0514) or any member of the Classics staff.

Comparative Literature

The study of comparative literature has the following aims: to develop the student's ability to read literature with critical perceptiveness; to provide a more accurate sense of literary history than the study of a single literature makes possible; to encourage detailed scrutiny of literary masterworks selected from more than one language, place, or time; to prepare the student for more advanced, methodical investigation of problems involving more than one literature; and to attempt to make clear the meaning and function of literature in itself and in its interdisciplinary dimensions.

Two different types of major program lead to the B.A. degree in Comparative Literature. One is designed for the student who plans to go on to graduate study in comparative literature or in some closely allied field; the other is directed toward the needs of a student who is not planning graduate study but wishes to read widely and with some depth in at least two different literatures.

The first type of program normally involves the study of literature in two languages, a major and a minor; one of these may be English. Majors must also fulfill a requirement in a third language, preferably ancient, either by taking six hours of elementary course work or by passing the appropriate reading examination. The usual program for this first type of major consists of 42 hours of course work, not including the work done in the third language. These 42 hours should be distributed as follows: 15 in the literature of the major language, 12 in the literature of the minor language, and 15 in Comparative Literature (including 3 directed toward the literature of the major language). Any student who is capable of doing upper-level work in a third language may elect the following distribution: 15 in the major literature, 9 in one minor literature, 6 in another, 15 in Comparative Literature, and 3 to be elected in any of the preceding categories.

The second type of program involves the study of literature equally in two languages. The normal program will consist of 45 hours of course work, distributed as follows: 15 in the literature of one language, 15 in the literature of the second language, and 15 in Comparative Literature.

Neither language department courses taught in translation nor Comparative Literature courses numbered lower than 203 may be counted as part of the major. Comparative Literature 203 and 204 may be counted only if the student has arranged beforehand with the instructor to do reading in the original language. All Comparative Literature courses at the 200 level are, however, strongly recommended to prospective majors as providing essential backgrounds and introductions to more advanced study. Language department courses numbered higher than 140 may be counted as part of the major.

Comparative Literature 380, Theories of Literature is required of all majors without exception. Comparative Literature 204, Classics of European Literature is required of all majors who have a primary interest in modern literature. It is also recommended that majors take at least three hours of their work in the form of a non-Western humanities course or a course in the Department of Afro-American Studies. Except for Comparative Literature 380, courses may not normally be counted as a part of the major program if they are taken on a pass/fail basis.

Economics

Economics is the study of an imposing, hard fact of life, that what we as a society would like to have exceeds the capacity of our resources to provide it. We are forced, therefore, to choose--and simultaneously exclude—those goods and services we will have from the larger menu of possibilities. Economics develops the basic

principles stemming from this scarcity and applies them to analyze the various aspects of human activity where such choices must be made.

The Economics Department at the University offers courses spanning this naturally broad range of interests within economics. The courses are subject to continuous review as the findings and techniques of economic science improve. In recent years substantial numbers of new courses have been added and many existing courses revised.

Courses are offered in such topics as economic theory, international trade, industrial structure and regulation, labor economics and human capital, mathematical economics, economic history, lesser developed economies, comparative systems, regional and urban economics, public finance and history of economic thought.

Thus the individual student is faced with a choice. The department has far more course offerings than he, even as a major, could reasonably take. But his decisions have been made much easier by the flexibility deliberately built in the course structure. A student who wishes a basic understanding of economics or completion of a (D) distribution requirement will probably take Economics 100, Elements of Economics. If he is interested in a particular topic he may take Economics 121, International Trade; Economics 141, Labor Problems; Economics 171, Comparative Systems; and Economics 181, Urban Problems; all of which presume no previous economics courses. A student expecting to take more than one economics course should begin with Economics 103, Microeconomics and continue with Economics 104, Macroeconomics. Then, if the economics of a particular subject interested the student, he may enroll in the appropriate one from among most other courses offered by the department. A student interested in developing economic tools of analysis further for a career in business or systems analysis, for example, can take Economics 203 and 204 after the two introductory courses.

The same freedom of choice extends to majors in economics. Graduates of the undergraduate program in economics continue in a wide variety of categories such as graduate school, law school, government, or business so that they should be able to structure their own appropriate program.

Along with university and college requirements the department requires majors to complete 24 credits in economics which must include 104, 203, 204 and at least 3 other courses of the 200 or above level. The only other requirement is one of calculus such as 116, 127, 135, or 146 so that students have some familiarity with the language in which so much of modern economics is conducted. Majors are assigned to a permanent adviser when they enter the department but are not required to obtain his signature on semester programs. In practice many economics majors follow an informal advising system of consulting faculty members from whom they have had courses or who are well versed in specific areas.

English

The student who majors in English will gain a considerable knowledge of Western literature; he will develop skill in expository and creative writing; and he will increase his capacity to read literary works with perception and to judge them by critical standards. Such a program has maximum value as liberal education, and is especially useful to students whose interests are in writing, editing, criticism, and teaching. Randall Current is departmental Chief Adviser; James Leheny is Director of Undergraduate Studies.

The Department of English offers courses in composition, literature, and language. The Program in Journalistic Studies is also administered by the Department. Students majoring in English must take 1) one period course in English literature before 1800, 2) one semester of study in a non-English literature, read either in the original language or in English translation, and 3) three of the following four options: a) one course that has as its primary concern the study of the English language, b) one course in the works of Shakespeare, c) one course that studies intensively a single major British or American author, d) one course in the development of a literary genre such as tragedy, comedy, satire, lyric poetry, the novel. The student should elect his remaining six English courses and appropriate courses in other departments, including University core requirements and electives, to provide himself a coherent unit of study that accords with his own needs and interests. He is invited to consult with appropriate members of the Department about such areas of coherence as medieval studies, Renaissance studies, literature and psychology and American studies.

An English major must take at least 30 and no more than 45 hours of upperclass English courses except to the extent that he earns credits beyond the 120 hours required for graduation. Honors theses may be included in or excluded from the 30-hour total at the writer's discretion. A quality-point average of 2.0 or better must be maintained in the upperclass courses listed in the preceding paragraph. The student may count in the 30 hours required for the major up to six credits for any upperclass course in Comparative Literature, or in any foreign literature read in the language or in translation; any upper-level course in Journalistic Studies or in Linguistics; and any upper-level course in Speech primarily concerned with language or literature. Furthermore, upon presentation to the Chief English Adviser of sufficient justification, the student may obtain permission to count other courses not here included.

A student who intends to apply for admission to the Education Block in preparation for secondary school teaching should consult with Gary Aho, Chairman of the English Department's Committee on Teaching.

French

The vast richness of France's long cultural life—royal, imperial, and republican—as well as the tenacity of France's citizenry wholeheartedly bound to that life, have given the world an unforgettable gift. Apart from the natural grace and incisiveness of its language, French literature, rarely stolid, is a continual and exhilirating plunge into intellectual and spiritual turmoils committed to an understanding of human dilemma. For that reason, the best of French literary works needs no dusting off to be appreciated today, for they either forecast or they are already the contemporary image of a questioning, vibrant civilization. Ties of language bind parts of Belgium and Switzerland to metropolitan France, but without loss of identity, while new, different, and often brilliant expressions of man's condition emerge with increasing rapidity from artists in French Canada, Africa and the Antilles.

Students planning to major in French have access to programs ranging from language skill courses at all levels to a rich body of courses devoted to literature and civilization. To supplement the major, requirements

of which are outlined in several other brief documents, students are urged to take advantage of our overseas programs in Grenoble and Pau, or to spend their entire junior year in Paris under the auspices of the University of Massachusetts-Boston. Majors will also find living in the French Corridor not only a successful way of learning spoken French outside of the classroom, but also an important introduction to life in France. The department regularly invites exceptional scholars to spend a semester or year on campus to teach undergraduate courses; it also receives the annual visit of a theatrical troupe offering a varied repertoire; it makes available a film series open to the public.

Special departmental advisers determine the major's proper placement within the department, help to formulate the future program of each student, and resolve academic problems that may arise during the major's four years on campus; other special advisers clarify overseas programs. For their part, majors may and should elect (within the limits of the 36-credit major field) related courses in other fields: philosophy, art history, English literature, French history, and so on. Advisers will always assist majors in selecting those extra-departmental courses meant to enrich and enhance the major field.

The major in French is carefully designed both in breadth and in depth to form the well educated citizen. At the same time, portions of the major program are calculated to prepare for teaching at the secondary level and to serve as a preliminary training leading to the degrees of Master of Arts, Master of Arts in Teaching, and the Doctor of Philosophy. Students may wish to discuss many additional programs leading, for example, to foreign service careers or posts requiring both a proficiency in spoken French as well as a wide knowledge of French thought and life. As a support for future professional life, the French language is used exclusively in all major courses.

For complete information concerning the major in French, please consult Professor Micheline Dufau, Chairman of the Department of French and Italian, or designated advisers.

Geology

For students considering Geology as a career, the opportunities are many. Those interested primarily in basic science may look to positions in teaching, in museum work, on state and Federal surveys, and in various research organizations. Those concerned with applied science may work in mining geology, petroleum geology, engineering geology, environmental geology, groundwater geology, coastal geology, surficial geology, and economic mineralogy. The fields of space science and oceanography also provide opportunities for students with geological training.

The Bachelor of Arts degree program in Geology is intended for those wishing a broader education in liberal arts than is possible with the Bachelor of Science degree. The Bachelor of Science degree provides adequate preparation for graduate work in Geology. The Bachelor of Arts degree may also be adequate preparation for graduate work in Geology when planned in consultation with an adviser.

The Bachelor of Science degree program is divided into two options, a Geology Option and an Earth Science Option. The Geology Option is designed for those planning a professional career in Geology, and provides preparation for graduate work. The Earth Science Option prepares students specifically for careers and certification in the teaching of Earth Science at the secondary level. The departmental Chief Adviser is Mr. T. Rice.

Bachelor of Arts in Geology degree requirements are: fulfillment of the general University and College of Arts and Sciences requirements for the B.A. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or alternatively, Geology 105, 106, 107, or 108 and Geology 160); a minimum of 24 credits in upper division Geology courses (Geology 192 is considered an upper division Geology course); a minimum of 15 credits in supporting natural sciences and mathematics (Natural Science and Mathematics courses may be elected from the offerings of the following departments: Astronomy, Biochemistry, Botany, Chemistry, Microbiology, Mathematics, Physics, Statistics, and Zoology; supporting science courses may also be elected from the offerings of Computer Science, Marine Science, and certain other departments with the approval of the student's adviser). Any student following this degree program who may plan to go on to professional work in Geology or related science is expected to consult with his adviser before selecting his supporting natural science and mathematics courses. (These courses should include Chemistry 111-112, Physics 141-142, and the necessary supporting mathematics courses, usually at least Calculus I.)

Bachelor of Science, Geology Option, degree requirements are: fulfillment of the general University and College of Arts and Sciences requirements for the B.S. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or, alternatively, Geology 105, 106, 107, 108 and Geology 160); followed by Geology 192, 220, 230, 231, 240, 250, 251, and a minimum of 3 credits of work elected from upper division Geology courses; summer field experience (ways in which this requirement may be fulfilled should be discussed with the student's adviser); and work in supporting Natural Science and Mathematics courses (for list of Departments see description of B.A. degree) consisting of Calculus I and II plus one additional 3-credit course in Mathematics, Statistics, or Computer Science, Physics 141 and 142 (Introductory Physics for science majors), and a minimum of 3 credits elected from the course offerings in the supporting disciplines; plus a minimum of 6 credits elected from upper division Geology courses or the supporting disciplines.

Bachelor of Science, Earth Science Option, degree requirements are: fulfillment of general University and College of Arts and Sciences requirements for the B.S. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or, alternatively, Geology 105, 106, 107, or 108 and Geology 160); followed by Geology 192, 220, 230, 240, 250, 251, and a minimum of 2 credits of work elected from upper division Geology courses; work in supporting Natural Science and Mathematics courses (for list of Departments see description of B.A. degree) consisting of Calculus I and II, Chemistry 111 and 112 (General Chemistry for science majors), Physics 141 and 142 (Introductory Physics for science majors), or 6 credits in Astronomy, and 12 additional credits (other than Geology) in the Natural Sciences or Mathematics selected with the student's adviser to constitute a "minor" concentration; and the Secondary Education Block (Psychology 101 and 301 plus courses specified by the School of Education). Students electing this degree option should register with the Secondary Education Office in the School of Education during their

Sophomore or Junior year to be sure that they are accepted for admission to this program.

Geography

The program in geography provides a sound preparation for majors intending to proceed to graduate study and a broad array of elective or required courses in systematic and regional geography for students majoring in other fields.

For students specializing in geography there is a wide variety of possible careers in teaching at all levels in planning, industry and government agencies.

The faculty is prepared to discuss a program of courses in geography and related fields which best fits the career intentions and interests of the individual student. The minimal major requires that the student take one Introductory course (135 or 155), two courses in Regional Geography (200-239), Cartography (250), two courses in Systematic Geography (260-399) and any other three upper division geography courses.

Prof. Terence Burke is the Chief Adviser for Geography.

Germanic Languages and Literatures

To fulfill an undergraduate major in German, a student must complete 33 credits in the department's junior-senior courses. Two programs are available: one is designed principally for those who wish to teach in elementary or secondary school (Program A), the other for those who are primarily interested in continuing their studies in graduate school (Program B).

Students selecting Program A should take 161, 201, 202, 211, 221, 241, 283 and 284, and a minimum of three courses in German literature, one of which must be in the twentieth century (331, 332, 333, or 334).

Students selecting Program B should take 161, 201, 202, 211, 221, 284, 321, and 391, and one course in each of the following categories: (a) 331, 332; 333, 334 (b) 311, 312, 313 (c) 301, 302, 303.

One course in history or philosophy is required of all German majors.

Freshmen who fulfill the language proficiency requirement upon entrance should take 161 or 201.

Students are urged to supplement their course work with at least one summer session at an approved summer school of German or by participating in a summer program abroad, such as the University offers in Freiburg, Germany.

Hispanic Languages and Literatures

The department offers a major in Spanish and a number of courses in Portuguese. A major in Portuguese is planned.

All the department's programs stress training in and the use of language skills. The courses in Hispanic literature are taught for their basic literary values and for the insights these afford into the cultures of Spanish- and Portuguese-speaking peoples. The department also offers courses which directly stress the use of the Spanish language and which are of particular advantage to those Spanish majors who plan to teach the language.

The undergraduate major program consists of 36 junior-senior credits, 9 of which may be in related areas and disciplines approved by the department. Entering Spanish majors who achieve an intermediate year level in the placement tests are urged to take Spanish 146, an intensive course which will permit them to start their Spanish concentration one semester sooner than if they were to take Spanish 130-140, the usual intermediate course.

Prerequisite to a major in Spanish are the following courses: Spanish 131-141, 161-162, 181-182, 190.

The successful completion of courses from the following areas will constitute partial fulfillment (24 credits) of a major in Spanish:

(a) Three courses in Conversational Spanish: Spanish 251, 252, 253 (one credit each).

(b) One course from the Medieval Literature group: Spanish 315, 317, 318.

(c) Two courses from the Renaissance and Golden Age Literature group: Spanish 325, 330, 335, 340.

(d) One course from the Eighteenth- and Nineteenth-Century Literature group: Spanish 355, 365.

(e) One course from the Twentieth-Century Peninsular Literature group: Spanish 381, 382, 383, 384.

(f) Two courses from the Spanish-American Literature group: Spanish 370, 371, 372, 373, 374, 375.

Additional options are being planned, with the object of allowing students to choose either the major program outlined above or an alternate program which would give greater emphasis to language and linguistics. Among the possibilities of the alternate program is preparation for work in Bilingual-Bicultural education.

History

Courses in history are designed to provide an understanding of man through a study of patterns of development in the past. The study should also give the student an introduction to major problems in world affairs. A major in history has value to the general student as a humanistic discipline. It has application as preparation for careers in such fields as teaching, law, government, journalism, ministry, library science and business.

History majors must take as required courses in their freshman and sophomore years two year-long sequences chosen from History 100-101 or 110-111, 115-116, 120-121, 140-141, 150-151. The history major will select one of four areas of specialization (European, British, American or Latin American history) and take within it a minimum of 15 to 18 credits of upper-level course work. Students specializing in European history will be required to include in their program at least 3 credits in ancient or medieval history and an additional 3 credits in the early modern period (from the Renaissance through the 18th century). In addition a student will take 6 or 9 credits outside the specialization for a total of 24 upper division credits.

Italian

The immeasurable wealth of Italy's long cultural life as well as its contribution to Western civilization are manifest. Apart from the beauty of its language, Italian literature is a never ending search for a better understanding of the human condition. Italian literary works are among the most appreciated today for their probing questioning of historical events and social phenomena, their avant-garde character, and their artistic representation of reality.

Students planning to major in Italian have access to programs ranging from language skill courses at all levels to a rich body of courses devoted to literature and civilization. To supplement the major, requirements of which are outlined in other brief documents, students can take advantage of the University Summer Program in Bologna, Italy. Often, at times in conjunction with

other colleges in the Amherst area, the department invites exceptional scholars to spend a semester or year on campus to teach undergraduate courses.

Special departmental advisers determine the major's proper placement within the department, help to formulate the future program of each student, and help resolve academic problems which may arise during the major's four years on campus. Majors should elect (within the limit of the 36-credit major field) related courses in other fields such as philosophy, Italian history, Italian art, and upper division courses in other literatures. Advisers will always assist the major in selecting those extra-departmental courses intended to enrich and enhance the major field.

The major in Italian is carefully planned both in breadth and in depth to form the well educated person. At the same time aspects of the major program are designed to prepare for teaching at the secondary school level and to serve as a preliminary training leading to the degrees of Master of Arts, Master of Arts in Teaching, and the Doctor of Philosophy. Students may wish to discuss many additional programs leading, for example, to foreign service careers or posts requiring both a proficiency in spoken Italian as well as a wide knowledge of Italian life and thought. As a support for future professional life, the Italian language is used exclusively in all major courses.

For complete information concerning the major in Italian, please contact Professor Zina Tillona, Associate Chairman for Italian Studies.

Journalism

This co-curricular (non-credit) tutorial program is open to all students, regardless of their majors, who think they are interested in journalism careers.

Newspapers in Northampton, Greenfield, Holyoke, and Springfield cooperate in this co-curricular journalism program. The college daily also cooperates, and any student who writes for it may obtain tutoring in journalistic writing techniques. Undergraduates interested in journalism careers should spend a few hours weekly writing for the college daily, starting in their sophomore year, and should seek work on a commercial newspaper during the summer of their junior year. Summer placement aid is provided as part of the tutorial and counseling program.

As a rule, the director of the journalism program arranges for students to participate in the tutorial program with commercial newspapers after they have participated in the tutorial program with the college daily.

Journalistic Studies

This liberal arts curriculum program introduces students to journalism as an academic discipline (communications research). Majors in Journalistic Studies must choose either an *interdepartmental major* in which the student earns at least 15 junior-senior credits in Journalistic Studies along with 15 junior-senior credits in one other liberal arts department, or a *double major* in which the student earns 15 credits in Journalistic Studies while also completing all the requirements for a major in one other liberal arts department, such as English, History, or Political Science. A student's choice of an interdepartmental or a double major is made by agreement with his or her adviser. The interdepartmental major is generally limited to honor students who must apply to the Chairman of Journalistic Studies.

All writing courses are taught by the Department of English, and any two of its eight advanced writing courses are acceptable in meeting the major requirement of at least 15 credit hours in Journalistic Studies. Because the writing process is the same regardless of the product, no particular writing courses are recommended. No more than one writing course should be elected in any one semester. All majors must elect at least three of the following eight content courses in Journalistic Studies:

Introduction to Mass Communication
Language and Communication
Independent Study and Research (I and II)
The Communication Process (Summer Course)
Mass Communication Theory
International Communication
Freedom of the Press Seminar

The Journalistic Studies courses provide background for students interested in such diverse career objectives as communications research, law, advertising, editorial work for newspapers or magazines or publishing houses or radio and TV stations, public relations, teaching, and creative writing. Graduate study is required for careers in communications research.

Students interested in the Journalistic Studies program should see Dr. Howard Ziff.

Linguistics

Though it is a humanistic discipline, linguistics is best described as the science of human language. Through the scientific study of the structure of language, linguists seek to understand the nature of that human mental faculty by which we produce speech from an intended meaning, understand meaning from spoken or written language, and acquire our native language. Linguists study the nature of the knowledge a human being possesses when he "knows" his native tongue. Although Linguistics has no undergraduate major, courses in linguistics are counted for major credit in several departments, and are relevant to majors in English, the foreign languages, Anthropology, Speech, Psychology, Philosophy, and Computer and Information Sciences.

Mathematics

(See also Probability and Statistics)

The student electing mathematics as a major will find a variety of stimulating program options. These include preparation for a career in teaching at the secondary school level, graduate and research work in mathematics, computer programming and data processing, actuarial work, statistics, or an industrial position. Mathematics is also a good general major for students who are uncertain of their career plans. In addition, there are many opportunities for interdisciplinary study based on mathematics. Both Bachelor of Arts and Bachelor of Science degrees are offered, and the choice between them is usually based upon the interests and intentions of the student.

All mathematics majors are required to complete a two-year sequence in calculus and linear algebra, or the equivalent. In addition, eight upper-division courses are required. These may be chosen from the department's offerings or from certain mathematics-related courses in other departments. Five of these upper-division courses must be taken in the form of two two-semester sequences in two of the areas of algebra, analysis, applied mathematics, and geometry and topology, and a one semester elective from a third of these

areas. Students who have taken calculus in high school may be entitled to advanced placement with credit for their previous work; they should consult the mathematics placement counselor during the summer counseling period. Further detailed information about mathematics major requirements may be found in the Mathematics Major's Information Leaflet which may be obtained from the department.

The student majoring in mathematics will have ample opportunity to shape his major program to fit his interests. If he is interested in computer and data processing he would probably take courses in computer and information science, logic, linear programming and possibly probability and statistics. The student aiming for a teaching career at the secondary level might elect courses in geometry and number theory, and then spend one semester of his senior year practice teaching in a public secondary school. A student interested in actuarial work would take courses in analysis and probability and statistics, and also computer science. Those interested in industrial work would do well to take advantage of the department's offerings in analysis and applied mathematics.

Students interested in statistics will find a good basic preparation in the mathematics department's course offerings, and will have an opportunity to take statistics courses for credit toward a major in mathematics.

Those planning on college level teaching or research in mathematics should be thinking of graduate school and are urged to take a number of the "pure" mathematics courses such as group theory, topology, differential geometry, and set theory.

Students who demonstrate unusual mathematical aptitude by the completion of their junior year are encouraged to enroll in a graduate course or to participate in the Senior Honors Program in which the student undertakes a substantial independent study project and writes an honors thesis.

Every student majoring in mathematics is assigned a faculty adviser. Further opportunities to meet with faculty members on an informal basis are provided by various department-sponsored activities. In the past these have included a mathematics club for undergraduates, and a junior colloquium at which special lectures for undergraduates were given by faculty members. For those who enjoy mathematical competitions, the department has entered a team in the national Putnam Prize competition for the past several years. Professor S. Allen is the departmental Chief Adviser.

Microbiology

The major program in microbiology is designed to offer students sound preparation for more intensive graduate study and research in microbiology, as well as basic preparation for a wide variety of positions as microbiologists in research and non-research laboratories. In either event, microbiology majors should immediately begin preparation in chemistry. Microbiology majors are required to have broad training in collateral sciences, and minimum requirements include chemistry through quantitative analysis and organic, and one year each of introductory biological science, physics, and mathematics. Those students contemplating graduate study will be advised to emphasize stronger training in these collateral sciences. Courses in microbiology are designed to offer fundamental training in the basic core areas and disciplines of this field. Microbiology 250, 280, 340, senior seminar, and elective courses contributing to a total of at least 17 credits in microbiology are required of majors. Prof. R. P. Mortlock is departmental Chief Adviser.

Music

The Music Department offers the Bachelor of Music degree and the Bachelor of Arts degree. A student must apply to the department for admission. An audition is required of all applicants.

The Bachelor of Music degree may be earned with one of three areas of concentration: performance, theory-composition, or music education. The three programs have a considerable part (91 credits) in common: The University core requirements (33 credits—36 when Music 111 is counted as the "C" course), a series of background courses in Music (58 credits) consisting of theory courses 111, 112, 113, 114, 211, 212, 215, and 216 (23 credits), music history and literature courses 102, 201 and 202 (9 credits), performance courses each semester (24 credits), and course 363, Conducting, (2 credits).

The additional requirements for a concentration in performance are: music courses 217, 385, 386, 18 credits in performance, and 12 elective credits, 6 of which may not be music credits (totalling 129 credits). A senior solo recital is required.

The additional requirements for a concentration in music education depend upon whether the student's primary skill is vocal or instrumental. In either case, 5 additional credits in performance work and 15 credits for the teacher certification courses are required. For voice students, 16 credits in music education, 6 credits in Italian, and 6 elective credits (totalling 139 credits) are required. For instrumental students 7 credits in music education, 18 credits in instrumental techniques, and 3 elective credits (totalling 139 credits) are required.

The Bachelor of Arts program for a music major is pre-professional, serving the needs of the student who wishes to broaden his cultural background. All majors will take 111, 112, 113, 114, 201, 202, 211, 212, and must register for applied music and either band, orchestra, or chorus every semester. The student will choose as his area of concentration music history, theory, or applied music. The junior-senior years will include a sequence of advanced courses suggested by the department. Students whose major area is applied music are required to present a senior solo recital. Prof. J. Contino is the departmental Chief Adviser.

Majors in other departments may elect a minor in music. This program should include 111, 112, 201, 202, and 4 credits in ensemble or individual applied music. Education majors, upon completion of 111-112, should elect 242 in lieu of 201.

The band, orchestra, chorus, and various small ensemble groups are open to all University students who wish to participate in a performing organization.

The Music Department is an associate member of the National Association of Schools of Music.

Philosophy

Philosophy deals with questions of central and perennial human concern: large questions, having to do with reasoning, or right and wrong, or man, or the world, in general terms; and small questions about the fine structure of knowledge, existence, and value. There is a special pleasure in thinking about such questions, and in learning how to think about them clearly, responsibly, and effectively. A philosophy student becomes

acquainted with an important part of our common intellectual heritage; but he also acquires intellectual habits and skills which serve him well in other fields and disciplines and indeed in daily life.

The core fields in philosophy are logic, ethics, metaphysics, and theory of knowledge. There are also specialized fields, such as philosophy of science, political philosophy, aesthetics, philosophy of religion, and philosophy of language. A student may wish to develop a competence in one of the specialized fields, or in the philosophy of ba certain period (e.g., in ancient philosophy or in the philosophy of the 17th century), or in a particular school or style of philosophy (say in existentialism, or in analytic philosophy).

The Philosophy Department offers courses in all areas of philosophy at all levels, from the most elementary to the most advanced. Majors in philosophy take 30 credits in departmental courses. No particular course is required, but each major has to have one semester course (3 credits) in logic, one in ethics, and four in the history of philosophy. The 100-level courses may be counted in meeting these requirements. Students with specialized interests can arrange independent study courses; and those with a B average or better can do honors work in their senior year, in which an honors thesis, written under the supervision of a faculty tutor, is presented in lieu of 6 of the required 30 course credits. Professor Gareth Matthews is Director of Undergraduate Studies and Chief Adviser for the major.

Physics

(See also Astronomy)

The Department of Physics and Astronomy offers programs of study and individual courses in physics for students in science and science related areas and for liberal arts students.

For the liberal arts student a variety of one and two semester courses is available. Physics 115, 116, 117 and 118 consider topics in music, special relativity, nuclear energy, and quantum physics respectively. Physics 121-122 provide a broader view of the ideas and concepts of physics for the non-science student.

Physics 141-142 are designed for students in the life sciences as well as pre-med, pre-dent, and pre-vet majors. Physics 161-162-163 provide the necessary physics background for engineering, chemistry, and other physical science majors. Honors sections are available in Physics 161-162. These sections are identified by the numbers 171-172. An introductory course in physics for Elementary Education majors is available as Physics 130.

Physics 100 is appropriate for students who want to be exposed to some of the highlights of Physics in one semester. This course offers an excellent opportunity for a student to test his interest in Physics as a possible major area.

Students planning to major in Physics may consider one of two kinds of programs. The R program is aimed at those who wish to pursue research and university careers and plan to go on to graduate study in Physics. The T program is designed for those who plan to go into inter-disciplinary work, physics teaching at the high school level or science-oriented, administrative, technical, and business careers. Considerable flexibility is available in this latter program to suit the needs and goals of the individual. Although it is possible to switch between the two programs until fairly late stages, students are strongly urged to plan their courses early in consultation with faculty advisers in the Department. Dr. Morton M. Sternheim, Director of Undergraduate Studies in this Department, will provide information concerning counseling. Either the series Physics 181-182-183-184 or Physics 161-162-163 is appropriate for Physics Majors in the Freshman and Sophomore years, although Physics 181-184 is the preferred start for students interested in the R program. This series is also available for non-physics majors who may wish to learn Physics with a more substantial degree of mathematical sophistication. Minimum mathematics courses are Mathematics 123-124-173-174 (or equivalent background). These should be started at the beginning of the Freshman year if possible. The Freshman and Sophomore years should include two science elective courses (such as Chemistry 111, 112).

In addition to the above, the following are minimum requirements for a B.A. or B.S. degree in Physics: 18 credits in upper division courses in the Department of Physics and Astronomy, which must include at least 4 credits in electricity and magnetism with a laboratory, 3 credits in modern physics and 3 credits in advanced experimental work or an experimental honors project. Normal preparation for graduate study in Physics (R program) consists of several Physics and Mathematics courses in addition to the minimum requirements (see the following typical program). The distinction between the B.S. and B.A. degrees is made on the basis of distribution requirements set by the College of Arts and Sciences.

Typical programs for both types of majors are:

R Program

Freshman year	
Phys 181	Phys 182
Math 123	Math 124
Science elective	Science elective
Sophomore year	
Phys 183	Phys 184
Math 173	Math 174
Junior year	
Phys 251, 255	Phys 252, 256
Phys 387	Phys 319
Senior year	
Phys 271, 285	Phys 272, 286
Phys 375	Phys 376 or Honors project

T Program

Freshman year	
Phys 100	Phys 161
Math 123	Math 124
Science elective	Science elective
Sophomore year	
Phys 162	Phys 163
Math 173	Math 174
Junior year	
Phys 200	Phys 301, 375 or 376, 210
Senior year	
Phys 302, 386, 390	Education block or other electives

Political Science

Courses in Political Science investigate the nature, functions, and problems of political systems, and of the place of politics in the modern world. These courses can be broadly grouped into the fields of Political Theory, American Politics and Public Law, State and Local Politics and Public Administration, Comparative Politics and Area Studies, and International Relations.

The degree program in Political Science provides a thorough foundation for enlightened citizenship and to prepare them for a wide range of careers, such as graduate study leading to academic or research positions, public service at the federal, state or local level, political office, the study and practice of law, foreign service, business and education. Professor Jerome Mileur is the Chief Undergraduate Adviser.

The Political Science Department offers three introductory courses: 100 American Politics; 150 Comparative Politics; and 161 World Politics. Any of these courses meets the University requirement of an introductory course in social science. Political Science majors are required to take two of the above three courses, the two selected depending upon the background, interest and experience of the student involved. Credit will not be awarded for more than 6 hours of introductory work.

Majors in Political Science are normally expected to complete the basic courses in their freshman or sophomore years. A minimum of 10 additional courses is required. At least one course must be selected from each of the five fields: political theory, American politics and public law, state and local politics and public administration, comparative politics and area studies, and international relations. Any four additional Political Science courses will complete the Departmental distribution. In addition, the Department requires a minimum of 12 credits from among the non-introductory offerings in history, philosophy, anthropology, economics, psychology, and sociology. Any combination of four courses above the 200 level satisfies this requirement.

The curriculum is flexible enough to accommodate a wide range of career and vocational interests. Students are encouraged to develop their individual programs in consultation with Departmental advisers. Opportunities also exist for independent research (through the Senior Honors Program), for exchange programs (within the Five College area, among a number of participating universities and colleges in the United States, and with a number of universities abroad), and for various internships and training programs at the local, state, and national levels.

Probability and Statistics

(See also Mathematics)

The curriculum in probability and statistics is intended to develop student insight into the nature of scientific method, with emphasis upon probabilistic models of its chief tool, the experiment. Distinctions between deductive and inductive methods of reasoning are explored. Statistical techniques for dealing with data in small or large quantity are developed and studied. Courses offered introduce the student to analytic devices for dealing with data that are commonly used in the social, biological, and physical sciences; business, engineering and other disciplines.

Students with training in calculus should elect Statistics 315 and 316. Students without calculus who desire a thorough grounding in the concepts underlying statistics should elect Statistics 231 and 232. Those who wish merely to obtain some familiarity with elementary statistical ideas and techniques should elect Statistics 121 and subsequently Statistics 251.

Any of the three courses Statistics 121, 231, or 315 serve as prerequisites for sampling theory (S271), design of experiments (S261, S262), and multivariate analysis (S281, S282).

There is at present no undergraduate major in statistics. Those who intend to study statistics at a graduate level should concentrate on mathematics and elect courses in computer science. Statistics finds useful applications in diverse fields such as animal and plant breeding, econometrics, engineering, market research, sociology and psychology. Advanced courses in statistics require a background of at least two years of calculus and preferably Mathematics 225/525 Advanced Calculus and Mathematics 211/511, 212/512 Abstract Algebra.

The Statistical Laboratory is open to students and staff wishing to use its facilities. Students wishing to use the calculating machines will be instructed in their proper use. Professor R. Kleyle is Chief Adviser.

Psychology

The courses in the Psychology Department are planned to impart an understanding of the basic principles, methods and data of psychology as a science and the application of this knowledge to current issues. The Department recognizes that interest in psychology is not limited to those who intend to pursue careers in the discipline. Course offerings are therefore designed so as to permit students to pursue study of various aspects of the subject to differing levels of depth. The wide range of the discipline further permits students to pursue programs of study which lead to either the B.A. or the B.S. degree, depending on the pattern of courses the student elects in the Department and the College.

Psychology 101 is the prerequisite entrance course for all students. Both psychology majors and non-majors may then elect any of the following additional courses without further prerequisite: 141, 145, 201, 210, 220, 230, 260, 262, 263, 270, 280, 290, 301, 305, 311, 325.

Students interested in majoring in psychology should elect Psychology 141 following completion of Psychology 101 and may then pursue a general psychology major or one designed for those preparing for graduate study and professional careers in the field. The general psychology major provides opportunities either for those seeking a general education or for those entering career fields for which psychological information is relevant to pursue a major in psychology without the emphasis on laboratory methodology that would normally be part of the program of those seeking admission to graduate study in the field.

The general psychology major must elect, in addition to Psychology 101 and 141, the following: Psychology 305 and a minimum of 21 (and no more than 27) credits of advanced level courses in the Department. Included in the electives must be at least two courses from each of the following two groupings: *A)* 210, 220, 230, and 250; and *B)* 260, 270, and 280. This program allows the student considerable flexibility to elect a variety of courses both within and outside the Department suited to his interests and needs. Students completing this major will fulfill the Departmental requirements for the Bachelor of Arts degree.

NOTE: Students who have entered the B.A. program may elect the additional courses indicated below to complete a "career" major *without* shifting to a B.S. program, or they may elect to become B.S. degree candidates if in the balance of their program they fulfill the *additional science requirements of the College*. Depending on their backgrounds, certain transfer students may have difficulty fulfilling these requirements in the time they have available. Students who are in doubt as to which major or degree programs to follow should discuss the available options with the Undergraduate Advising Office in Tobin Hall.

The *career psychology major* must elect the same program as the general psychology major as a minimum. In addition, such students should plan to elect Psychology 145 and at least one laboratory course from each of the following two groupings: *A)* 211, 221, 222, 231, and 251; and *B)* 261, 271, 281, and 282. These laboratory electives must be taken in proper sequence with their associated non-laboratory prerequisites or corequisites. Students completing this major will fulfill the *Departmental requirements* for either the Bachelor of Arts or the Bachelor of Science degree.

Students in the "career" program (either B.A. or B.S.) who are otherwise eligible will be encouraged to participate in the Honors Program in their junior and senior years.

Selected majors in either program may from time to time be invited to participate in Special Problem programs, the Department's cooperative teaching program or both.

General vs. career major. Both majors permit a considerable degree of flexibility to students in electing courses to meet their individual needs. Graduates from either program (and with either B.A. or B.S. degrees) may pursue advanced study in psychology or related fields. The designation of one program as a "career" major is for the purpose of informing students of the *typical preference* of graduate psychology departments at the present time for applicants who have some background in quantitative and laboratory methods.

Students in the career major program would be assumed to have already made commitments to pursue graduate study, though of course they need not follow this implied intention. Those who for any reason choose to pursue the general program rather than the more intensive career program need not feel that they have excluded themselves from further study or careers in the field.

Only in respect of admission to courses with limited enrollments and to restricted honors and other special offerings will preference be given to those students electing the career major. Otherwise, students in both majors (and in both B.A. and B.S. degree programs) will have full access to the facilities of the Department.

Professor Morton Harmatz is Director of Undergraduate Studies. Students should contact the undergraduate secretary in Tobin Hall for advising.

Rhetoric

The Rhetoric Program offers a flexible and varied experience for students fulfilling the University's core requirement. The requirement states that all students (with certain exceptions for advanced placement) will take two courses in Rhetoric, one of which must be Rhetoric 100 or Rhetoric 110. Through an inter-disciplinary effort, involving teachers from English and Speech as well as other departments, the Program seeks to give students help and practice in many kinds of writing and oral communication.

In a world where problems of reaching people through words have become crucial to us all, an effort to study and try out for oneself a number of forms of expression becomes a worthwhile educational task. At present the Program devotes attention, in its several courses, to such examples as formal and informal exposition both oral and written, imaginative literature, mass media, and film.

There is no undergraduate major in Rhetoric, though a graduate program is offered by the Speech Department.

Professor Malcolm Sillars of the Speech Department is Acting Director of the Program. Professor John Harrington is Associate Director, with special responsibility for those courses staffed by members of the English Department.

Slavic Languages and Literatures

The Russian major is a relative newcomer in the curricula of most of our major educational institutions. Yet the importance of Russian, along with Chinese and English, as one of the three major world languages cannot be denied. The major role played by the Soviet Union in world affairs makes it essential to keep informed about all aspects of Soviet life. Moreover, the Russian language is the vehicle of one of the world's great literatures, as well as the avenue of an increasing body of vital technological information.

The Russian major aims at maximal proficiency in all four language skills; for this reason, language study is the most significant component of the major program. Opportunity is also provided for the student to achieve a background in the literature and history of Russia, as well as to gain some competence in related areas of economy, political science, sociology and anthropology.

The range of career opportunities open to the Russian major includes service in the Federal government, in private business, in library work, in research institutions, in the mass media and in the teaching of Russian at all educational levels. The study of Russian also provides a rich and rewarding cultural experience and an expanded knowledge and understanding of the Russian people and their society.

Department requirements for a major are the successful completion of:

a) Six semester courses of language study at the junior-senior level (18 credits): Russian 261, 262, 271, 272, 281, 282.

b) Two semester courses of literature study at the junior-senior level (6 credits): Russian 291, 292.

c) At least two additional courses within the department, to be chosen in consultation with an adviser on the basis of the student's post-graduate plans.

d) Two semester courses in Russian History: History 214, 215.

The student is encouraged to select more than the minimum number of required courses in order to achieve the strongest possible background in the discipline. The choice of additional courses, both within and outside the department, will depend in large measure on the student's career plans. For this reason, it is essential that majors and prospective majors consult early and often with the departmental advisers. Professor Maurice I. Levin is Chief Adviser for the department.

Sociology
The courses in sociology are planned to give the student an understanding of the factors which influence man in his activities and interests as a member of society and to introduce the fundamental methods of research in sociology. The course offerings are designed so that students who desire to prepare for graduate work, as well as those who do not, will find suitable programs for study available within the department.

Career opportunities are open in a wide range of fields which include public and private welfare agencies, governmental and private research organizations, and education. Those interested in research careers should incorporate within their programs courses in statistics and methodology beyond the introductory levels and should plan on graduate training if they aspire to full professional status in the discipline. The American Association of Schools of Social Work indicates that the pre-professional subjects most closely related to professional work in that field are economics, political science, psychology and sociology.

All majors are required to take Sociology 101 (Introductory Sociology), and a minimum of eight to a maximum of ten 200-level courses selected from among courses offered by the Sociology Department. Sociology majors, especially those who are considering graduate studies, are strongly advised to take a statistics course, Sociology 282 (Sociological Theory), and Sociology 295 (Research Methods). Sociology majors must take four courses from the "E" group in the catalog from at least two of the groups, (a) Biological Science, (b) Physical Science, (c) Mathematics, and are required to select two courses of 3 credits each from Economics, Geography, Political Science, Psychology, and Anthropology. Prof. Robert Faulkner is the departmental chief adviser. Mr. William D. Bathurst is Information Officer for Sociology majors.

Soviet and East European Studies
This program provides an opportunity to study the Soviet and East European area from the perspective of several academic disciplines. Requirements for a major are:

1. Proficiency in a relevant language (usually Russian) at a level adequate to enable the student to conduct research in that language;
2. successful completion of 10 courses dealing with the area in a minimum of three disciplines to be chosen from Anthropology, Economics, History, Political Science, Slavic Languages and Literatures, and Sociology;
3. two courses in modern European history.

The major in Soviet and East European Studies was established in 1971 as an alternative to the major in Slavic Languages and Literatures and to a major in one of the several disciplines offering courses on the Soviet and East European area. This major program is designed for those students who want to acquire a knowledge of this large and important part of the world through study across disciplinary lines. It may be particularly useful for students contemplating work in teaching, government service, journalism and other fields.

Students interested in graduate study in the area may also find the major useful, although it should be noted that most graduate programs are in a single academic discipline only. Accordingly, a student contemplating work toward an advanced degree is advised to have at least a minor in the discipline in which he or she is most interested. (It is possible to take sufficient courses to fulfill the requirements for two majors, with this fact indicated upon the official transcript of the student. This type of program may be devised by an individual student to fit specific plans for graduate study.)

The Committee on Soviet and East European Studies administers the program. Members are: Joel Halpern (Anthropology); Paul Hollander (Sociology); Robert Jones (History); Maurice I. Levin (Slavic); Stanley Radosh (Slavic Bibliographer) and Karl Ryavec (Political Science), Chairman. Questions regarding the details of this program may be obtained from the Department of Slavic Languages and Literatures, Herter Hall 438, or from Professor Karl Ryavec, Department of Political Science, Thompson Hall.

Speech
Courses in speech are designed to enrich the student's understanding of man through theoretical study of the speech communication process and the application of this theory to various speech forms. A major in speech prepares a student not only for a career in one of the speech disciplines, but also for a career in law, government, the arts, or business.

Majors are required to select one of the following areas of concentration: 1) Communication Disorders (Speech Pathology and Audiology), recommended for students who plan to prepare themselves for graduate study in order to meet American Speech and Hearing Association (ASHA) certification standards for careers as speech therapists and audiologists; 2) Mass Communications, recommended for students who plan to pursue careers in educational or commercial media or to prepare themselves for graduate study in mass communications; 3) Communication and Rhetorical Theory, recommended for students who plan to pursue careers in law, the ministry, public affairs, and similar professions or to prepare themselves for graduate study in rhetoric; 4) Speech Education (a combination of courses from a combination of areas), required of all students who plan to earn a secondary school teacher's certificate in speech.

Majors must meet the requirements of the area of major concentration. Specific information may be secured in the departmental office.

Zoology
Beginning with the class of 1972, the curriculum for Zoology majors has been revised extensively. The new curriculum reflects the following opinions of the faculty.

1. Students who major in Zoology should acquire a broad knowledge of biological concepts and principles, reinforced by factual knowledge without which these concepts and principles are professionally meaningless.
2. Within this framework, or core curriculum, a considerable degree of flexibility in selection of courses is both possible and desirable.
3. The core curriculum should be supplemented by a coordinated group of elective courses. These will most often be in Zoology, other biological or physical sciences, mathematics, psychology or anthropology but may be in any other department of the University which best prepares each student for his own professional goals, which takes advantage of his interests, and which also takes into account limitations in his aptitudes.

Each student majoring in Zoology must complete the following Zoology courses: 240 (Principles of Genetics);

360 (Cell Physiology); 221 or 223 or 227 (Comparative Anatomy or Histology or Embryology); 281 or 282 or 283 (Biology of the Lower Invertebrates or Biology of the Higher Invertebrates or General Parasitology); 246 or 335 or 337 or 350 (Population Genetics or Limnology or Ecology or Animal Behavior); and 366 or 370 or 380 (Vertebrate Physiology or Comparative Physiology or Developmental Biology). The student must attain intermediate proficiency in one of French, German or Russian and complete satisfactorily the following collateral courses: Botany 100 (Introductory Botany); Chemistry 111, 112 (General Chemistry); Chemistry 261, 262, 263, 264 (Organic Chemistry); Biochemistry 222 or 223 (General Biochemistry); Mathematics 123, 124 (Analytic Geometry and Calculus), or Statistics 231, 232 (Fundamentals of Statistical Inference), or Computer Science 131, 132 (Introduction to Computers and Programming, Survey of Computer Applications); and Physics 141, 142 (Introductory Physics). Students with a special interest in chemistry or chemical biology may, with the approval of the Chemistry Department, substitute Chemistry 113, 114 for 111, 112; and those with a special interest in physics may wish to substitute Physics 161, 162, 163 (General Physics) for 141, 142. Special sections of Mathematics 123, 124 for Life Science majors are being developed.

All students should enroll in a chemistry sequence in their freshman year, because subsequent courses in Organic Chemistry and Biochemistry are prerequisite to Zoology 360 which in turn is prerequisite to all of the courses in the 366-370-380 group.

Botany 100 should be elected in the fall of the freshman year, as it will serve to review major biological concepts prior to the Zoology major's first Zoology course (genetics) in the spring of his freshman year.

Zoology 101 (Introductory Zoology) is not required of Zoology majors. Those who have not studied biology in high school or those who feel that their knowledge of introductory Zoology is inadequate may enroll in the course or audit the lectures prior to or concurrently with their enrollment in Zoology 240.

Students who, by advance placement, receive partial or full credit for English, Foreign Language, or Mathematics may take advantage of the increased flexibility in the freshman year to complete other general College or University graduation requirements, to enroll in courses of interest in other departments, or to begin or complete their Physics requirement in the freshman year.

The curriculum for those who plan to become certified secondary school biology teachers requires, in addition to the departmental requirements outlined above, Botany 125 (The Plant Kingdom) and 126 (New England Flora); Psychology 101 (General Psychology) and either 263 (Adolescent Psychology) or 301 (Educational Psychology); Education 251 (History of Education) and 282 (Pre-practicum) and, in the senior year, the concentrated "Secondary Education Block" of 12 credits of Education courses. Students in the Secondary Education curriculum may, with the permission of their adviser, substitute Zoology 135 (Introductory Physiology) for the requirement of one of the 366-370-380 group providing that the substitution is not made before the student's junior or senior year, when his plans for secondary teaching have become firm.

Because applications exceed available space, the department has had to limit the number of majors it can accept. The only fair basis on which such limitation can be made is the student's over-all academic performance during his first three semesters. The required level of achievement varies but tends to be around a 2.0 quality point average or better.

Program in Computer and Information Science

The Program in Computer and Information Science offers a wide range of undergraduate courses in the areas of Computers, Theory of Computation, and Cybernetics.

An increasing number of undergraduates, irrespective of their major, are finding it useful to have the ability to program and use modern computing equipment. They will find four courses (Introduction to Problem Solving Using the Computer; Introduction to Computer and Information Science and FORTRAN Programming; Introduction to Computer Organization and Assembly Language Programming; Comparative Programming Languages) very useful in getting hands-on experience with the time-sharing system at the University and mastering batch processing using the FORTRAN IV language.

A number of courses introduce undergraduates to the design of computers, the design of compilers for communicating with computers in high level languages, and with new techniques for reducing complex problems to computer form.

Courses in automata theory, linguistics and automata, combinatorial theory, and related topics introduce the student with a mathematical background to the many exciting problems posed by the theoretical study of computation.

Students from all schools of the University have expressed interest in the new program in cybernetics. Of particular note are the courses "Cybernetics and the Brain," which introduces the student to the computational study of brain function; and "Ecological Cybernetics," which shows how mathematical techniques may combine with computer simulation to allow man to tackle large-scale problems of ecological interactions. In addition, the course "Computers and Society" helps students who want to understand the use of computers to solve social problems, and of the studies required to avoid "side effects"—including such problems as data banks, computerized voting, automated health care, and computer-aided instruction.

While no formal undergraduate major exists in Computer and Information Science, it is possible for students to seek a bachelor's degree with individual concentration, the program being worked out individually.

College of Food and Natural Resources

The College of Food and Natural Resources, the oldest college of the University, offers a broad general education with specific training in a specialized area. Upon the completion of the requirements for the Bachelor of Science degree, the student will have devoted his time to pure science, social and humanistic studies, and applied sciences and technology.

Undergraduate students in the College of Food and Natural Resources are exposed to an interdisciplinary, systems-oriented, problem-solving atmosphere that has been developed to a high degree.

A broad choice of electives within most of the major programs gives the student an opportunity to prepare for a career in business, industry, education, research, government, services or production agriculture.

A unique feature of the College of Food and Natural Resources is that the faculty for all the major programs is drawn from the three divisions of the College—research, resident teaching and extension, thereby bringing a depth of teaching to every student.

All departments—Agricultural and Food Economics, Food and Agricultural Engineering, Entomology, Food Science and Technology, Forestry and Wildlife Management, Hotel, Restaurant and Travel Adminstration, Landscape Architecture and Regional Planning, Plant Pathology, Plant and Soil Sciences and Veterinary and Animal Sciences offer graduate degrees in a discipline or professional field.

INTERNATIONAL AGRICULTURAL STUDIES (Interdepartmental Program). The unprecedented increase in the human population of the world makes mandatory rapid increases in world food production. Estimates indicate that total food production must double by the year 2000 to maintain our current inadequate nutritional levels and must triple if reasonable improvement is to be accomplished.

Students in this program will prepare themselves for careers in foreign agricultural development and trade. Students will be trained for international careers in the several technical fields within agriculture, in administration of agricultural programs, and in agribusiness. The program will require five years to complete, including a required year abroad in a developing country during the fourth year, and leads to a Bachelor of Science degree with a major in International Agriculture. A total of 132 credit hours, including six awarded for the overseas training and six for language certification, will be required for graduation.

In addition to University core curriculum requirements and professional courses in their individual majors, students will use electives to take the following recommended courses. (For Freshman year curricula, see major program for required Freshman courses.)

Agricultural and Food Economics 110 and 381
Sociology 101 and 252
Anthropology 104 and 379
Geography 255
Economics 266
Political Science 130

Certification of ability in the non-English language spoken in the region of the student's overseas training experience.

The year abroad will include language study and supervised work experience in a developing country. Certification of language ability is required.

The program also involves farm work experience and participation in pre-departure orientation for year-abroad students.

STOCKBRIDGE SCHOOL. For those students interested in a two-year Associate Degree program in the food and agricultural industries, the University provides offerings in the Stockbridge School. A separate bulletin describes these offerings in detail.

MAJOR PROGRAMS IN THE COLLEGE OF FOOD AND NATURAL RESOURCES, B.S. DEGREE, ARE AS FOLLOWS:

Agricultural Business Management

Growing demand for food and fiber products, both for domestic and foreign consumption, increases the importance of planning and management in the production and marketing of these products.

Agricultural Business Management focuses upon the application of principles of economics and business management to the problems of supplying agricultural business and the production and marketing of agricultural products.

The rapidly changing agricultural industry offers increasing opportunities for students with specialized training in business and economics, as executives of marketing firms, farm supply organizations and food processing concerns. Many other opportunities are available in teaching and research and in adminstrative positions and public service.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
*Math. 111, 121 or 123 Introductory	3	Math. 113, 123 or 124 Introductory	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Agric. & Food Economics 110	3	Rhetoric Elective	3
Rhetoric 100	3	§Elective	3
	15		15

*On basis of placement tests at time of summer counseling Alg. & Trig. 121—(Not open to students having entrance credits in Trig.)

†Choose from Chem. 111 & 112, Physics 103 & 104, Bot. 100, Zool. 101, Microbiol. 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100, 101, 150, & 151, Psych. 105 & 106, and Sociol. 101 & 102.

§Recommendations for some elective courses are made from the fields of Economics, Business and Technical Subjects in Agriculture, depending upon the interests of the individual student.

Agricultural Engineering

This professional field includes engineering activities which relate macrophysical and microphysical environments to the production, preservation, and processing of food and other biological materials. The academic program is quantitative in nature and emphasizes the integration of mathematics and the physical sciences into the interpretation and solution of biological production and processing problems. Agricultural engineers find professional employment in a variety of industries as well as in public and private agencies engaged in research and development.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100	3	Rhetoric Elective	3
Mathematics 123 Anal. Geom. & Calculus	3	Mathematics 124 Anal. Geom. & Calculus	3

Chemistry 111	3	Chemistry 112	3
Engr. 103 Graphics	3	Engr. 104 Problems	2
Social Science Elective	3	Physics 161 General	4
	15		15

Animal Sciences and Pre-Veterinary

The curriculum in the Animal Sciences, including poultry, is designed to provide fundamental training and knowledge in the comparative nutrition, physiology, genetics, and management of various classes of livestock and to understand the role of animal production in the national and world economy. Options emphasizing commercial animal production are supported by electives in agricultural economics, agricultural engineering, and business administration. Students interested in graduate work in such specialized areas of the animal sciences as nutrition, physiology or genetics should elect programs with stress on the sciences.

Freshman pre-veterinary students in the College of Food and Natural Resources usually major in Animal Science, but may choose other departments if appropriate to the students' interests. Those who by their work in the first year demonstrate a potential for success should apply to the Pre-Professional Advisory Committee for admission into the pre-veterinary program (see page 47 under heading Pre-Dental, Pre-Medical, etc. for additional information). All pre-veterinary students, regardless of major, are counselled by the pre-veterinary adviser in the Animal Sciences Department.

FRESHMAN YEAR

First Semester	Credits	*Second Semester*	Credits
Animal Sci. 121 Introduct.	3	Zool. 101 General	3
Botany 100 General	3	Chem. 112 General	3
Chem. 111 General	3	Math. 112 Finite	3
*Math.	3	Social Sci.	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Entomology

Courses in Entomology acquaint students with all phases of insects and insect control, including apiculture and medical entomology. Trained entomologists find positions in public service and industry, such as teaching at all levels; research, quarantine and regulatory work in state or Federal service, various roles in public health and pest control activities; research, sales and public relations work in the agricultural chemicals industry; and agriculture.

FRESHMAN YEAR

First Semester	Credits	*Second Semester*	Credits
Chem. 111 General	3	Chem. 112 General	3
Zonl. 101 Introductory	3	Entomol. 126 General	3
*Math.	3	Math. 112 Finite	3
Foreign Language or Agric. & Food Econ. 110	3	Foreign Language or Botany 100 Intro.	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Environmental Design

The Department of Landscape Architecture and Regional Planning offers an Environmental Design program which prepares students for professional study at the graduate level and also provides an introduction to problems of the design of the physical environment for those not intending to pursue graduate study. Options are offered in Pre-planning, Pre-landscape architecture and Park and Open Space Administration.

The type of work in each of these professions is unique:

The landscape architect brings a concern for people, a concern for the natural environment and a concern for visual quality to bear on the design of developments and on the planning of communities and regions.

The park administrator is involved in park and open space planning and development and in the management of such areas to insure long range quality.

The planner is responsible for developing alternative methods of achieving goals. There are many kinds of planners, and planning can be approached from many disciplines. This department is concerned with city and regional planning. It emphasizes the constraints and opportunities provided by land as the primary resource base. In combination with courses in the appropriate departments, it stresses, also, social, economic, and political factors which influence planning at various governmental levels.

A 2.0 cumulative quality point average is required for admission as a major to the junior year of this program. Prospective majors are advised to take Environmental Design 221 and/or 244 as sophomores. Freshmen should concentrate on fulfilling University core requirements. Recommended courses are as follows:

Humanities: Art 100, 115; History 100, 101.

Social/Behavioral Sciences: Political Science 100, Sociology 101, Economics 125, Psychology 101.

Mathematics/Natural Sciences: Botany 100 or 101, Geology 101 or 280 for all areas of concentration.

Park & Open Space Administration: Entomology 126.

Pre-Landscape Architecture: Philosophy 125.

Pre-Planning: Statistics 121.

Freshman majors should contact the department early during the first semester to be assigned an adviser.

Fisheries Biology

Fisheries Biology is concerned in its broadest terms with the management of the aquatic environment in both freshwater and marine situations leading to maximum sustained yields of both sport and commercial catch. It deals with the management of resources and with fundamental factors affecting the biology of species from a research point of view.

Government, state and federal, provides the largest number of career opportunities.

FRESHMAN YEAR

First Semester	Credits	*Second Semester*	Credits
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 116 or 123 Calculus	3	Math. 117 or 124 Calculus	3
Botany 100 Intro.	3	Zool. 101 Introductory	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Forestry 222 Cons. of Natural Resources	3	Social Sci. Elective	3
	15		15

Food Marketing Economics

The food distribution industry is the largest single in-

dustry in the nation in terms of number of people employed and in dollar sales. The number of managerial and executive positions in the food industry is growing at a rapid rate because of the expansionary nature of the industry and the advancing state of scientific management being employed.

Abundant opportunities are available in private industry, government, and education. Students receive basic courses in Economics, Business, and Labor management.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
*Math. 111, 121 or 123	3	Math. 113, 123 or 134	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Rhetoric 100	3	Rhetoric Elective	3
Agric. & Food Econ. 110		§Elective	3
Food & Nat. Res.	3		
	15		15

*On basis of placement tests at time of summer counseling. Math. 121—(not open to students having entrance credit in Trig.)

†Choose from Chem. 111 & 112, Physics 103 & 104, Botany 100, Zool. 101, Microbiology 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100, 101, 150, and 151, Psych. 105 & 106, and Sociol. 101 & 102.

§Recommendations for some elective courses are made mostly from the fields of Economics and Business, depending upon interests.

Food Science and Technology

A major in Food Science and Technology provides scientific and technological training in the principles concerned with the processing, preservation, and packaging of foods and food products. The student's training is directed to the application of modern science and technology to research and to the manufacturing and distribution of foods. Major fields open to graduates include: (1) product research and development; (2) food processing and packaging; (3) technological work and research in government, industry, and education; (4) advanced graduate study.

The curriculum in Food Science and Technology, of which approximately 30% of the credits are electives, is designed to provide flexibility to meet the interests and objectives of the student as well as the opportunity to obtain professional training as recommended by the Institute of Food Technologists.

Supporting courses are selected with the guidance of the major adviser and may include, among others: Agric. Eng. 386, Chem. 281, 282, Biochem. 224, Food Sci. 258, 365, 384, Microbiology, Nutritition, Statistics, and Computer Science.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 Language & Writing	3	Rhetoric 110 Language & Speaking	3
Chemistry 111 General	3	Chem. 112 General	3
*Math. 123 Anal. Geom. & Calculus	3	Math. 124 Anal. Geom. & Calculus	3
Zoology 101 Intro.	3	Food Sci. 101 Struggle for Food	3
Social Sci. or Elective	3	Social Sci. or Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Forestry

This major is concerned with the conservation and management, for the public benefit, of forests, park lands, and other open space through the production of wood, water, wildlife, and amenity values such as recreation and aesthetics.

The curriculum in Forestry is based on the biological and natural sciences, a knowledge of the environment, economics, and social inter-relationships. Six curricular options are offered: General Forestry, Forest Resource Conservation, Forest-Business Management, Forest Hydrology, Forest Recreation, and Forest Science.

This accredited program prepares graduates for continued education at the graduate school level, and for employment with private industry, federal and state resource agencies, secondary school education, conservation and planning organizations.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 116 Calculus	3	Math. 117 Calculus	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Botany 100 Intro.	3	Forestry 112 Dendrology	3
Forestry 222 Cons. of Natural Resources	3	Elective	3
	15		15

Hotel, Restaurant, and Travel Administration

The curriculum in Hotel, Restaurant and Travel Administration provides technical and professional courses for persons who plan a career in ownership, management or sales in the hotel/motel, food service, and travel fields. In addition to the required core curriculum courses, students take courses in accounting and control; personnel and management; food planning, purchasing, preparation, and service; promotion, merchandising and sales; kitchen planning and maintenance, travel and tourism. Emphasis is on principles, analysis, computer application and decision-making.

The student selects one of these areas of concentration: Hotel Administration, Restaurant Administration, Institution Management or Travel and Tourism.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Hotel & Rest. Adm. 100 Introductory	3	**Humanities Requirement	3
Rhetoric 100	3	Nutrition & Food	
*Sci. Requirement	3	Food Prep. & Service	3
Math. (Basis of Test Results)	3	Rhetoric 110	3
Elective	3	*Sci. Requirement	3
	15	Statistics 121 or Equivalent	3
			15

*Elect three courses identified by letter "E" in catalog.

**Elect three courses identified by letter "C" in catalog.

Natural Resource Economics

The resource economics program is designed to train students to assist in making public and private decisions on resource development and management which will contribute to the twin goals of greater resource productivity and improved environment. Students will study the many problems of resource use, the forces which have combined to create these problems, and the possible solutions to these problems. Training in economic decision-making and the technical characteristics of specific natural resources provide a unique competence for performing these nationally important careers.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
*Math. 111, 121 or 123	3	Math. 113, 123 or 124	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Agric. & Food Econ. 110 Food & Nat. Res.	3	Elective	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling. Alg. & Trig. 121—(not open to students having entrance credits in Trigonometry).

†Choose from Chem. 101 & 112, Physics 103 & 104, Botany 100, Zool. 101, Microbiol. 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100, 101, 150, & 151, Psych. 105 & 106, and Sociol. 101 & 102.

Natural Resource Studies

A non-professional curriculum designed for students who wish to become generalists in the area of natural resource management and conservation, rather than specialists. Its primary objective is the education of an informed layman; it will not normally qualify students for employment within specific areas of the natural resource field. The curriculum has a minimal core of specified courses and offers great flexibility. Careful guidance coupled with early decisions will enable students to enter certain professional specialties and/or graduate school.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	Rhetoric Elective	3
Forestry 222 Cons. Nat. Res.	3	Natural Resource Elective	3
Botany 100 or Zool. 101	3	Botany 100 or Zool. 101	3
Math. (on basis of tests)	3	Chem. 110 (or higher)	4
Humanity or Social Science	3	Humanity or Social Science	3
	15		16

Plant Industry

The curriculum in Plant Industry provides students with a scientific basis of soil and plant relationships; a general knowledge of economic plants and an area of special study. By selection of option and elective courses and special problems, students major in: Agronomic Crops (i.e., Field and Forage Crops); Horticultural Crops (i.e., Flowers, Ornamentals (Nursery), Fruits and Vegetables); or Turf Management. Students are prepared for a variety of career opportunities in industry, business, marketing, production, sales, control, and regulatory services in state and Federal agencies.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100	3	Rhetoric Elective	3
Botany 100 General	3	Math.	3
*Math.	3	Plant & Soil Sci. 100 Basic Plant Sci.	3
Plant & Soil Sci. 110	3	Social Sci. Elective	3
Social Sci. Elective	3	Humanities Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Plant Pathology

Plant Pathology is concerned with the nature and control of plant diseases caused by fungi, viruses, bacteria, nematodes, certain higher plants and unfavorable environmental conditions. Plant pathologists fill positions in public service and in industry, such as teaching at all levels; research in state, Federal, university, and industrial laboratories and experiment stations; and Extension Service through Federal, state and county organizations. They are also employed in quarantine and regulatory work, in various roles in plant disease control, and in sales and public relations work.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
*Math.	3	Math. 112 Finite	3
Chem. 111 General	3	Chem. 112 General	3
Botany 100 General	3	Zool. 101 General	3
Foreign Lang. or Agri. & Food Econ. 110 Food & Nat. Res.	3	Elective	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Plant Science

There is a great need for highly trained men in the plant sciences to teach and study the fundamental physiology and genetic processes taking place within plants. A more complete understanding of these processes and the influence of environmental factors upon them will lead to a significant improvement in the supply and quality of plant food and fiber. Students interested in such careers as plant breeder and geneticist, secondary or college teacher, research and resource development personnel and like professional positions should major in Plant Science. This option provides the breadth and depth in basic biological and physical sciences and mathematics necessary for graduate study.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Botany 100 General	3	Humanities Elective	3
Social Sci. Elective	3	Math.	3
*Math.	3	Social Sci. Elective	3
Plant & Soil Sci. 110 Plant Propagation	3	Plant & Soil Sci. 100 Basic Plant Science	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Soil Science

Soil science deals with the physical, chemical and biological properties of soils as well as their relationship with higher plants. Men trained in this area become soil chemists, soil physicists, soil microbiologists, hydrologists and soil conservationists. Graduate study is mandatory for professional careers in soils. The soils curriculum provides the necessary breadth and depth in biological and physical sciences and mathematics for graduate study.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Botany 100 General	3	Humanities Elective	3
Social Sci. Elective	3	Math.	3
*Math.	3	Social Sci. Elective	3
Plant & Soil Sci. 110 Plant Propagation	3	Plant & Soil Sci. 100 Basic Plant Science	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Wildlife Biology

The first professional degree in Wildlife Biology is the Master of Science; for this reason study toward the Bachelor of Science in Wildlife Biology should be regarded as pre-professional. Students planning to enter graduate school are urged to meet with their advisers.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	Rhetoric 110 or 100	3
*Math. 121 or 116	3	Math. 113 or 117	3
Chem. 111 General	3	Chem. 112 General	3
Botany 100 Intro.	3	Zool. 101 Introductory	3
Forestry 222 Cons.	3	Econ. 125 Elements	3
	15		15

*On basis of placement tests at time of summer counseling.

Wood Science and Technology

The program in Wood Science and Technology emphasizes studies in the nature and properties of wood, the engineering and chemical technology of its manufacture into a variety of useful products, and the business aspects of industrial management and marketing. Strong demands exist for graduates in wood-processing firms and service-related industries, and in marketing and merchandising.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 123 Calculus	3	Math. 124 Calculus	3
Botany 100 Intro.	3	Forestry 112 Dendrology	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Engineering 103 Introductory	3	Engineering 104 Introductory	2
	15		14

School of Business Administration

The faculty of the School of Business Administration is keenly aware of the dynamic changes taking place in our economy, the extensive shifts in occupations and professions and the consequent need for intelligent and well-educated businessmen. The continuing advancement of technology, science, and the behavioral sciences has placed upon Schools of Business Administration the necessity to probe, not only into the developments of its own areas of education, but also into the relationships that exist among other areas such as mathematics, economics, psychology, sociology, and government.

The School of Business Administration prepares students to take advantage of important economic opportunities and eventually to assume positions of responsibility in business. The school's educational program is directed toward the broad aspects of business, encouraging high standards of ethical conduct, broad social responsibilities, and the development of competence in particular courses of study of the student's own interest, aptitude, and choice.

The first two years emphasize general education by providing fundamental courses in the humanities, mathematics, science, and social science. In addition, basic courses in accounting and economics prepare the student for further work in the School of Business Administration. The junior and senior years emphasize a greater degree of specialization and provide for this in the programs indicated below. But even in these last two years all students need to view business as a whole in so far as a "core" of courses can do this. This "core" consists of introductory courses in Finance, Marketing, Management, Business Law and Computer Programming. A total of at least 120 credits is required for graduation. Each course of study leads to a degree of Bachelor of Business Administration.

Students transferring to the School of Business Administration from any school or college within the University shall receive junior and senior elective credit only for those courses passed with a grade of C or better.

Students who intend to transfer from junior or community colleges should complete the program in liberal arts and not register for courses in Business Administration, except Principles of Economics and Elementary Accounting.

Transfer students who complete courses in their first two years that are offered in the junior or senior years will receive transfer credit only if such courses are accepted by the department concerned. An examination for such credit may be required.

The School of Business Administration is a member of the American Association of Collegiate Schools of Business.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	Rhetoric 110 Elective	3
Mathematics 116	3	Mathematics 117	3
†History and/or Political Science	3	†History and/or Political Science	3
‡Natural Science	3	*Math 115	3
*Sociology	3	*Psychology	3

*May be taken either semester.

†Any sequence or combination of History 100, 101, 150, 151 or Political Science 100, 150, 160, 161.

‡Any course identified by the letter "E" in the catalog.

Accounting
The accounting program prepares students for public accounting and for positions in business, industry, and government which require a knowledge of accounting.

General Business and Finance
The department offers five programs of study and specially designed programs for those students who wish to combine business administration with a related field of study outside the School of Business Administration. The program in Financial Management is designed for those students who wish to prepare for careers in the area of planning and controlling the financial operations of non-financial firms, financial firms, and governmental units. The program in General Business, emphasizing breadth of knowledge and viewpoint, is designed for those students who are uncertain as to their specific career objectives. The program in Busines Administration and Economics recognizes the close relationships between areas of study and permits students to complete 27 credits in economics. The program in Business Administration and Quantitative Methods exposes students to operations research and systems analysis through a detailed treatment of the application of mathematics, statistics, and computer science to problems in all of the functional fields of business administration. Since the mathematics and statistics requirements for this program depart from the normal requirements, it is important that interested students elect this program early in their studies. Sophomore and transfer students who have not completed the specified quantitative courses may elect this program only with the permission of the program adviser. The program in Urban and Regional Studies combines courses from many disciplines, including economics, sociology, political science, civil engineering, landscape architecture, and agricultural economics. The specific content of a special program is mutually determined by the department chairman and the student.

Management
Management majors are prepared to assume leadership positions in various types of organizations: business, government, and non-profit institutions such as hospitals, universities, and research organizations. Basically, all management majors become thoroughly acquainted with the essential functions of organizations, particularly operations, financing, and marketing, and with the elements of managing such as planning, developing an organization structure, motivating employees, and controlling performance. Most importantly, thorough training is provided in the skills of human relations, and in understanding the behavior of people at work. Courses normally include such topics as management practices, personnel policies, manpower planning, social responsibilities of business, labor and industrial relations, the uses of computers in organizations, and theories of organizational behavior.

Majors are available in *general management*, *personnel management*, *operations management*, (emphasizes the efficient managing of the production of goods and services, and explores in greater depth the uses of computers and quantitative aids to planning and decision making) and *systems management* (prepares the student for work in systems analysis, management information systems, and for a management role in the large scale, multi-organizational systems found in education, health, and urban affairs).

Marketing
The role of marketing management in our economy is becoming increasingly important. The department of marketing offers a broad range of courses for those students interested in careers in marketing administration, advertising, marketing research, and wholesale and retail enterprise. The department's objective is to provide a specialized and comprehensive understanding of today's managerial marketing problems.

School of Education

The School of Education has revised its entire curriculum with the intent of providing students with a variety of alternatives, relying more heavily on self-directed learning and focusing on problems and areas which have a high degree of social relevance. This revision and reevaluation of curriculum and structure is an ongoing process which will result in many new programs not included in the following information.

There are a varying number of learning centers within the School, each dealing with a specific area of education: Aesthetics; Foundations; Higher Education; Human Potential; Human Relations; Humanistics; Innovations; International Education; Leadership and Administration; Media and Technology; Occupational Education; Research; Teacher Educators; and Urban Education. All centers offer courses which are open to undergraduates, regardless of major, for their own professional and personal development.

In addition to these areas of specialization, there are numerous, continually changing academic programs in a non-center classification. Examples of current programs in this area include Ecology, Futuristics, and Instructional Applications of Computers.

An integral part of the undergraduate program is the Modular Credit Program. This exciting spin-off from traditional education enables students and faculty alike to share in varied learning experiences. Each learning experience carries an agreed-upon number of modules of credit, which are cumulative. Fifteen modules is equivalent to one University credit. Independent study programs are also offered to undergraduates. The student negotiates a learning contract with a sponsoring faculty member and is enabled to pursue in-depth study in an area of education, fusing personal and social relevance into the program of study.

All teacher education programs leading to certification are coordinated and approved through the Teacher Preparation Planning Council (T.P.P.C.). There are fourteen alternative programs currently available for candidates in elementary or secondary Teacher Education. Internships, pre-practicums, tutorials and field experiences have been greatly expanded in most alternative programs. Placements for this field work are available in Western Massachusetts and as far off campus as California.

Programs currently in effect are in the areas of Early Childhood, Integrated Day, International Education, Explorations, Alternative Schools, Distributive Education, Media for the Deaf, Urban Education, Foundations, and Off-Campus Internships.

Complete details on all programs beginning in September will be available in May. Students are encouraged to inquire at the Undergraduate Affairs Office or the Graduate Affairs Office concerning specific courses and credential programs.

School of Engineering

The School of Engineering offers curricula in Agricultural Engineering, Chemical Engineering, Civil Engineering, Industrial Engineering, Mechanical Engineering, and Electrical Engineering. Each of the curricula leads to the Bachelor of Science degree in that particular branch of engineering. All curricula are accredited by the Engineers Council for Professional Development.

Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the material and forces of nature for the benefit of mankind. An engineer requires intensive technical training but at the same time he should acquire the broad education that distinguishes the professional man from the technician. His education does not end with formal schooling but continues throughout his life as he accumulates experience.

The curricula in engineering have been carefully prepared to offer each student the opportunity to acquire the sound training in mathematics and the basic sciences of chemistry and physics upon which is built the work in the engineering sciences. In the senior year, courses are offered which enable the student to use his previous training for engineering analysis, design and engineering systems in his particular field of interest. About 20 percent of his time is devoted to studies in the social science and humanistic area. Some opportunity is provided to elect courses from both the technical and humanistic-social fields. The curriculum of the freshman year is the same for all. Specialization to a limited extent begins in the sophomore year.

The School contains five administrative departments, and there are a variety of optimal programs available to upper-class students in each of these departments. Many of these are interdisciplinary in nature and cut across departmental lines. Thus, for example, students may concentrate in areas such as Materials, Systems, the Environment, Bioengineering, Food Engineering, Transportation, Urban Systems, and Energy.

Although the curricula within the School of Engineering are shown as eight semesters (normally four years), they require up to 130 semester hours credit for satisfactory completion. This is well above the University minimum of 120 semester hours for a degree and it requires intensive work in Mathematics, Science and Engineering. As a result even students in good academic standing frequently elect to extend their programs into a 9th and sometimes a 10th semester.

Freshman Engineering

All new students in engineering are enrolled in the Freshman Engineering Program until qualified to enter into a degree program. This is normal upon satisfactory conclusion of the uniform freshman year.

COURSE REQUIREMENTS—FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100	3	Rhetoric Elective	3
Math. 122 or 123	3	Math. 124 or 125	3
Chem. 111	3	Chem. 112	3
Engin. 103 or 104	3	Engin. 103 or 104	2
Soc. Sci. Elective	3	Physics 161	4
	15		15

Agricultural Engineering
This field includes engineering activities which relate macrophysical and microphysical environments to the production, preservation, and processing of food and other biological materials. The academic program is quantitative and emphasizes the integration of mathematics and the physical sciences into the interpretation and solution of biological production and processing problems. Agricultural engineers find professional employment in a variety of industries as well as in public and private agencies engaged in research and development.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100, Language & Writing	3	Humanity Elective	3
Chem. 111	3	Chem. 112	3
*Math. 123 Anal. Geom. & Calculus I	3	Math. 124 Anal. Geom. & Calculus II	3
Social Sci. Elective	3	Physics 161 General	4
Engr. 103 Graphics	3	Engr. 104 Problems	2
Physical Education 100	1	Physical Education 100	1
	16		16

*On basis of placement tests at time of summer counseling.

Chemical Engineering
Chemical Engineering centers around the creation, development, design and operation of processes for bringing about chemical and certain physical changes in materials. Chemical Engineers may be engaged in any of a wide range of activities concerned with converting an idea to a profit. These include research and development, economic and market analysis, design, construction, operation, production supervision, sales, technical service, and management. Basic research for new knowledge, teaching, and consulting also offer challenging and rewarding careers for many chemical engineers. Chemistry, physics and mathematics are the underlying sciences of chemical engineering and economics is its guide in practice.

Chemical engineers are in demand by industries manufacturing chemicals and also by the many related "chemical process industries," including petroleum refining and petrochemicals, plastics, synthetic fibers and textiles, pulp and paper, drugs and pharmaceuticals, natural and synthetic rubber, foods, soaps and detergents, paints and synthetic coatings, gas and coal chemicals, steel and all the metal manufacturing industries and many others. Much of the work of the atomic energy program is chemical engineering, and new fields to which chemical engineers are contributing include bio-medical, environmental, and ocean engineering.

Civil Engineering
Civil Engineering is concerned with all kinds of construction—buildings, bridges, highways and railways, airports, rivers and canals, harbors, dams, pipelines, etc. Transportation, the efficient and economical transfer of people and goods from place to place, is another concern to civil engineers. They are also deeply involved in providing adequate and safe supplies of water for homes and industries, in controlling and limiting the pollution of lakes, streams and oceans, and of the atmosphere. Civil engineers have assumed major responsibilities in ocean engineering, for construction and other operations, for underwater exploitation of mineral and other resources in the seas, and for planning and organizing the transportation that will be required eventually in regions of underwater activity. Various specialized areas of civil engineering make essential contributions to programs such as hydraulic engineering and fluid mechanics, soil mechanics and foundations engineering, surveying and mapping, structural engineering and materials engineering.

In every area of Civil Engineering there is the choice of a wide range of activities: research to obtain new knowledge, development of practical methods, design of utilizing existing knowledge and the results of research, designing projects which satisfy known requirements, planning for maximum economy and efficiency, construction according to plans and specifications, and operation and maintenance. In addition, civil engineers are always deeply involved and are frequently in charge of large-scale projects which involve many fields of activity and require the coordination of backgrounds, such as urban planning, water resource management, and transportation systems. In general, Civil Engineering is a field of activity which is concerned with the public well-being through protection and control of our environment.

Electrical and Computer Systems Engineering
Electrical Engineering is the application of electrical and mathematical principles to the solution of engineering problems, and to the design of the electrical and electronic equipment of the future. A wide variety of electrical systems will serve mankind by performing important and complex tasks. Modern communication systems, high speed computers, and bio-medical instrumentation are just a few of the creations of electrical engineers. Because of the diversity of the electrical engineering education, graduates will be employable in sales, production, design, development, research and management positions.

The undergraduate curriculum is designed to prepare each student for work in any of these fields and to serve as a basis for further specialization. As continued study after graduation is essential in this rapidly growing field, basic physical and systems principles are emphasized in the undergraduate program. Courses taken outside of the department in liberal arts and other engineering disciplines provide the student with a broader understanding of engineering and its relationship to other fields.

The program leading to a degree of Bachelor of Science in Computer Systems Engineering is also available to all interested students. Further information on this program may be obtained from the Department of Electrical Engineering.

Industrial Engineering and Operations Research
Industrial engineers are concerned with the design, installation and improvement of integrated systems of men, materials and equipment. These systems are found in nearly all organizations (manufacturing and production, government, financial, health service, and sales to name a few) and at all levels within these organizations. Consequently, the placement of industrial engineers is varied. Also, since the responsibility of an industrial engineer normally spans several functional areas, he acquires an excellent background for management positions.

The curriculum is very flexible. The eleven required courses (33 credit hours) in the Industrial Engineering Department stress the quantitative approach to decision problems. Since the areas of application are so varied, a block of nine courses (27 credit hours) are set aside

so that each student may design a curriculum which matches his particular interest. This segment is developed in conjunction with his adviser and may emphasize a particular area of application and/or the development of more sophisticated methodology. Because continued education is a necessity, students completing the program are prepared for both professional and graduate work.

Mechanical Engineering
Mechanical engineers use the principles of dynamics, solid mechanics, fluid and gas dynamics, heat transfer, thermodynamics, and materials science together with mathematical and computer methods for application to research, development, design, and management in industry, government, and engineering education.

Students majoring in mechanical engineering may choose from alternative options emphasizing mechanical, aero-space, or materials studies. Mechanical engineers design and analyze a wide variety of systems in fields such as manufacturing, energy conversion, and transportation. Aero-space engineers design and analyze systems for aircraft and space such as propulsion, astrodynamical, and vehicular. Materials engineers study the atomic structure of materials, polymers, materials processing, and materials analysis. All options are fundamental and flexible so that students may prepare for either professional employment or graduate study.

School of Home Economics

Home Economics encompasses areas of study which apply the principles and concepts of fundamental arts and sciences to the physiological, psychological, social and economic environmental needs of man.

The School of Home Economics has four departments: Clothing and Interior Design (C&I D); Community Services (CO SERV); Human Development (HUM DEV); and Human Nutrition (HUM NUT). The letters in parentheses are area codes. Within these four departments the following undergraduate majors are offered:

In Clothing and Interior Design: Fashion Marketing, Consumer Services in Clothing, and Interior Design.

In Community Services: Consumer Economics, Community Services and Extension, and Home Economics Education.

In Human Development: Child Development, and Special Programs by Arrangement.

In Human Nutrition: Human Nutrition, Community and Public Health Nutrition, Dietetics, "Not for Profit Food Service Administration," Foods in Business, and Computerization in Nutrition and Food Service.

The undergraduate program leading to a Bachelor of Science degree, emphasizes a liberal education in the sciences, arts and humanities with specialized instruction as preparation for professional careers, seeking to develop a disciplined mind, mental curiosity and professional competence.

Professional home economists serve individuals, families, and communities through schools and colleges, extension programs, business organizations of many kinds all over the world, community and government organizations and agencies, newspapers, magazines, radio and television. Representative types of activities include teaching, research, writing, dietetics, extension work, interior design, fashion merchandising, food consulting, food service management and product development.

Clothing and Interior Design
This field of study encompasses the near environment, emphasizing clothing, the transitional factor between the individual and his surroundings, and housing, which provides shelter for the family.

The professional specialization in the area of Clothing can be obtained in Fashion Marketing and Consumer Services in Clothing. These majors provide opportunities for synthesis of knowledge from arts, humanities, social sciences and business in the understanding of human use of textiles, non-textiles and clothing. Basic to study in both majors is the interrelationship of aesthetic, historical, social, psychological, economic, cultural and physical aspects of textiles, non-textiles, and clothing—in addition to their effects on production, distribution and consumption. The retailing and professional opportunities associated with clothing, textiles, home furnishings, and related merchandise are numerous. Among these are positions with manufacturers, producers, retailers, buying organizations, newspapers and magazines, radio, TV and consumer groups, as well as educational programs and social and government agencies.

The program in Interior Design has two options. The profession encompasses a wide range of work, from restoration of historic buildings, through the design of public structures and private residences to the develop-

ment of highly specialized applications such as interiors of living spaces, set designs, displays, and furniture design. The professional interior designer is qualified to provide for the public, in a professional manner, planning, counsel and guidance with respect to the design, decoration and arrangement of interior areas of any private or public building or structure. An understanding of design also contributes to satisfying individual needs. The professional designer must also be cognizant of the sociological and psychological influences of his contributions. He is involved and exposed to the research and development of new products and techniques.

The program provides a broad general education and depth in the specialized professional area. For those who may wish to go on to graduate studies, depth in the social sciences should be pursued.

Community Services

The areas of Home Economics Education, Consumer Economics, and Management and Family Economics were merged in 1972 into the single department of Community Services. The three options available in the Community Service Major are Consumer Economics, Community Services and Extension, and Home Economics Education. These options lead to careers in public service such as in government agencies, cooperative extension programs, and teaching at the secondary school level. Many opportunities are also provided by business, particularly in the consumer related areas.

Students may elect a semester or full year affiliation with a developing or overseas nation, or they may elect to participate in the University exchange program such as at the Universities of Hawaii, New Mexico, Oregon or Alabama. Students may also wish to avail themselves of the opportunity to participate in the University Year for Action Program, BDIC or University Without Walls programs.

Human Development

Human Development is an interdisciplinary study primarily focusing on psychological, social, and biological factors affecting development of the individual from conception to senescence. However, the discipline relates human development to the biological and social history of man and to cross-cultural studies of human development.

Human Development is a social science leading to graduate work in Child Development, Human Development, Psychology, Sociology, Social Work or Education, and also offers at the undergraduate level a number of specializations leading to careers related to various stages of the life cycle: Child Development and Early Childhood Education; Special Child Programs, such as work with the physically handicapped, the emotionally disturbed, the mentally retarded, the blind, and the deaf; Social Programs, such as Head Start, day care centers, social agencies, adoption agencies, and community action programs; Youth Development; Family Life Education; Programs for the Aged; Interdisciplinary Programs such as programs involving ecology and human potential.

Directed experience with the children of the laboratory school and their families and with children in public and specialized schools and clinics provides the opportunity for students to develop a sound personal philosophy of early childhood education and child development.

Students may elect a semester or two of study at the Merrill-Palmer Institute of Human Development, a semester or two at another university (in the United States or abroad), take courses in the other four colleges of the Five College Cooperation program or other special programs, such as BDIC, the Action Program, and University Without Walls.

Human Nutrition

The problems of nutritional well-being are of increasing concern to all segments of society. Undernutrition and deficiency diseases exist in the developing nations, and at the same time the richer nations suffer from obesity, degenerative diseases and the problems of additives and potentially hazardous food residues.

The program in Human Nutrition leads to an understanding of the causes of some of our present problems in nutrition and suggestions for their alleviation. There is one major program which is required for all students but recommended additional courses are shown for various specializations such as community nutrition and dietetics. Specialization in computerization in Nutrition and Food Service is a new field which requires both an understanding of Human Nutrition and also linear programming techniques.

The varied career options open to students with training in nutrition include research, community service, product development and demonstration, hospital dietetics and food service administration. Individual specializations other than those indicated can be arranged by discussion with members of the department.

School of Physical Education

The School of Physical Education includes the Departments of Physical Education for Men, Physical Education for Women, Department of Leisure Studies and Services, and Athletics. It offers undergraduate majors in Physical Education and Leisure Studies and Services, and graduate programs in Exercise Science and Sport Studies. Other programs in the School include the general physical education program, the intramural sport program and the intercollegiate athletic program.

General Physical Education Program

This program offers instruction in sport, dance, and other forms of physical activity to all undergraduate students in the University. Each student must fulfill the PE requirement (1) by taking a one-semester, 2-credit course on a graded basis, (2) by taking two semesters of 1-credit courses on a graded basis, or (3) by taking either of the above options on a pass-fail basis.

One of the few certainties facing college graduates is that they will be continually faced with choices regarding physical activity. Burgeoning leisure time, increasing spectator interest in sport, increasing opportunity to participate in carry-over sports such as golf, tennis, bowling, and gliding, as well as jogging and fitness programs, and increasing exposure to concern of medical people, particularly cardiologists, about inactivity, insure continued contact with the idea of physical activity and sport.

Some students enter the University with a background that enables them to fully appreciate and achieve satisfaction from participation in a sport and/or physical activity program. However, others are limited by insufficient preparation at earlier age levels. The General Physical Education Program offers (1) the opportunity for self-assessment in terms of skill competencies and fitness components and (2) the opportunity to gain the ability to assess and interpret a wide variety of programs involving sport and physical activity as they relate to the individual's well-being.

The student has almost unlimited choice in selecting specific courses from those in sport skill, dance, and conditioning, as well as theoretical courses (classroom instruction and laboratory work) probing the "why" of sport and physical activity.

Majors' Program

The Department of Physical Education for Women and the Department of Physical Education for Men cooperatively offer a co-educational program for those students who wish to pursue physical education as a major. Two major options are available. Students may elect to follow either the teacher education program or the related disciplines program which includes study in exercise science or the theory of sport. The teacher education option offers further opportunity for specialization. A student may select a concentration in secondary education, elementary education, or special education. Similarly, concentrations available through the related disciplines program are: dance, exercise physiology, kinesiology, sport history, sport psychology, and sport sociology.

The dance concentration affords opportunity to start course work in the freshman year. The program allows a student to gain depth in not only the art of dance, but other related areas. In addition, in the senior year a student may choose the student teaching semester to meet certification requirements or select more advanced courses preparing for future academic or professional study.

Each student is expected to select an area of concentration during the second semester of the sophomore year. During the first two years of study, essentially the same for all majors, students fulfill the University core requirements and the physical education core requirements. The only variations from one student's program to another are in electives available within these requirements. The physical education core consists of the following courses:

Courses	Credits
Exc Sci 204—Human Anatomy Prerequisite: Zoology 101	3
Exc Sci 205—Kinesiology Prerequisite: Exc Sci 204	3
Exc Sci 278—Physiology of Exercise Prerequisite: Zoology 135	3

A student will select three of the following four courses:

PE 200—Sociology of Sport and Physical Activity Prerequisite: Sociol. 101	3
PE 201—Psychology of Sport and Physical Activity Prerequisite: Psych. 101	3
PE 202—History of Sport and Physical Activity Prerequisite: History 100 or 101	3
PE 203—Philosophy of Sport and Physical Activity	3
Skills and Coaching Courses	*14
Total	*32

*Only 8 of the 14 credits in skills and coaching courses will generally be taken during the first two years. Thus the student actually completes 26 credits in the physical education core during the freshman and sophomore years.

The recommended program for these first two years of study is as follows:

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Elective (C, D, E) (Select 2)	6	Elective	3
Zool. 101 Intro. Zool.	3	Electives (C, D, E) (Select 2)	6
PE Skills	2	Zoology 135 Intro. to Physiology	3
Rhetoric 100 or 110	3	PE Skills	2
	14	Rhetoric Elective	3
			17

Electives: Soc. 101 (D), Psy. 101 (D), Hist. 100 or 101 (C), Phil. 105 (C). These are prerequisites to Physical Education Core Courses.

SOPHOMORE YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Exc Sci 204 Human Anatomy	3	Elective	3
*PE 200, 201, 202, 203 (Select any 2)	6	Exc Sci 205 Kinesiology	3
PE Skills	2	*PE 200, 201, 202, 203 (Select any 1)	3
		PE Skills	2

Elective	3	Exc Sci 278	
		Phys. of Ex.	3
	14		14

*The student must take 3 of these 4 courses during the sophomore year. They may be taken in any order provided the prerequisites have been met.

Department of Leisure Studies and Services

The professional in Leisure Services is a diagnostician of the leisure needs of people and a developer and provider of opportunities to meet these needs. He or she works primarily at the executive, administrative, and supervisory levels, although a few settings involve more direct program leadership.

Options are available leading to a variety of careers in: voluntary and youth-serving organizations, college unions, military establishments, municipal and other governmental agencies, and commercial and private enterprises; as well as in hospitals and other institutions and agencies dealing with the mentally retarded, emotionally disturbed, physically handicapped, and other types of dependents. An option in environmental interpretation includes suboptions emphasizing natural history and environment, American history, archaeology, or natural resources planning and management, and outdoor education.

The curriculum presented below represents a core program. After becoming familiar with the various career opportunities, the student and adviser select an appropriate current option or develop an innovative plan to fit unique goals. Recent examples of the latter include leisure services in the inner city, community resources for recreation, leisure services in correctional agencies, outdoor recreation, and outward bound leadership. In each case a coordinated group of courses totalling 15 credits is selected by the student and adviser to constitute the option.

In addition to completing the curriculum below, the student is required to possess a current Red Cross Advanced First Aid Certificate. The student majoring in Leisure Studies and Services is also encouraged to gain as much practical noncredit experience as possible through volunteer service, as well as part time and seasonal employment in several settings and with varied types of participants.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
LSS 101, Man and Leisure	3	LSS 111, Program Activities I	3
Rhetoric 100, Language and Writing, or Rh. 110, Language and Speaking	3	Rhetoric Elective	3
Humanities & Fine Arts Elective (C)	3	Humanities & Fine Arts Elective (C)	3
Math. or Nat. Science Elective (E)	3	Math. or Nat. Science Elective (E)	3
Sociol. 101, Intro. to Sociology (D)	3	Psych. 101, Elem. Psychology (D)	3
PE 100	1	PE 101	1
	16		16

Department of Athletics

Members of the athletic department are responsible for the conduct and administration of the various phases of intercollegiate and intramural athletic programs.

Department of Public Health

The curriculum in Public Health is designed to prepare students for health career opportunities or further study in environmental health and health education.

The department also provides a course of study in Medical Technology. Students are expected generally to follow the course sequence outlined below. A minimum of 32 major credits is required of all students for the Bachelor of Science degree. Credits from other University departments are included in these major credits.

Environmental Health

Designed to prepare for career opportunities in radiological health, industrial hygiene, environmental sanitation, occupational health, public health laboratory, etc., or further study at the graduate level requiring specific technical knowledge and competence.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	Rhetoric 100 or 110	3
Math. 127 Calculus	3	Math. 128 Calculus	3
Chem. 111	3	Chem. 112	3
Zool. 101 (General)	3	Zool. 230	3
*Psych. 101 or Sociol. 101	3	*Sociol. 101 or Psych. 101	3
General Phys. Ed.	1	General Phys. Ed.	1
	16		16

*May be taken either semester.

If a language is elected, intermediate proficiency is required.

Community Health and Health Education

Designed to prepare for first level career opportunities in community health education, health services administration, non-medical administration, health program development, epidemiology, health statistics, etc., or for further study at the graduate level requiring specific professional and technical competence.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	Rhetoric 100 or 110	3
Math. 127 Calculus	3	Math. 128 Calculus	3
**Chem. 111	3	**Chem. 112	3
Zool. 101 (General)	3	*Sociol. 101 or Psych. 101	3
*Psych. 101 or Sociol. 101	3	[1]Elective	3
General Phys. Ed.	1	General Phys. Ed.	1
	16		16

*May be taken either semester.

**With approval of adviser may take Chem 101-102 but will have to take an extra science or public health course.

[1]Elective chosen from Humanities.

If a language is elected, intermediate proficiency is required.

Medical Technology

The program sequences outlined below are recommended for young men and women who are interested in the wide variety of career opportunities available in Medical Technology. Medical Technology graduates are eligible for laboratory positions in hospitals, clinics, health departments, pharmaceutical firms, and medical

research foundations. The course of study is intended also to prepare students for continuation at the graduate level.

There are presently two courses of study which Medical Technology majors may opt in pursuit of a Bachelor of Science degree. Students electing Option I are required by the affiliated hospital schools of Medical Technology to have maintained averages of "C" or better in their science and mathematics courses. These students must have earned a total of 90 academic credits and satisfied the departmental and university curriculum requirements before beginning their hospital internship. Transfer students must, in most cases, elect Option II.

Option I. This curriculum consists of a three-year academic program followed by a 12-month internship in an accredited school of Medical Technology affiliated with the University. After successful completion of the 12-month internship and after satisfying the requirements of the department, a student will receive a Bachelor of Science degree in Medical Technology. A total of 130 academic credits is necessary for graduation with this option. Forty academic credits are earned during the fourth year, upon successful completion of the internship.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	*Rhetoric	3
Math. 127	3	Zool. 145 (Human Genetics)	3
Zool. 101	3	Chem. 112 (General)	3
Chem. 111 (General)	3	**Social Science or Foreign Language	3
*Social Science or Foreign Language	3	Phys. Ed.	1
Phys. Ed.	1	Medical Technology 101	3
	16		16

*Rhetoric 110, 140, 145, 160, 165, or 170.

**Intermediate Proficiency is required if a foreign language is elected to fulfill the University's requirement.

Option II. This is a four-year academic program leading to a Bachelor of Science degree. Following graduation, the student will be assisted in arranging for a 12-month internship in an accredited school of Medical Technology. The student must complete all of the requirements established by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. A total of 120 academic credits is necessary for graduation with this Option.

Students electing Option II should follow Option I program for Freshman, Sophomore and Junior years.

Division of Military and Air Science*

The Division of Military and Air Science includes the Department of Military and the Department of Air Science. Both departments offer Reserve Officer Training Corps (ROTC) commissioning programs that enable the University graduate to fulfill his military obligation as a commissioned officer. Students who have completed a four-year or a two-year program may be commissioned in the respective services upon graduation from the University.

Students may register for the first course of the four-year program at the same time they register for other University courses. No formal application is required. Upon successful completion of the first two years, the student then may apply for admission into the final two years of the ROTC program.

The two-year program requires that the student have two academic years remaining at either undergraduate or graduate level. Successful completion of a six-week program on a military installation during the summer prior to enrollment is a prerequisite for these students. Those interested should apply two academic semesters before enrollment, since processing must be completed six months before the start of the fall semester. The two-year program is available to transfer students and students unable to participate in the four-year program.

Both departments offer scholarship assistance to qualified students. University tuition, fees, textbook allowances, and lab expenses, plus a stipend of $100 per month are received with a scholarship. Non-scholarship students receive a monthly stipend of $100 for the final two years of the four-year program or for both years of the two-year program.

Participation in the ROTC programs is voluntary. Uniforms and textbooks are provided.

Qualified students interested in becoming military pilots may participate in the Flight Instruction programs of the departments. Completion of a program leads to pilot qualification in Army Aviation or the Air Force. In addition to actual flight instruction, students take ground instruction in weather, navigation, and FAA regulations.

Students with previous military training may have this experience credited toward all or part of the first two years of the four-year program. Individuals with prior active service, previous ROTC training, military school attendance, Civil Air Patrol training, or service academy attendance should consult the departments.

In their senior year, students may request a delay in reporting to active duty in order to complete graduate work or to attend professional school.

Department of Air Science

The Department of Air Science offers courses of general interest to the University student and of specific interest to both male and female students who would like to prepare for and serve as officers on active duty in the U.S. Air Force. The curriculum is designed to study the need for military forces, the nature of military forces, their organization and mission with emphasis on the Air Force, and the nature of service as a profession-

*Academic credit for Military and Air Science courses taught at the University was restored by the Trustees on May 2, 1973, retroactive for the 1972-73 school year. This action was taken while this publication was at the printer, hence credit information contained herein relative to Military and Air Science courses is superseded and should be confirmed with that department.

al Air Force officer. Courses encourage critical thinking, imagination, and a high degree of student involvement.

In the four-year program, the student enrolls in an Air Science course each semester and attends field training for four weeks between the sophomore and junior or junior and senior years. There are two major phases in the four-year program curriculum. The first phase is the General Military Course (GMC) which forms a single unit offered during the freshman and sophomore years. The studies cover the nature and causes of international conflict, the functions and employment of U.S. military forces, and defense policies in the contemporary world. This first phase carries no service commitment and is an excellent way for students to study the military and decide if they want to continue on for an Air Force commission. Enrollment in the General Military Course confers no military status on the student.

The second phase of the four-year program is the Professional Officer Course (POC) taken during the Junior and Senior years. Enrollment depends on academic and medical qualification and selection by the department. In the POC, academic concentration is on the preparation for service as an Air Force officer. Academically it deals with the historical development of airpower, aero-space power today, astronautics and space operations, Air Force leadership at the junior officer level, and a study of military management. The development of communicative techniques is an integral part of the POC curriculum.

A two-year program student enrolls in the POC, after the special six-week field training and receives the same instruction as a four-year POC member.

Corps Training is a non-academic, cadet-planned and directed activity centering on military customs and courtesies and the career environment of the Air Force officer. Corps Training provides practical experience in leadership and management.

Field Training involves a practical, firsthand experience with military life on an Air Force installation. Cadets receive instruction on junior officer activities, career field orientation, Air Force base functions and environment, aircraft and aircrew orientation, survival training, and physical conditioning. Applicants for the two-year program also receive academic instruction during their attendance at field training.

Scholarships may be awarded to qualified students in the four-year program. Students compete for college scholarships that start at the Freshman, Sophomore, Junior or Senior year. High School Seniors compete on a national basis for the scholarships that start at the Freshman year.

Varied extracurricular activities exist for interested students.

Successful completion of the Air Force ROTC program results in the awarding of a commission as a Second Lieutenant in the United States Air Force.

The first year courses meet for one classroom hour and one corps training hour per week:

FRESHMAN YEAR

First Semester	*Second Semester*
Air Science 111 U.S. Military Forces in the Contemporary World, I	Air Science 112 U.S. Military Forces in the Contemporary World, II

Department of Military Science

A program of general military subjects is presented by the Department of Military Science which qualifies the University graduate for a commission in any of the seven combat and seven non-combat branches of the United States Army. Thus, regardless of which academic major study program a student chooses, he will find appropriate leadership opportunities open to him in the modern Army upon graduation and attainment of a commission.

The program consists of a basic course, Freshman and Sophomore year, and the advanced course, Junior and Senior year. During the basic course students are introduced to American Military History, Map Reading and Tactics, and Military Leadership and Management. The advanced course provides instruction in Military Leadership and Management, Military Methods of Instruction, Tactics, Military Law and Defense Organization and Management.

Students participate in leadership laboratory during the basic and advanced courses. The purpose of leadership laboratory is to learn customs and courtesies of the Army and to provide experience in leadership, management, and discipline. The advanced course plans additional field exercises and students participate in field trips to military installations on the eastern seaboard.

Cadets designated as Distinguished Military Students, by reason of their achievement in academic and military studies, may apply for a commission in the Regular Army. Students receiving a Reserve Commission may be required to serve from three months to two years active duty. In addition to the normal four-year scholarship, one, two, and three year scholarships are offered to qualified students enrolled in the four-year program. The Professor of Military Science is responsible for the selection of students to receive these scholarships. High school seniors compete on a national basis for the four-year scholarships. The same financial benefits apply to this scholarship program as to the four-year scholarship program.

Various extracurricular activities exist for interested students.

FRESHMAN YEAR

First Semester	*Second Semester*
MS 111 American Military History I	MS 125 American Military History II

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George A. Norton, B.S. (University of Maine), *Director of Physical Plant*
Francis J. Teahan, *Director of Procurement*

Five College Cooperation

North Burn, Ph.D. (Tufts University), *Coordinator*

Chaplains

Rabbi Martin Kowal, M.H.L. (Jewish Theological Seminary of America), *Chaplain to Jewish Students*
Rev. Thomas H. Lindeman, B.D. (Pacific School of Religion), *Campus Minister, United Christian Foundation*
Rt. Rev. David John Power, A.B. (Georgetown University), *Chaplain to Roman Catholic Students*

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For Course and Faculty Section

*All regular semester courses meet for three class hours each week unless otherwise indicated. All courses carry three credits unless otherwise stated. Courses have no prerequisites unless listed.

GENERAL ACADEMIC REGULATIONS

ATTENDANCE

The attendance of students at all regularly scheduled classes at the University is expected. No administrative control of attendance is exercised except as hereinafter provided. In cases of illness, students are to explain their absences directly to their instructors. The grade of the student who has met the requirements of the instructor in making up his work shall not be reduced for absence because of illness. Students are not to be penalized for official off-campus trips.

CONDUCT

The customary high standard of college men and women in honor, self-respect, and consideration for the rights of others constitutes the ideal of student conduct. The privileges of the University may be withdrawn from any student at any time if such action is deemed advisable. It should be understood that the University, acting through the President or any administrative officer designated by him, distinctly reserves the right, not only to suspend or dismiss students, but also to name conditions under which they may remain in the institution. Hazing in the sense of the punishment or humiliation of students is not permitted.

GRADE REPORTING AND ACADEMIC REGULATIONS

Enrollment in and graduation from the University involve both quality and quantity of work. The quantity of work is measured by the credits obtained by successful completion of courses. The quality of work is measured by grades. Each grade is equated with a quality point as noted below.

GRADING SYSTEM

The aims of the letter system of grading are to divorce the evaluation of student achievement from any rigid numerical system and to encourage judgment on the basis of total performance. This philosophy recognizes that performance measurement is a relatively inexact art.

Each instructor may use some numerical system of preliminary grading in order to evaluate examinations, papers, laboratory work, etc.; many will use the traditional percentage method. However, it is not automatically assumed that 80–89 is a B or that 90–99 is an A, or that the grading pattern is to be fitted to a given performance curve. A student's performance is evaluated on its own merits and the final grade awarded according to the definitions accompanying the letter grades.

No matter what system of grading is used close decisions will always have to be made—sometimes to the apparent advantage of the student and sometimes to his disadvantage. Proper use of the letter grading system, however, avoids emphasis on fine distinctions which may merely be manifestations of the grading device, rather than real differences in student performance.

Effective with the Fall Semester, 1971, the official grading system is:

A, AB, B, BC, C, CD, D, F, W, Inc.,

with the following grade points: A = 4.0, AB = 3.5, B = 3.0, BC = 2.5, C= 2.0, CD = 1.5, D = 1.0.

The grade of F, while being recorded, is no longer included in the quality point calculations. A student who withdraws from a course within the first eight weeks of the semester receives a W; withdrawal after that period is recorded as an F. An Incomplete indicates that the course work has not been finished. If no final grade is reported to the Registrar before the end of the course add period of the following semester, the Incomplete will be changed to an F by the Registrar.

No course marked W, F, or Inc., earns graduation credit for a student. Such a course may be repeated for credit. A course marked with a grade of D may be repeated for a higher grade but *not for additional credit*. If a D course is repeated, both grades will be used in computing Q.P.A.s.

UNDERGRADUATE ACADEMIC REGULATIONS

The new academic regulations were designed primarily to support the student in his progress toward his academic degree. The regulations require that schools, colleges, and departments give special attention to students who are having academic difficulties, whatever the reasons. They will also allow the University to identify as quickly as possible, in order to provide appropriate counseling, those students whose progress seems to indicate that the probability of their achieving their degree objective is small. The new regulations also raise flags if students are not making normal progress toward a degree (at least 12 graduation credits per semester) as well as if they are not meeting minimum standards.

Academic Status Categories:

A. Definition:

At the end of each semester, the student's performance to that time puts him into one of the following five categories and, except as noted below, he will be in this category during the next term he enrolls:

1. *Academic Good Standing:* Means that the student is making satisfactory progress, both qualitatively and quantitatively, toward graduation.

2. *Academic Warning:* Means that the student is not making satisfactory qualitative and quantitative progress toward graduation. A student in this category must have his program of studies for his next semester reviewed by his Academic Dean (or duly authorized faculty agent) before he can validate his registration for that next semester. The Academic Dean may, on the written recommendation of an appropriate agency, change the category to Academic Good Standing.

3. *Academic Probation:* Means that continuation at the indicated rate will not lead to required graduation average within ten semesters. A student whose record puts him in this category for the first time must confer with his Academic Dean (or duly authorized faculty agent) about his status. The Academic Dean may: (1) on the recommendation of an appropriate agency, change the category to Academic Warning, or (2) permit the student to enroll in the category of Academic Probation, in many cases with restrictions on the course program. The student may appeal the Academic Dean's decision to the Board of Admissions and Records. In this case, both the student's petition and the reasons

for the Dean's action are submitted in writing; neither appears before the Board unless the Board asks both to come.

4. *Academic Suspension:* Means that the student may not enroll for the semester immediately following suspension. After a first academic suspension and an absence of at least one semester he can apply for readmission. A student who returns after a period in the Academic Suspension category must have his academic program reviewed by the Academic Dean (or an authorized agent) and will have academic status reviewed at the end of the semester. A student in the Academic Suspension category may not live in University housing, represent the University in any way, or hold a job on campus. A second academic suspension results in academic dismissal.

5. *Academic Dismissol:* Means that the student has been permanently separated from the University.

B. Procedural Rules:

1. Records for students will indicate Academic Warning, Probation, Suspension and Dismissal for internal purposes. Transcripts will show Suspension and Dismissal.

2. A student in Academic Good Standing may interrupt his studies indefinitely and be re-admitted (on application) in the same standing.

3. A student with Academic Warning may interrupt his studies indefinitely and be re-admitted (on application subject to approval of his program of study by his, perhaps new, Academic Dean) in the same standing.

4. Summer Session work may raise or lower a student's standing.

5. A student is placed in Academic Suspension category after: (a) a second assignment to Academic Probation, (b) two assignments to Academic Warning and one to Academic Probation in consecutive semesters; or (c) four consecutive assignments to Academic Warning. Academic Dismissal will occur after a second Academic Suspension.

C. Criteria For Categories:

1. *Academic Good Standing* results from achieving the following cumulative average and graduation credit during the semester just completed.

a. A cumulative average of at least:
   1) 1.8 for first semester students
   2) 1.9 for students after two semesters
   3) a cumulative average of 2.0 and at least 1.8 semester average thereafter

b. Completing credits:
   1) At least 12 n after n semesters and
   2) At least 12 n in most recently completed and current semester

2. *Academic Warning* results from the student not qualifying for either Academic Good Standing or Academic Probation.

3. *Academic Probation* results from:
A cumulative average less than 1.3 for all first semester students, less than 1.5 for regular students at the end of their second semester, less than 1.7 for regular students at the end of their third semester, less than 1.9 for all others.

PASS/FAIL COURSES

The purpose of the Pass/Fail program is to encourage full-time students to be usefully venturesome in the choice of their elective courses.

Any full-time undergraduate shall be eligible to use a pass/fail option in one course each semester. A student may elect to take up to and including five (5) University core requirement courses pass/fail. For courses required for a student's major, permission of the department is necessary. An eligible student taking a full load in summer work (9 credits) may be allowed the pass/fail option in one course.

Each School, College or Division of the University is authorized to formulate and enforce its own pass/fail regulations concerning the number of such courses allowed beyond one course per semester pass/fail up to and including 15 courses in a student's undergraduate career.

Students who take courses in the School of Education and in the School of Physical Education to satisfy the physical education requirement shall not be deprived of their normal option to take another course on a pass/fail basis for that particular semester.

On Registration Day, each eligible student will receive a pass/fail eligibility card. The student has ten (10) days to decide whether to exercise this option and in which course to use it. The card is turned in directly by the student to the Registrar's Office. The Registrar's Office shall not inform the instructor that the course is being taken on a pass/fail basis. Students need not inform their instructor that they are taking a course on a pass/fail basis. A pass/fail course cannot be converted to a regular grading basis after the ten-day period has passed.

The Registrar's Office will send out the same course grading card for all students so that instructors will record an appropriate grade. The Registrar is empowered to translate grades A through D to the grade of "P" for a student who used his pass/fail option. A "P" in a course earns a student graduation credits, but the course is in no way counted in his quality point average calculation. A student who does failing work in a pass/fail course shall be given the grade of "F".

We would like to stress the fact that pass/fail is strictly a student option. The purpose of the pass/fail program is to encourage full-time students to be usefully venturesome in the choice of their elective courses. With very few exceptions, there are no mandatory pass/fail courses other than in the School of Education.

Students who sign up for mandatory pass/fail courses outside the School of Education have to use their one and only pass/fail option for that particular semester, which does not give them a chance to experiment by taking an elective course pass/fail.

FINAL EXAMINATIONS

It is University policy not to require a student to take more than two final examinations in one day. Any student who finds he has a conflict in his examination schedule or more than two in one day should report this to the Schedule Office, 168 Whitmore Administration Building.

GRADUATION REQUIREMENTS

It is the responsibility of the individual student to review his own progress toward graduation and the fulfillment of University and school requirements. Through his

own initiative, he should address questions concerning these matters to his adviser, Dean, or the Registrar. It is each student's responsibility to submit a diploma card at the beginning of his expected year of graduation to set the graduation process in motion. The card, submitted to the Registrar's Office, must be complete and accurate.

All four-year curricula of the University conform to the following basic conditions:

Quality Point Average

The graduation requirement is a cumulative average of 2.0. A transfer student must satisfy the cumulative quality point average of the class to which he is assigned. Students originally assigned to a class prior to 1972, if they have earned 60 or more credits in their previous class designation, will be held only to the previous class designation graduation average.

Accumulated Credits

A. The successful completion of at least 120 semester hours of academic credit. Individual colleges, schools, divisions and departments may require more than 120 semester hours of academic credit.

Core Curriculum Requirements

In addition to the requirements for all students listed below, each school or college and major program has additional requirements to be found in other parts of the Bulletin.

B. An introduction to the theory and practice of writing and speaking, and to the study of communication in our society by the successful completion of two courses in Rhetoric, one of which must be Rhetoric 100 or Rhetoric 110, chosen from those identified by the letter "B" in this Bulletin.

C. An introduction to the humanities and fine arts by the successful completion of three courses chosen from those identified by the letter "C" in this Bulletin.

D. An introduction to the social and behavioral sciences by the successful completion of three courses chosen from those identified by the letter "D" in this Bulletin.

E. An introduction to mathematics and the natural sciences by the successful completion of three courses chosen from those identified by the letter "E" in this Bulletin.

F. Intensive or specialized work in a particular department, division, school or college constituting a major and consisting of the successful completion of at least fifteen semester hours of credit in junior-senior courses in the area of the major.

G. A basic physical education course of two semesters' duration is required of all students. The course is PE 100 and carries one credit per semester. A transfer student awarded 15 or more transfer credits must complete the physical education semesters of the class to which he is assigned (i.e. a transfer student given 15 transfer credits must complete one semester of physical education). A transfer entering with an Associate Degree from an accredited institution is exempt from physical education. Students who originally enroll in this University, subsequently transferring in work from other institutions, may be awarded physical education waivers congruent with those given to transfer students. Veterans are not automatically awarded waivers.

HONORS

University Honors Groups

At the beginning of each semester a list is published of those students who, during the previous semester, made a semester grade point average of 3.0 or higher while carrying 12 or more regularly graded credits (other than pass grades). Three groups are recognized as follows:

First Honors — 3.8 (3.75) or higher;

Second Honors — 3.4 (3.35) to 3.7 (3.74) inclusive;

Third Honors — 3.0 (2.95) to 3.3 (3.34) inclusive.

Graduation with Distinction

High ranking students will be graduated as follows:

Summa Cum Laude — Cumulative average 3.80 or higher.

Magna Cum Laude — Cumulative average 3.40 to 3.79 inclusive.

Cum Laude — Cumulative average 3.00 to 3.39 inclusive.

Beginning with the class of 1977, the minimum average for *cum laude* is raised from 3.0 to 3.2 and that no degree higher than *cum laude* will be awarded automatically on the basis of the Quality Point Average alone. Higher honors will be awarded only through departmental (or BDIC) honors work or departmental recommendations. This will be mandatory for the Class of 1977 and optional for graduating classes prior to that time.

A transfer student, to be eligible for consideration for graduation with distinction, must have earned his final 60 semester hours of credit in residence at the University, 48 of which must have been taken and passed on a regularly graded basis (other than pass grades).

REPORTS AND TRANSCRIPTS

Final Grades:

Fall semester: distributed to students at registration.

Spring semester: mailed to student at his permanent address.

Summer semester: one report printed at end of summer for all summer courses. Distributed to students at fall registration or mailed to student at his permanent address.

Two transcripts of a student's record will be furnished without cost by the Registrar's Office. For each additional copy there will be a charge of $1. No transcript is issued without the student's written request. A partial transcript is never issued.

GENERAL REQUIREMENTS

RESIDENCE

It is the policy of the University that the final year's scholastic work be taken in residence, which is defined for this purpose as continuous enrollment and regular attendance in classes conducted on the campus of the University. This requirement may be waived by the Board of Admissions and Records upon recommendations of the major department and Dean of the college or school. Such approval should be obtained in advance of undertaking the degree *in absentio*. The Board may also waive the requirement for a student admitted to an appropriate professional school after completion of six or more semesters of work at the University, provided:

1. That the cumulative average at the University is 2.5 or higher.

2. That satisfactory evidence is presented indicating completion of work comparable to that offered at the University in amount sufficient to satisfy requirements for the appropriate bachelor's degree.

3. That the major department and Dean of the College or School approve.

No student is allowed more than ten semesters, including semesters at other colleges, to attain the required graduation average. Twelve accumulated semester credits earned in summer schools at the University or other colleges constitutes a semester. A student who maintains the required graduation average but is deficient in course requirements may continue enrollment until his course requirements are completed.

A student must successfully complete a minimum of 45 credits in residence to be considered for the baccalaureate degree.

DINING

All freshmen, sophomores and juniors residing in University residence halls will be required to board at University dining halls except that such students who are members of fraternities or sororities may be permitted to board at the respective fraternities or sororities by permission of the appropriate student personnel dean. University board is optional for seniors and is available on a cash basis.

PAYMENTS DUE

Diplomas, transcripts of record, and letters of honorable termination will be withheld from all students who have not paid all bills and all loans due the University. All such bills due the University must be paid ten days preceding Commencement. If paid after that date and the student is otherwise eligible, he may graduate the following year.

REGISTRATION

PRE-REGISTRATION

Every student must pre-register during the designated period. Students who pre-register late will be charged a fee of $5. A student who does not pre-register will forfeit his option to register for the following semester and must submit an application for re-admission (within the stated deadlines) before being allowed to register again.

LATE REGISTRATION

Each student must report for registration on the appointed day. Late registrants must pay a $5 fine.

COURSE REGISTRATION

No course will be recorded on the permanent records of the University nor will a student receive credit for it unless he has registered for such a course in accordance with established procedure on a regularly scheduled registration day or unless his registration shall have been made official by a Course Add Card filed with the Registrar.

No instructor should allow a student to enter his class unless the student was officially enrolled on a regularly scheduled registration day or has submitted a Course Add Card authorizing his admission to the class. A course dropped without the approval of the Registrar will be treated as a Failure.

COURSE ENROLLMENT AND WITHDRAWALS

A. General Regulations

1. *Course Loods*

The normal credit load is at least 15 credits. Regular students will carry a minimum of 12 credits. The maximum semester credit load is established by the appropriate school or college. Only students of high academic standing (cumulative averages of 2.5 and above) will be permitted to take an overload of one course with the approval of the academic dean involved and of two courses with the approval of the Dean and the Provost. Approval forms are available in the Office of the Registrar. Seniors in their final two semesters may carry an overload of one course each semester without special permission if such an overload will enable them to graduate, or an overload of two courses each semester with the approval of the academic dean. Seniors needing six or more courses totaling at least 18 credits to graduate may elect to distribute their course load over their final two semesters. Under this arrangement, reduced load permission is not required to carry less than 12 credits.

2. *Certification of Course Changes*

To add, drop, or change a course, the student must obtain the signature of the instructors concerned, the faculty adviser (if required by his major department), and the appropriate officer in the Registrar's Office. Signed cards are to be filed with the Registrar. Instructors and advisers are referred to the Manual for Faculty Advisers for specific information.

3. *Exceptions to the Regulations*

Exceptions to these regulations are made only in cases of protracted illness, critical personal or academic problems, and then only with the approval of the student's Academic Dean based upon recommendation of the appropriate office among the following: Health Services, Area Coordinators, Dean of Students, or Counseling and Guidance Office.

B. Course Registration Changes

ADD PERIOD — Within the period of up to and including ten academic days from the beginning of a semester a student may add, drop, or substitute a course without notation on his record. Monday through Saturday are defined as full academic days. No courses may be added after this period.

W PERIOD — Within the period of the 11th academic day and up to and including the eighth academic week from the beginning of a semester a student may drop a course subject to the minimum load regulation above; the notation of withdrawal on his record as a W is the only record.

F PERIOD — After the eighth academic week and subject to general regulations above, a student may not drop a course without having an F entered on his record at the time of withdrawal.

C. Withdrawal from the University

Prior to the eighth academic week, when a student withdraws from the University, grades of W will be noted on his record. The portion of the semester will not count as one of the ten semesters permitted toward attaining the graduation average.

After the eighth academic week, grades of WF or WP will be entered, as appropriate, for all courses in which the student is enrolled. The semester will count

as one of the ten semesters permitted for attaining the graduation average.

CHANGE OF MAJOR

A student wishing to change his major must get a Major Change Card at the Registrar's Office. This change is to be approved by the head of the department or school in which he is now majoring and also by his new major adviser. This card, properly endorsed, must be returned to the Registrar's Office before the change receives final approval. As part of the major change procedure, the student takes his Academic Records Folder to the new department. It is very important that the student notify the Registrar's Office of all changes of major as well as inaccuracies concerning his major. This is especially important during the junior and senior years.

CLASSIFICATION OF UNDERGRADUATE STUDENTS

A. Degree Students

1. *Full-Time Students*

All students carrying 12 or more credits must be accepted as degree candidates and assigned to a graduating class.

2. *Reduced Load Students*

Full-time students may obtain exemption from the minimum load requirements set by the Faculty Senate only upon approval of their academic dean based upon recommendation of the appropriate one of the following: Health Services, Dean of Students, or Counseling and Guidance Office. Such exemption is ordinarily not granted except upon the basis of health or critical personal or academic problems. A regular student may not enter the non-classified degree category nor the special (non-degree) category.

Reduced load students are considered as full-time students in *all* benefits, fees, and obligations. They continue in a class designation. The only exception made in their case is to the minimum load regulation. Although reduced load students carry less than the minimum load, the appropriate semester and cumulative quality point requirements for retention do apply and the semester counts as one of the ten towards graduation. Reduced load students bear a regular Student I.D. card.

3. *Non-Classified Degree Students*

Students who are admitted to degree status on the same basis as full-time students, but with the expectation of only part-time pursuit of the degree are considered *Non-classified Students*. They are given a classification of "NC." For their initial enrollment they are processed as incoming freshmen or transfer students. They are assigned to a major department, to provide appropriate counseling and pre-registration advising.

Non-classified students are not entitled to student benefits, other than departmental support. They are billed by the credit with other fees assessed only as appropriate to Special Students (below). At pre-registration a special billing card is filled out by student and adviser. To be eligible for continued enrollment, non-classified students must maintain a cumulative average equal to the graduation average of the University. They bear a Special Student I.D. card.

The category "Non-Classified" is an original admissions category and is not designed as a category into which full-time students may revert for purposes of part-time study.

B. Non-Degree Students

1. *Special Students*

Primarily intended for University employees and others affiliated with the University. A special student may be accepted for one or two courses on a non-continuing basis (Class designation "SP"). No evaluation of transfer credentials or course advising is offered to students in this category nor are they entitled to any student benefits. Their continuance is not automatic, but at the discretion of the appropriate admissions officer. A minimum of the graduation average of the University is required for an "SP" to continue. They bear a Special Student I.D. card. Regular students may not revert to this category for purposes of part-time study.

SPECIAL COURSE REGISTRATION

ADVANCED PLACEMENT

If a student is given advanced placement by a placement examination or by some other means, he will be given credit but no grade for the omitted work. He will be considered to have completed any requirement represented by the omitted work. Credit without grade awarded in this manner will be treated as transfer credit and not computed in quality-point averages.

AUDITING

A full-time undergraduate student may audit a course by presenting his I.D. card to the instructor of the course, provided that the instructor can accommodate the auditor in his class, believes that the student has sound academic reasons for the audit and has the proper preparation. The student will be expected to pay laboratory fees, where applicable. The audited course is not represented in any way on the student's permanent record.

CREDIT BY SPECIAL EXAMINATION

The requirements of any course approved for credit may be met by examination upon arrangement with the dean of the school or college and the head of the department offering the course. All such arrangements must be completed prior to the mid-semester. A student who has been a full-time degree student but who is on leave and in good academic standing is eligible to take one or two courses in this fashion. No student may earn more than 30 credits in this manner. Grades and credits of courses taken by examination are included in the quality point average calculations. Forms may be obtained in the Registrar's office.

CREDIT FOR WORK COMPLETED AT FOREIGN INSTITUTIONS OR IN MILITARY SERVICE

Students seeking credit for work taken at foreign colleges or for service-connected educational experiences must apply to the Registrar. Frequently credit may not be granted for such work without approval of the department concerned. No student will automatically receive credit for any specific course. Each case must be decided according to appropriate criteria.

UNDERGRADUATES TAKING GRADUATE LEVEL COURSES

Registration of an undergraduate in a graduate course numbered in the 400, 700, or 800 series is subject only to the permission of the course instructor. An undergraduate student who wishes to register in a graduate course numbered in the 500 or 600 series must file a specific authorization, issued by the Head of the Department offering the course, with the undergraduate Registrar.

INDIVIDUALIZED PROGRAMS

Bachelor's Degree With Individual Concentration

The Bachelor's Degree with Individual Concentration is a two-year program, supervised by an interdisciplinary faculty committee rather than by a traditional department. The program will lead to either a Bachelor of Arts or a Bachelor of Science degree with Individual Concentration. The work for the degree, normally in the sophomore and junior or junior and senior years, will take the place of the traditional major. The program the student designs for himself usually will draw upon courses currently offered by more than one department, school or college of the University. (Five College courses could be appropriate in some cases.) Together, these courses should constitute a program not otherwise available to the student in any manner. Some general programs might be, for example, Private and Performing Arts, Urban Studies, American Civilization, or Behavioral and Natural Science. In each case, the course of study will be developed by the individual student with the approval of his faculty sponsor, and the committee supervising the program. The chairman (and the committee) report to the Office of the Provost.

Any sophomore or junior with a 2.0 quality point average and with at least four semesters of undergraduate work remaining is eligible.

Application Procedures: First, the student must have in mind both a personal or professional goal for his proposed studies, and a related combination of courses not offered in any regular department or interdisciplinary program at the University. He should present this program — with three interrelated courses for each of the first two semesters — in a formal statement that demonstrates their interrelation for his own particular purposes. Second, he should locate some one member of the University faculty who, after reading the statement, agrees to serve as his sponsor, helping him to evaluate his program as he proceeds and helping him, too, to choose later courses based on the results of his first semesters. Most course work should be drawn from the offerings in this *Undergraduate Course and Faculty Directory;* although some departments, under "Special Problems" headings, offer wide possibilities. In some cases off-campus projects under sponsor supervision or work at other universities may be used. The program also has its own course listings for special projects. The faculty sponsor should be familiar with the student's principal field of interest. Third, the formal statement and a cover letter naming the sponsor should be forwarded, in person or by mail, to Prof. Arthur F. Kinney, Director, BDIC, Blaisdell House, and an appointment arranged for a conference with the Director, sponsor, and student to discuss the advisability of the proposal.

The Director is assisted by a Supervising Committee composed of Professor Anthony Borton (Veterinary and Animal Sciences), Stockbridge Hall and Professor Stanley Moss (Psychology), Tobin Hall; a faculty advisory committee; and a student advisory committee.

Note: (1) The degree earned will be either the B.A. or B.S., depending upon the area in which the greater concentration of advanced work is done; (2) Students seeking this degree must still fulfill the usual University core and distribution requirements, which are (a) the completion of 120 credit hours, (b) the achievement of the 2.0 graduation average, and (c) core and distribution courses. For special waivers (not normally granted), students are asked to consult the Director.

University Honors Program

The University Honors Program offers unusual opportunities for the superior student who is willing and able to engage himself seriously in the learning process. The features of the Program are:

1. An individualized schedule of studies;
2. Thoughtful guidance by a preceptor, a specially selected professor;
3. Special honors courses;
4. An opportunity to take advantage, as early as the freshman year, of the riches of a large University and four famous private colleges, with informed counseling about course offerings.

Each student prepares, with the aid of his preceptor, a plan of studies designed to meet the student's abilities, interests and needs. Each preceptor is a member of the faculty especially interested in working closely with serious and able students. His responsibilities include not only helping select courses but also guiding the student's intellectual development. Among the preceptors are some of the most distinguished members of the faculty as well as younger professors of great ability.

The special requirements of the Honors Program are few. A Commonwealth Scholar is expected to take one special honors course each semester during his freshman and sophomore years, and a total of twelve honors credits during his junior and senior years. The freshman-sophomore honors courses have three characteristics: they are usually available only to Commonwealth Scholars, with classes typically including only some sixteen students; they deal with selected topics treated in depth (they are not survey courses); and they emphasize discussion and the writing of papers instead of lectures and objective testing.

The junior-senior honors credits may be obtained from honors interdisciplinary seminars, special honors projects, honors courses in one's major (where available), independent study, and Five College course offerings.

The Honors Program is open by invitation only. Director of the Program is Dr. Cynthia G. Wolff; Assistant Directors are Dr. W. Brian O'Connor and Dr. Mary Sirridge. The Honors Council includes Drs. Ernest Buck, Micheline Dufau, Castellano Turner and T. O. Wilkinson, and students Janet Berlo, Rosanna Falabella, Alec Vachon and Dennis Wakefield. The Honors Offices are in Machmer Hall.

Senior Departmental Honors — Departmental Honors are designed to give highly qualified students time and opportunity for independent study in their major field. To be eligible for admission, a student should have a cumulative average of 3.0 or higher for the first five semesters of university work and demonstrate outstanding promise in his major field. In exceptional cases students who have averages lower than 3.0 but show unusual aptitude for independent work may be accepted if a written statement establishing this is presented to the Director of Honors. During the senior year, honors candidates carry forward their independent study each semester in the department of the major. Six credits (or in some cases, nine) are awarded at the

completion of the project, displacing two regular 3-credit courses during the senior year. A Departmental Honors candidate is assigned a committee of three faculty members who supervise the study and the preparation of a thesis, which is defended orally. If he satisfies all the requirements of his department and the Honors Program, attaining a grade of B or higher, the candidate is awarded honors in the field of his specialization upon graduation. Those with passing grades lower than B receive special projects credit toward their degree.

Southwest Residential College Program

Southwest Residential College is the largest residential and social unit in the University, with some 5500 students in 26 high- and low-rise halls.

The Southwest Academic Program is available to all students living in the area and includes some 200 sections of regular departmental courses taught in the residence halls. In addition, Southwest has its own course offerings designed to respond to expressed student needs and concerns. One-credit courses or "colloquia" are largely student-oriented and student-taught. Involving some 1400 students each semester, they range in subject matter from apiculture to Zen. Three-credit Southwest "390" courses are experimental courses, frequently interdisciplinary, taught by regular faculty members and qualified graduate students. The Southwest academic program does not at present offer its own majors although individual students are designing their own majors under the BDIC program. Registration for Southwest courses is carried on in the area at the beginning of each semester.

In attempting to determine the needs of students both in the University and in the larger social community, Southwest has recognized two crucial areas of concern: racism and sexism. These issues have been made the express priorities of this residential area, and Southwest's social and academic resources are being increasingly bent to serve these priorities. Each semester, 390 courses in white racism and social awareness along with courses in black studies are offered, to develop student awareness of the problems of racism as well as to meet the needs of minority students in the area. Courses in Women's Studies, Sex Roles in Society, and Human Sexuality are also offered each semester to raise students' consciousness on the issues of sexism in society. Southwest also serves these priorities by the development of a Black Students' Center, a Center for Racial Awareness, and a Women's Center. Each of these centers generates social and academic programs.

Southwest promotes other kinds of cultural and social awareness through its international studies program, cross-cultural workshops, and community action programs which take Southwest students into neighboring municipalities for service and study. Development for the governance of Southwest is a collaborative effort between the staff and the student governing body—the Southwest Assembly.

Project 10, a semi-autonomous experimental academic program primarily designed for students living in Pierpont House, is a distinct though not wholly separate part of Southwest Residential College and its academic program.

Project 10

Project 10 is a semi-autonomous experimental program based in Pierpont House in Southwest Residential College. It begins its sixth year in 1973. The Project's members are drawn from students and faculty of the University. They participate in a wide variety of seminars, workshops, and tutorials each semester, and attempt to explore different ways of learning and different options on credits and grading. The Project is an attempt to build a living-learning community which can foster and sustain individual growth and personal expression, while its members learn how to make decisions, how to measure learning, and how to accept accountability to others.

A special program option within Project 10, the Inquiry Program, offers an alternative to the general University degree requirements. It is an alternative to the ordinary approach to separate courses and credits in the freshman and sophomore years. In fact, in Project 10 there is nothing called the freshman or sophomore class. Students individually negotiate plans of study for the first 60 credits of undergraduate work. The Inquiry Program seeks individuals who are ready for self-directed learning, both in the classroom and in independent studies, and who believe they can profit from collaboration with a faculty adviser in the design of a total program.

Students with as divergent personal aims as preparing for medical school or exploring communal living are finding Project 10 a human-sized program with many of the virtues of a small college—greater intimacy and intensity of education—yet able to draw upon the resources of a large university.

Orchard Hill Residential College Program

Master: Professor Christopher Hurn; Full-Time Faculty: Wilesse Comissiong; Area Director: James West; Faculty Residents: Luther Allen (Political Science), Richard Tedeschi (French), Ian Thomas (Engineering), Nina Yankovitz (Art); Preceptors: John Brentlinger (Philosophy), Ernest Johnson (Food and Agricultural Engineering), William Whiston (Business Administration), Alvin Winder (Nursing).

Orchard Hill Residential College is a unit of four residence halls offering distinctive educational and cultural programs for students seeking an alternative college experience. Orchard Hill offers in excess of 35 3-credit interdisciplinary courses each semester and an increasing percentage of these satisfy University core requirements.

Orchard Hill courses, although taught by faculty members, spring from students' appreciation and perception of what they need to know. Although there is yet no one focus which all Orchard Hill courses share, the academic program is moving toward several distinctive emphases: programs concerned with the relationship between social thought and social action in the community, programs concerned with the contemporary arts and society, with science and technology, and programs which are addressed to the specific needs of Third World and women students in the community. Underlying all these programs is a stress upon educational engagement with societal issues.

In addition to 3-credit courses, Orchard Hill offers a large variety of student initiated colloquia. These colloquia are sponsored by resident faculty members or

faculty fellows and supported by the student area government and the Master's Office. The number of these colloquia has greatly increased in the last several years and it is expected that a large percentage of all students will participate in this or in other educational programs.

Students living at Orchard Hill have close contact with resident faculty members and preceptors, many opportunities for involvement in educational programs and, by the same token, many demands placed upon their time and energies. Students who are willing to commit themselves to this kind of intensive educational experience, once accepted by the University, must apply through the College Admissions Committee. Applications may be obtained at the Master's Office, 101 Eugene Field House, where brochures are also available upon request.

Center for Outreach Programs

The Center for Outreach Programs has five main purposes:

1) Outreach is responsible for keeping an up-to-date inventory of all programs on campus that offer a service to the community. This inventory is checked and revised at the end of each semester.

2) Outreach goes out into the community to find what needs different agencies, departments, and programs may have that students at the University can fill. These needs are then brought to the attention of the University community.

3) Outreach acts as a clearinghouse, referring students, faculty, and people of the community who wish to do part-time volunteer work to existing programs on campus (that offer a service to the community) and to the needs of the different agencies, departments, and programs in the community.

4) Outreach has an expanding internship program. Outreach has set up several full-semester off-campus learning experiences. By providing the opportunity for off-campus work, Outreach helps students who want to become better-oriented in their career choices through related field work, while at the same time earning a full semester's credits.

5) In addition to the programs listed above, Outreach also develops various programs throughout the year which meet specific needs in the community and which help to satisfy the student's need for an experience related to her/his academic field of interest.

A student who wishes to become an Outreach volunteer sets up an interview with one of the staff. The interview provides a chance to ask questions about the program, to find out what types of volunteer opportunities are available, and to let the staff member know where the student's interests lie. After students decide which agencies they might be interested in serving, they are given the names and phone numbers of contact people. It is the student's responsibility to get in touch with and set up appointments with these people. The student is asked to report back to Outreach when placed in a job assignment.

A student who wishes to volunteer, either in a part-time position or in a full-term internship, must be willing to make a definite time commitment. The agencies and the people in the community operate all year. Therefore, they want volunteers who plan on becoming involved.

Outreach volunteers work in agencies such as day-care centers, nursing homes, legal aid services, institutions for the blind, deaf, and mentally retarded, detention centers, prisons, community aid programs and hospitals.

Outreach interns work in Senatorial offices in Washington, D.C., mayors' offices, Congressional offices, community action agencies, institutions for the physically handicapped, etc.

DIRECTORY OF COURSES

THIS DIRECTORY lists offerings available in each college, school, division, and department. Students should consult the index for the general fields under which specific courses may be found.

SUMMARY OF THE COURSE NUMBERING SYSTEM

000-099 Non-credit courses with no quality-point value toward graduation (such as courses needed to make up entrance deficiencies).

100-199 Undergraduate credit only: freshman-sophomore level.

200-399 Undergraduate credit only: junior-senior level.

400-499 Professional courses open to students having the bachelor's degree.

500-699 Courses available for graduate credit.

700-999 Graduate level courses.

Under normal circumstances, undergraduate students will be concerned only with courses numbered below 400. Students interested in the University's program of graduate studies should consult the *Graduate School Bulletin*.

The following numbers are assigned to special courses and academic activities:

190, 290, 390 New undergraduate courses being taught on experimental basis — not listed in catalog.

385-386 Special Problems, Undergraduate.

391-397 Seminars, Undergraduate.

398-399 Departmental Honors.

700 Special Problems, Graduate.

800 Master's Thesis.

900 Doctoral Dissertation.

Roman numerals indicate the semester(s) in which a course is given.

Capital letters appearing in parentheses after course titles designate various categories of courses required for graduation. See the first section of this book for a full explanation of graduation requirements.

NOTE: All regular semester courses meet for three class hours each week unless otherwise indicated; all courses carry three credits unless otherwise indicated. Courses carry no prerequisites unless specified.

COLLEGE OF ARTS AND SCIENCES

Dean Alfange, Jr., *Dean, Faculty of Social and Behaviorol Sciences*; Jeremiah M. Allen, *Dean, Faculty of Humanities and Fine Arts*; Mac V. Edds, Jr., *Dean, Faculty of Natural Sciences and Mathematics*; Donald C. Freeman, *Associate Dean, Faculty of Humanities and Fine Arts*; H. Duncan Rollason, Jr., and James W. Shaw, *Associate Deans, College of Arts and Sciences*; Stephen I. Allen, Julia A. Fata, George T. Sulzner, and James L. Wozniak, *Assistant Deans, College of Arts and Sciences*.

The College of Arts and Sciences consists of three Faculties with a common curriculum. Departments and programs within each Faculty are as follows:

Humanities and Fine Arts — Afro-American Studies, Art, Classics, Comparative Literature, English, French and Italian, Germanic Languages, Hispanic Languages, History, Linguistics, Music, Philosophy, Rhetoric, Slavic Languages, and Theatre.

Social and Behavioral Sciences — Anthropology, Asian Studies, Economics, Political Science, Psychology, Sociology, and Speech.

Natural Sciences and Mathematics — Biochemistry, Botany, Chemistry, Geology and Geography, Mathematics and Statistics, Microbiology, Physics and Astronomy, and Zoology.

The College has programs of study leading to four bachelor's degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music. All departments (except Linguistics) offer a program leading to the B.A. degree. In addition to the customary departmental majors, interdisciplinary majors are provided in Journalistic Studies, Judaic Studies, Near Eastern Studies, Pre-dental, Pre-medical and Pre-veterinary Studies, and Soviet and East European Studies. A Latin American Studies Certificate Program, which does not constitute a major, is offered for students with particular interest in this area. The B.S. degree may be earned only if the major is mathematics, natural science, or psychology. The B.F.A. programs have a strong emphasis in art and the B.Mus. programs reflect an emphasis in music. All degree programs combine a basic proficiency or experience in communication skills and a study in depth in one area with supporting study in the other two of the three main divisions of learning represented by the three Faculties.

Courses appropriate to the communicative skills and distribution requirements in the three areas are noted in University Bulletins by the respective codes (B), (C), (D), and (E).

A program of study which conforms with the following eight provisions qualifies the student who completes it for the appropriate degree. Advanced placement and transfer credits may be applied toward any or all of these qualifications, but at least half of the major program must be completed in residence.

1. At least 120 credits (Core Requirement A).

2. Rhetoric (Core B): Two "B" courses required, one of which must be either Rhetoric 100 or 110.

3. Foreign Language: For the B.A. and B.S. degrees only, a basic proficiency or experience with foreign language must be demonstrated by (a) completion of a foreign language course at the 140 level, (b) satisfactory performance on an achievement or placement test, (c) four high school units in one foreign language or three units in one and two units in another foreign language, (d) a year in a high school in which English is not the basic language, (e) substitution of language-related study, if there is clearly demonstrated difficulty in language study, which has been approved by the Foreign Language Board. Note: 110, 120, 130 levels may be taken pass/fail.

4. Humanities and Fine Arts (Core C): Four "C" courses for B.A.; three "C" courses for B.S., B.F.A., B.Mus. (140-level "C" language courses may be used if language requirement is otherwise satisfied).

5. Social and Behavioral Sciences (Core D): Four courses, three of which must be "D", for the B.A.; three "D" courses for B.S., B.F.A., and B.Mus.

6. Natural Sciences and/or Mathematics (Core E): Four "E" courses for B.A., B.S.; three "E" courses for B.F.A. and B.Mus.

7. For a B.S. degree, the major must be science, mathematics, or psychology and a minimum of 60 credits must be earned in these disciplines.

8. An approved major program must be completed.

Full-time students with majors in the College are eligible to use a pass/fail option in one course each semester and in those summer sessions in which they enroll for at least 9 credits. University regulations restrict exercise of the option to a maximum of five courses completed in satisfaction of University core requirements, but the College permits its use in those courses presented in satisfaction of its additional requirements. Exercise of the option in courses required for a student's major is subject to permission of the Department.

College of Arts and Sciences Courses

100. Preparation for Foreign Language Study

101. Study Skills Credit, 2.

102. Freshman Seminar (Natural Sciences)

103. Freshman Seminar (Social Sciences)

104. Freshman Seminar (Humanities)

110. Mathematics in Spanish Credit, 2.

111. Concepts of Basic Mathematics

298, 299, Special Topics (College of Arts and Sciences)*

Seminars, experimental courses, special laboratory experience and/or directed individual investigation by students in their sophomore and junior years, with courses in the specific areas of Humanities, Social Sciences, and Natural Sciences. *Prerequisite, approval of the appropriate Dean following consultation with the College Curriculum Committee or a subcommittee thereof. Credit, 1-3.

W. E. B. DuBois Department of Afro-American Studies

Chairman of Department: Associate Professor Michael Thelwell; Associate Chairman: Assistant Professor Chester Davis; Professors J. Cole, Harrison, Roach; Associate Professors Bracey, R. Cole, Lynch, Shepp, Stevens; Assistant Professors Afesi, Richards; Instructors Austin, Miles, Ramos, Smith, Terry; Visiting Professors Achebe, Kaplan; Visiting Lecturer Lester.

A major in Afro-American Studies is offered. Specific requirements may be obtained by contacting Associate Chairman Davis.

101. INTRODUCTION TO BLACK STUDIES (D).
An introduction to a range of disciplines in history, social science, and the humanities within the broad sweep of the Black experience and guidance in the skills required for in-depth analysis of questions and problems relating to Black people.

110, 120. ELEMENTARY SWAHILI.
Essentials of Swahili grammar and basic vocabulary. Elementary syntax and phonology. Genetic relationships between Swahili and other Bantu languages. Practice in reading and speaking Swahili. Sequence: Afro-Am. 110, 120, 130, 140. 3 class hours, 1 laboratory hour.

111. SURVEY OF AFRICAN ART (C).
An overview of the literature on African art and an analysis of both the theoretical basis for its study and of the distinguishing characteristics of its major traditions. An historical survey of Black art from prehistoric times (5000 B.C.) to the European arrival. Study of the neo-traditional art and the tourist trade.

130, 140. INTERMEDIATE SWAHILI. (C designation on 140 level)
For students who have completed Afro-Am. 110, 120. More advanced study of grammar and idiom. Emphasizes conversation and readings in cultural and literary texts.

131. AFRICAN HISTORY (C).
The history of Africa including its natural environment, the development and basic characteristics of African culture, the major African civilizations from 300 A.D. to European penetration, the slave trade and its impact on African and European cultures, the use of colonialism, the development of movements for African independence, and finally the emergence of independent African states.

132. AFRO-AMERICAN HISTORY (C).
Begins with West African origins prior to the slave trade. The development, organization, practice, and consequence of slavery, and an historical survey of the American scene covering ten phases: beginning with the Revolutionary era and the paradox of slavery amidst the struggle for American political freedom, through the major issues and actions during the Civil War and Reconstruction to the politics of accommodation in the early twentieth century, ending with the origins of the Civil Rights movement and the present impasse in the search for an ideology. Covers all aspects of America's history from the standpoint of the Afro-American.

151. AFRO-AMERICAN LITERATURE AND ITS CULTURAL ROOTS (C).
The relevant forms of Black cultural expression contributing to the shape and character of contemporary Black Culture; the literary application of these in traditional Black writers. In four parts: (1) West African cultural patterns and the Black past; (2) the transition — slavery, the culture of survival; (3) the culture through the literature; and (4) Black perceptions vs. white perceptions.

152. BLACK RHETORIC (B).
Begins with the social and psychological implications of the adoption of English as a completely alien language. Traces development of the dialect, forms of expression necessitated by conditions of slavery; use of the Bible as a model for Black rhetoric; development of the sermon; evolution of the language of Black politics; and the use of satire as a means of communication.

161. INTRODUCTION TO POLITICAL SCIENCE — 20TH CENTURY (D).
The role of Black Americans in political theory and movements in the United States. Traces the development of Black political thought and organization up through the twentieth century, beginning with DuBois and including such movements as the Niagra and Garvey movements and Islamic Nationalism. The development of political institutions within the Black Community. Organizations of wide ranging political philosophies, from the National Association for the Advancement of Colored People to the Urban League and the Black Panthers.

211. AFRO-AMERICAN TEXTILE DESIGN AND FABRIC PRINTING.
The principle of design in the production of hand-printed textiles; designs will use motifs that reflect the Afro-American experience.

212. SCULPTURE: WELDED SHEETMETAL.
A basic and practical introduction to Black aesthetic and conceptual problems of Black sculpture. The theories on African art in relation to the Afro-American artist. The student is encouraged to find his or her own form of expression.

221. CULTURES OF WEST AFRICA (D).
A survey of the social, political, economic, and religious patterns of the traditional cultures of West Africa. The problems of continuity and change within these societies and their consequences.

222. THE BLACK CHURCH IN AMERICA (C).
The church as a continuing and powerful institution among Black Americans. The role of the church during different periods of history; functional interpretation of religion among Afro-Americans, and analysis of various types of Black churches.

223. AFRO-AMERICAN PEOPLE (D).
An analysis of the sub-culture of Black people in the United States. Definitions of Black culture, retention of Africanisms, language in relation to culture, the arts, the position of religion and the Black church, political movements and economic institutions as regards to Black culture.

224. ECONOMIC PROBLEMS OF BLACK PEOPLE.
Certain critical areas in the economic progress of the Black Community; an historical analysis providing a broad framework for understanding of current problems.

231. LIFE AND WRITING OF W. E. B. DuBOIS.
An in-depth study of the life and works of W. E. B. DuBois, "Father of Pan-Africanism," and his influence on the political thought of Black Americans.

232. HISTORY OF BLACK NATIONALISM.
The examination of Black nationalism from the Nationalist Movement of the 1870s to the present.

233. AFRO-AMERICAN SLAVERY.
Examines several important questions concerning slavery in the United States with some comparisons with slavery in Latin America. Identifies some important ideological forces which helped determine the character of the literature on the subject. Prerequisites, History 150-151, Afro-Am. 131-132, or permission of instructor.

251. BLACK DRAMA (C).
An investigation of the aesthetic and critical problems of Black drama, involving a close study of representative plays. The nature of the problem is whether white critics' judgments have not been too superficial and too motivated by a desire for the "primitive" and "simple" to allow that a Black writer could deal with universally human themes. The trends in current Black theater and a cursory look at contemporary street theater.

252. BLACK IMAGES IN WHITE AMERICAN WRITING (C).
A critical survey of white attitudes toward Blacks as reflected in the national literature from colonial times to the present.

253. PRE-CIVIL WAR BLACK WRITINGS (C).
Three novels, a play, significant poetry, autobiographies, appeals and defenses

suggest the variety and range of Black expression and attitudes towards their cultural and social position as New World Africans between 1776 and 1866.

261. REVOLUTION IN THE THIRD WORLD (D).
The dynamics of what has come to be regarded as the "first modern socialist revolution" in Africa and the Arab world: The Algerian Revolution.

262. WRITINGS OF FRANTZ FANON (D).
Fanon's analysis of the function of violence within the general framework of political action; his search for identity and his redefinition of the concepts of negritude; his participation in the Nigerian Revolution and his indictment of the European Liberal Left, and his theory on the phenomenon of decolonization, the one-party system, and his definition of the Third World as a new internationale.

263. PAN-AFRICANISM AND THE THIRD WORLD.
A survey primarily of the history of Pan-Africanism through its roots in the West Indies to its manifestations in England, the United States, and the Conferences of 1954. Also examines the politics of the "non-aligned" or neutralist countries under the leadership of such statesmen as Nehru, Tito, and Nasser, ending with an examination of the politics of the Third World Nation States.

264. FOUNDATION OF BLACK EDUCATION IN THE UNITED STATES (C).
A critical examination of the political, economic and social forces which have shaped the course of education for Black people in the United States from the reconstruction period to the present.

265. SEMINAR IN BLACK CULTURE.
An exploration of similarities and differences in the culture of Black folks in West Africa, the Caribbean and the United States. Following background lectures on African and Afro-American anthropology, each student makes a presentation based on comparative research on a selected aspect of Black culture. Prerequisites, Afro-Am. 121 and 122 or permission of instructor.

363, 364. PAN-AFRICANISM (STRUGGLE FOR LIBERATION AND INDEPENDENCE).
Offered for two semesters (one year) to analyze seriously the realities of the liberation struggle of African peoples. An in-depth examination of the writing of Pan-Africanists and a critical analysis of the revolutionary thrust toward independence and the unification of the African continent.

385, 386. SPECIAL PROBLEMS.

391, 392. SEMINAR.

Anthropology

Chairman of Department: Professor Richard B. Woodbury. Professors Fraser, Halpern; Associate Professors Armelagos, Cole, Hudson, Munn, Pi-Sunyer, Proulx, Salzmann, Workman; Assistant Professors Chandler, Faulkingham, Forman, Fortier, Ingersoll, Morbeck, Wobst.

Anthropology majors must take Anthropology 104 and one other of the following introductory courses: 102, 103, or 105. They should also select at least one course from the following social sciences: Sociology, Economics, Political Science and Psychology. All majors must elect a minimum of 30 credits in Anthropology, with at least 21 of these credits chosen from courses above the 100 level. The maximum acceptable credits in Anthropology is 45. Under special circumstances and with the adviser's approval, an Anthropology major may be allowed to substitute as part of this requirement non-duplicating courses in Anthropology given at another of the Five College Cooperative institutions.

102 (I) or (II). INTRODUCTION TO ARCHAEOLOGY (D).
The history, methods and theory of archaeology, with an outline of the main characteristics of the prehistoric record throughout the world. 2 lecture meetings, 1 discussion and/or demonstration section.

103 (I). INTRODUCTION TO PHYSICAL ANTHROPOLOGY.
Human evolution, human variation, racial classifications, racism, and modern theories of variation.

104 (I), (II). INTRODUCTION TO CULTURAL ANTHROPOLOGY (D).
Social and cultural anthropology dealing with variations among societies in technology and economics, social and political organization, art, religion, and ideology.

105 (I). INTRODUCTION TO LINGUISTIC ANTHROPOLOGY.
Survey of the role and contributions of linguistics in anthropology. Biological foundations of language; the process of communication; language structure; linguistic ontogeny, phylogeny, and prehistory; the principle of linguistic relativity; and other topics.

204 (I). THE ORIGINS OF ANCIENT CIVILIZATIONS (D).
A critical analysis of the archaeological data and theories pertaining to the origins and rise of civilizations in the Old World and the New. Prerequisite, Anthro. 102 recommended.

220 (II). RESEARCH TECHNIQUES IN PHYSICAL ANTHROPOLOGY; SKELETAL ANALYSIS.
Methods for excavating and analyzing human skeletal material with emphasis on sexing and aging techniques. Problems in growth and development and in pathology. 2 2-hour labs.

234 (I). PRIMITIVE ART.
A survey of the cultural and aesthetic aspects of the visual arts of primitive societies in sub-Saharan Africa, Oceania, and North America. Emphasis on the function and meaning of art in society.

237 (I). PEOPLES OF MESOAMERICA (D).
A survey of the peoples and cultures of Mesoamerica from the earliest human habitation to contemporary national cultures. Major trends traced from pre-Cortesian times through the colonial period to independence. Prerequisite, Anthro. 104.

252 (II). RURAL AND PEASANT SOCIETIES (D).
Rural and peasant societies from the standpoint of their population and institutions, their emerging needs, and their relation to mass society. Prerequisite, Sociol. 101 or Anthro. 104.

255 (I). PRE-INDUSTRIAL TECHNOLOGY.
Analysis of selected aspects of the material culture of simpler societies, both past and present, in relation to social and economic aspects of culture. Prerequisite, Anthro. 102 or 104.

260 (II). PEOPLES OF EUROPE: EASTERN EUROPE AND THE U.S.S.R. (D).
A survey of the peoples and cultures of Eastern Europe; emphasis on the Slavic peoples as well as upon those cultures transitional between Europe, the Middle East and Asia from their prehistoric origins to the period of their modernization, stressing the role of peasantries and nomads with their changing ecological adaptations. Prerequisite, Anthro. 104.

261 (II). PEOPLES OF EUROPE: THE WESTERN MEDITERRANEAN (D).
A survey of the peoples and cultures of Mediterranean Western Europe. Emphasis on the historical span from the crystallization of distinct national cultures to the present.

263 (II). URBAN ANTHROPOLOGY.
Using as a point of departure the current urban condition, the origins and evolution of cities are explored in a cross-cultural framework. Emphasis on the nature of rural-urban relationships and how these have changed over time.

265 (II). PEOPLES OF EUROPE: CENTRAL EUROPE (D).
Anthropologically oriented examination of the culture of Central Europe, with particular emphasis on Czech culture: geographic, historical and demographic background; survey of folk culture and folklore; languages and beginnings of

literary tradition; major developments in this century. Prerequisite, permission of instructor.

267 (I). PEOPLES OF EUROPE: ALPINE EUROPE.
Analysis of Alpine cultures from prehistoric through contemporary times. Cultural adaptation to environmental variation in mountainous zones and the interrelationship of mountain and lowland communities.

269 (I). CULTURES OF AUSTRALIA AND NEW GUINEA (D).
The ethnography of aboriginal Australia and New Guinea with emphasis on the particular problems of theory and analysis that have concerned anthropologists studying these areas. Prerequisite, Anthro. 104.

270 (II). CARIBBEAN CULTURES.
An ethnographic survey of the societies of the Greater and Lesser Antilles, emphasizing the interaction of European colonial and African cultures both historically and in respect to present economic and political problems.

315 (II). PRIMATE ANATOMY.
Structure and phylogeny of primates (prosimian, monkey and ape) with emphasis on evolutionary trends leading to man. Laboratory work provides experience in dissection. Prerequisites, Anthro. 103, Zool. 101 or equivalent. 2 class hours, 1 3-hour laboratory period.

320 (I). ECONOMIC ANTHROPOLOGY.
This course will survey the patterns of production, distribution and consumption in traditional societies as well as the social and political matrices of these patterns. Alternative theoretical approaches to selected problems in economic anthropology.

321 (I). PREHISTORIC CULTURAL ECOLOGY.
Analysis of culture ecological approaches to the interpretation of the prehistoric record. Prerequisite, permission of instructor.

325 (I). THE ANALYSIS OF MATERIAL CULTURE OF THE HISTORIC PERIOD.
The methods and techniques of analysis of temporal and spatial distributions, technology, and spatial interrelationships of several forms of material culture. Special attention to the relationships between material and non-material culture. Emphasis on historic period materials, but some prehistoric data is included. Recent contributions of ethnoarchaeologists.

330 (I). SOCIAL ORGANIZATION OF IMPERIALISM.
Analysis of the varieties of social relations between industrial societies and non-industrial areas of the world. Special attention to the development of Western imperialism in Africa, Asia and the Western Hemisphere and to the patterns of resistance, accommodation and rebellion that have developed in response.

333 (I). KINSHIP AND SOCIAL ORGANIZATION.
A course designed to acquaint the student with basic conceptual tools and problems in this field. Principles of social organization such as kinship, descent, ranking, etc., examined with reference to individual societies and general theory.

335 (II). NATIVE AMERICAN LANGUAGES.
A survey of American Indian languages, primarily north of Mexico. Genetic classifications and Sapir's classification based on structural resemblances between language families. Type of linguistic structure and structural restatements. Comparative work and reconstructions. Prerequisite, Anthro. 105 or permission of instructor.

336 (II). POLITICAL ANTHROPOLOGY (D).
Anthropological approaches to the study of politics in representative bands, tribes, and states. Evaluation of several analytic stances through reading and discussing relevant political anthropological literature.

340 (I). RELIGION AND RITUAL (D).
Classical problems in the anthropology of religion from Durkheim and Tylor to Evans-Pritchard, Levi-Strauss and Lloyd Warner. Special attention to the analysis of ritual. Prerequisite, Anthro. 104 or permission of instructor.

360 (II). LANGUAGE IN CULTURE AND SOCIETY.
The relationship between language and culture and between language varieties and social structure. Prerequisite, Anthro. 105 or permission of instructor.

362 (I). ORAL FOLKLORE IN NON-LITERATE SOCIETIES.
Introduction to the ethnography of oral folklore. Topical emphasis on the analysis and function of tales; geographic analysis of Africa and North America.

363 (I). LINGUISTIC ANTHROPOLOGY: COMPARATIVE DIMENSION.
The methods and interpretations of comparative linguistic analysis in the field of anthropology. Prerequisite, Anthro. 105 or permission of instructor.

364 (II). PROBLEMS IN ANTHROPOLOGY (D).
Examination of selected problems in physical anthropology, archaeology, social and cultural anthropology. Illustrative material drawn from both non-literate and peasant societies. Prerequisite, Anthro. 104 or permission of instructor.

365 (I). WORLD ETHNOGRAPHY (D).
Selected societies of Africa, the Americas, Asia and Oceania. Problems of comparing societies, especially with regard to their environmental contexts and levels of productivity. Prerequisite, Anthro. 104 or permission of instructor.

366 (II). THE INDIVIDUAL AND SOCIETY (D).
Selected approaches to the interrelations of individual behavior and social patterns, with consideration of data on "Western" and "non-Western" societies. Prerequisite, Anthro. 104 or permission of instructor.

367 (II). CULTURES OF AFRICA (D).
An extensive survey of the cultures of Africa, a comparison of their social, political, religious, and economic patterns, and toward consideration of the evolution and interrelationship of the cultures of the area. Prerequisite, Anthro. 104 or permission of instructor.

368 (I). OLD WORLD PREHISTORY (D).
A survey of the prehistoric cultures of Europe, Asia, and Africa, with emphasis on the Paleolithic, Neolithic and early metal-using periods. Designed to give an understanding of the significant cultural developments in the Old World before the emergence of historic civilizations.

369 (I). NORTH AMERICAN ARCHAEOLOGY (D).
An intensive survey of American Indian prehistory north of Mexico. Emphasizes the historical development processes in selected geographical regions. Prerequisite, Anthro. 102.

370 (II). NORTH AMERICAN INDIANS (D).
Indian tribes with various levels of technological development and social complexity, from areas north of Mexico, in terms of their environmental context and the impact of non-Indian societies on their cultures. Prerequisite, Anthro. 104.

371 (II). HUMAN EVOLUTION.
The mechanisms of evolutionary change, the fossil and archaeological evidence bearing on man's evolution, and an evaluation of the various interpretations of the evidence. Prerequisite, Anthro. 103.

372 (II). HUMAN VARIATION.
Description and analysis of qualitative and quantitative biological variation in and between human populations. Prerequisites, a course in Genetics (Zoology 145 or 240) and an elementary course in statistics. Anthro. 103, 371 recommended.

373 (I). CULTURES OF SOUTHEAST ASIA (D).
An introduction to the history and ethnography of the native cultures of

Southeast Asia, including consideration of the peasant populations and their expanding role in the development of modern Southeast Asian states. Prerequisite, Anthro. 104 or permission of instructor.

374 (II). CULTURES OF THE FAR EAST (D).
A survey of culture-history and ethnography of representative people of East Asia; peasant sub-cultures of traditional contemporary China, Japan, and Korea. Prerequisite, Anthro. 104 or permission of instructor.

375 (I). SOUTH AMERICAN ARCHAEOLOGY (D).
A survey of the pre-Columbian cultures of South America and their development, with emphasis on the Andean areas.

376 (II). SOUTH AMERICAN ETHNOLOGY (D).
An analysis of the colonial and contemporary cultures of South America with emphasis on Indian tribes. The interrelationship of Indian, European and Negro societies and their contributions stressed. Prerequisite, Anthro. 104 or permission of instructor.

377. SUMMER FIELD SCHOOL IN ARCHAEOLOGY.
Practical experience and training in archaeology. Both prehistoric and colonial sites are excavated, and instruction given in archaeological methods and techniques. Prerequisite, Anthro. 102 or equivalent and permission of instructor. Credit, 6.

378 (II). THEORY AND METHOD IN ARCHAEOLOGY (D).
An intensive examination into the scientific approach to modern archaeological research and the utilization of this approach for deriving and testing theories of prehistory and human behavioral patterns. Prerequisite, Anthro. 360 and permission of instructor.

379 (II). CULTURAL DYNAMICS AND APPLIED ANTHROPOLOGY (D).
Theories of cultural process and their application to practical cross-cultural situations in administration, technical assistance and community development. Prerequisite, Anthro. 104 or permission of instructor.

380. FIELD COURSE IN CULTURAL ANTHROPOLOGY.
A summer course affording the advanced undergraduate or graduate student supervised training in cultural anthropological research. Location varies from year to year. Prerequisites, advanced course work in Anthropology and permission of instructor. Credit, 6.

381 (I), (II). QUANTITATIVE METHODS IN ANTHROPOLOGY.
The interpretation and analysis of data from all fields of anthropology. Descriptive statistics, formulation and testing of hypotheses, correlation and regression. Discussion of current trends in the methodology of anthropological research.

382 (II). HISTORY OF ARCHAEOLOGY.
Events, major sites, and men important in the development of archaeology during the 19th century and 20th century. Theoretical and technical advances related to the present state of archaeology emphasized. Prerequisite, Anthro. 102 and permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

388, 389. READINGS IN ANTHROPOLOGY. Credit, 1-3.

399 (I), (II). SENIOR HONORS PROJECTS.
Individual study and research under the direction of a faculty member for highly qualified seniors. By invitation from the Director of Honors upon recommendation of the department. Credit, 6.

Art

Chairman of Department: Professor George M. Wardlaw; Professors Becker, Benson, Kamys, Mallary, Matheson, Norton, Perkins, Reed, Roskill, Roy; Associate Professors Berube, Cheney, Coughlin, Davies, Grillo, Schleappi, Stevens, Townsend, Wang, Wozniak; Assistant Professors Denny, Dube, Gongora, Hendricks, Kearns, Maguire, Parks, Patterson, Smith, Tarr, Wiedenhieft; Instructors Forwood, Mochon.

The three programs offered by the Art Department provide objectives ranging from a broad background of extensive coverage to highly specific professional investigations. The Bachelor of Arts degree is designed to provide an historical and aesthetic knowledge of the arts while affording an opportunity to develop creative ability in the several media. The other two programs, both of a professional nature, lead to a Bachelor of Fine Arts degree. The B.F.A. degree program with a major in Art Education is specifically designed for prospective art teachers. The B.F.A. studio program enlists more intensive coverage of one chosen medium, ceramics, painting, printmaking, or sculpture, to be selected as a major by the student at the end of the sophomore year. While all three programs are subject to the University and College of Arts and Sciences Core requirements, the B.A. program commands a greater involvement of courses not directly within the Art Department. The B.F.A. program allows greater latitude of Core requirements for further concentration within the Art Department.

The B.A. Studio or Combination Majors require minima of 42 art credits consisting of six elementary courses (two introductory art history courses and four studio courses) and eight upper division courses (numbered 200 and above), two of which must be art history.

The Art History Major requires a minimum of 30 art history credits, six at the introductory level and 24 upper division credits including at least 1 seminar course (300 level course).

Art History is taught both as an adjunct to studio work, and as an area of the humanities tying in with the history, literature and philosophy of a given culture or period, and forming part of the history of ideas in general. Course offerings in the area are organized to provide three levels of instruction. (A) The Introductory Survey (100 level), (B) Area Courses (200 level) and (C) Seminars (300 level). The student consults with the faculty, especially in the last two years, to develop the sequential program best suited to the student's needs and interests. Directed undergraduate work, including the writing of an honors thesis, may be elected by qualified students.

Acceptance to either of the B.F.A. degree programs is effected during the sophomore year through the submission of a portfolio to a faculty selection committee. Admission is based on the criteria of demonstrated ability and high academic standing, giving these programs the flavor of honors work. Before acceptance, during the first two years, the student experiences a foundation program of several courses in drawing, two and three dimensional design, and the general history of art. Because of its contemporary nature and relevance, Modern Art should be taken as early as possible in the B.F.A. programs as a second Art History course.

The B.F.A. Art Education program, which is run in conjunction with the School of Education, provides the student with the Massachusetts State Board of Education requirements for certification to teach art in the public school system at either the elementary or secondary level. The program's minimal requirements include 51 credits in Art courses, 6 credits in Art Education courses, 9 credits in Education and Psychology courses, 12 credits for teacher certification (including 16 weeks of observation and student teaching in either the elementary or secondary levels) and 42 credits in other academic disciplines which shall include courses in satisfaction of the "core requirements" of the College. Introductory courses in each major studio area are to be taken early in the program.

The B.F.A. Studio major program builds the best foundation for graduate study. It involves minima of 60 credits in Studio Art, 12 credits in Art History, and 48 credits in other disciplines (see College of Arts and Sciences requirements for B.F.A. degrees in Art). B.F.A. candidates will be reviewed by a committee of three faculty members from the specific major area at the end of the junior year. In the senior year a student may elect 6-12 credits in a degree project

directed toward the exploration of personal objectives in the specific major area.

CREATIVE ART

100. BASIC DRAWING (C).
Drawing in black and white, applying pencil, crayon, charcoal techniques to representation in line and tone, emphasizing sound observation and effective presentation. 6 studio hours.

102. DRAWING COMPOSITION (C).
Continuation of Art 100. Emphasis on pictorial composition and advanced drawing techniques. 6 studio hours.

104. THE VISUAL DIALOGUE (C).
Introduction to visual concepts through a combination of formal presentations and laboratory experiences. Emphasis on developing understanding of divergent points of view in Art rather than the development of skills or creative accomplishments. 6 class hours.

120. BASIC DESIGN I (C).
Two-dimensional design concepts arising out of work with specific problems in a variety of media. 6 studio hours.

122. BASIC DESIGN II (C).
Continuation of Art 120. Specific three-dimensional problems stressing the interrelationship of materials, processes, techniques, and sculptural concepts. Prerequisite, Art 120. 6 studio hours.

220. PAINTING I (C).
Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitation of sound composition. Prerequisites, Art 100, 120. 6 studio hours.

222. PAINTING II (C).
Initial concentration on transparent water color, emphasizing control of techniques and mastery of color relationships. Further experience with opaque water color, such as gouache, casein. Prerequisites, Art 100, 120. 6 studio hours.

224. PAINTING III.
Continuation of Art 220. Prerequisite, Art 220. 6 studio hours.

226. PAINTING IV (Techniques and Materials).
Advanced work in traditional and contemporary painting techniques and media. Includes encaustic, tempera, oil, oil-resin, acrylic polymer, synthetic media, grounds and supports. 6 studio hours. Prerequisites, Art 222, 224.

230. ADVANCED DRAWING.
Investigation and development of various techniques and media with special emphasis on figure drawing. Prerequisites, Art 100, 102. 6 studio hours.

232. ADVANCED DRAWING PROBLEMS.
Advanced work in traditional and contemporary drawing media. Independent exploration of graphic problems emphasized. Solutions to problems sought in relation to student's personal objectives. Prerequisite, Art 230. 6 studio hours.

240. PRINTMAKING: RELIEF I (C).
Basic study of material, technique, and aesthetic considerations peculiar to relief. Students print their own work. Prerequisites, Art 100, 120 or permission of instructor. 6 studio hours.

242. PRINTMAKING: INTAGLIO I (C).
Basic study of materials, techniques, and aesthetic considerations peculiar to etching, engraving, and aquatint. Students print their own work. Prerequisites, Art 100, 120, or permission of instructor. 6 studio hours.

244. PRINTMAKING: LITHOGRAPHY I (C).
Basic study of materials, techniques, and aesthetic considerations peculiar to lithography. Students print their own work. Prerequisites, Art 100, 120 or permission of instructor. 6 studio hours.

246. PRINTMAKING: RELIEF II.
Advanced study of materials, techniques, and aesthetic considerations relevant to relief printmaking. Students print their own work. Prerequisites, Art 240, 242, 244. 6 studio hours.

248. ART EDUCATION: METHODS AND MATERIALS I.
Methods, tools, and materials used in the public school art program, with emphasis on the elementary school level. 6 studio hours. Required for art education majors; prerequisite for student teaching.

250. ART EDUCATION: METHODS AND MATERIALS II.
The literature, philosophies, procedures, and methods used in the teaching of art, with emphasis on the secondary school program. Required for art education majors; prerequisite for student teaching.

254. TYPOGRAPHY I.
A studio course in typography and book design. The student selects a text, sets it in type, prints and binds at least one copy of the finished book. 6 studio hours.

260. SCULPTURE I (C).
Experimentation with materials. Investigation into the nature of 3-dimensional form. The development of 3-dimensional order. Individual projects. Prerequisites, Art 100, 122. 6 studio hours.

262. SCULPTURE II (C).
Continuation of Art 260. Prerequisite, Art 260. 6 studio hours.

264. SCULPTURE III.
A sequence of problems in direct and cast metal sculpture, using a variety of metals, techniques, and processes. Emphasizes traditional and modern foundry methods, and includes gas and electric welding. Prerequisite, Art 262 (previously or concurrently). 6 studio hours.

266. SCULPTURE IV.
Encourages development of a personal approach to sculpture and creative decisions. The student selects projects and materials of interest to himself and completes them within a classroom situation. Prerequisite, Art 264 (previously or concurrently). 6 studio hours.

270. INTRODUCTION TO METALS AND FIBERS (C).
Introduction to materials and concepts related to design and execution of objects utilizing, or embellished by, metals, wood, enamels or fibers. Emphasis on expanding design concepts applicable to the above media. Prerequisite, Art 100, 120 or 140. 6 studio hours.

280. CERAMICS I (C).
Involvement with form through the use of clay and related materials. Hand-building and work on the potter's wheel stress a creative, aesthetic approach and related ceramic history. Prerequisite, Art 100 or 120. 6 studio hours.

282. CERAMICS II (C).
Continuation of Art 280. Further refinement through hand-building and wheel techniques. Introduction to technology of clay, engobes, and firing. Prerequisite, Art 280. 6 studio hours.

284. CERAMICS III.
Creation of ceramic forms with stress on aesthetic principles rather than utility. Introduction to ceramic glaze technology and coloring media. Related ceramic history. Prerequisite, Art 282. 6 studio hours.

286. CERAMICS IV.
Continuation of Art 284. Emphasis on expressive potential of clay and glazes. Advanced techniques in glaze technology. Introduction to kiln design. Prerequisite, Art 284. 6 studio hours.

288. GLASS BLOWING I.
Basic principles and techniques of glass blowing from molten mixes, emphasizing experimental form. Prerequisite, Art 282 or permission of instructor. 6 studio hours.

292. LIGHT WORKSHOP.
Introduction to the use of light as a medium of aesthetic expression with emphasis on individual investigation into the techniques of modifying the quality of illumination. Prerequisites, three semesters in one of the following areas: painting, sculpture, ceramics, or printmaking. 6 studio hours.

320. PAINTING V.
Exploration of traditional and contemporary attitudes and approaches toward painting the human figure. Prerequisites, Art 224 and 226. 6 studio hours.

322. PAINTING VI.
Advanced work in painting composition with emphasis on independent exploration of painting problems and the development of effective personal forms of visual communication. Prerequisite, Art 224. 6 studio hours.

340. PRINTMAKING: INTAGLIO II.
Advanced study of materials, techniques, and aesthetic considerations relevant to etching, engraving, and aquatint. Students print their own work. Prerequisite, Art 240, 242, 244. 6 studio hours.

342. PRINTMAKING: LITHOGRAPHY II.
Advanced study of lithography, with emphasis on concepts and techniques of color lithography. Prerequisite, Art 240, 242, 244. 6 studio hours.

360. SCULPTURE V.
Advanced work in constructions and assemblage; formal and informal methods of composition, in a variety of materials and assembly techniques. Prerequisite, Art 266. 6 studio hours.

362. SCULPTURE VI.
Individual, collaborative and class projects of an advanced nature in new sculptural media such as plastics, light, and kinetics. Also inter-media projects involving the combination of sculpture with other arts such as painting, photography, architecture, urban design, music, dance, theater, etc. Prerequisite, Art 360 (previously or concurrently). 6 studio hours.

380. CERAMICS V.
Advanced exploration of ceramics and related media. Continued technology. Modern ceramic history. Emphasis on individual objectives. Prerequisite, Art 286. 6 studio hours.

382. CERAMICS VI.
Continuation of Art 380. Emphasis on personal interpretation of major contemporary problems in Ceramics. Prerequisite, Art 380. 6 studio hours.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

388. B.F.A. DEGREE PROJECT—CERAMICS, PAINTING, PRINTMAKING, AND SCULPTURE.
An independent advanced investigation and work pursued under the direction of a selected member of the faculty and designed to evolve a body of work mature in concept and individual in style. Specific requirements to be established by the director of the work. Independent studio work directed through frequent consultation with instructor. Prerequisite, Ceramics-Art 380, 382; Painting-Art 320, 322; Printmaking-Art 246, 340, 342; Sculpture-Art 360, 362.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

ART HISTORY

111. SURVEY OF THE HISTORY OF ART: EARLY CULTURES AND CIVILIZATIONS (C).
Art and architecture in the western world from the Paleolithic era to the Gothic period.

113. SURVEY OF THE HISTORY OF ART: RENAISSANCE TO MODERN (C).
Art and architecture in the western world from the Renaissance to the present time.

115. INTRODUCTION TO ART (C).
An introduction to great works of art studied in historical sequence, including techniques and aesthetic principles.

205. GREEK ART (C).
The sculpture, painting and architecture of Ancient Greece from Protogeometric beginnings to the end of the Hellenistic period. Students are encouraged to take Art 111 or Art 115 before this course.

225. EARLY MEDIEVAL ART (C).
Early Christian art and the beginnings of Byzantine art in East and West; Coptic art, Barbarian and Celtic influences in northern Europe; Carolingian, Ottonian and Anglo-Saxon art.

227. ARTS OF THE ROMANESQUE AND GOTHIC PERIODS (C).
Art of the High Middle Ages: Romanesque and Gothic art with emphasis on architecture, monumental sculpture and painting in western Europe.

233. ISLAMIC ART AND ARCHITECTURE I (C).
Survey of the art and architecture of the Islamic peoples. Origins of Islamic art and institutions in the Near East, and its development throughout the Islamic world to the eve of the Mongol invasions in the thirteenth century.

235. ISLAMIC ART AND ARCHITECTURE II (C).
Survey of the art and architecture of the Islamic peoples, beginning in the thirteenth century. The art of the Mongols and Timurids in Iran and the Mamluks in Egypt, through the great Turkish, Iranian, and Indian Islamic cultures of the sixteenth century and beyond.

245. ITALIAN ART OF THE EARLY AND HIGH RENAISSANCE (1400-1520) (C).
The development of Italian art and architecture of the fifteenth and early sixteenth centuries in historical context.

247. ITALIAN ART OF THE LATE RENAISSANCE AND MANNERISM (C).
The dissolution of the High Renaissance; proto-Baroque and early Mannerist art; the courtly Mannerism of the revived feudal class after 1530; the artistic response to the Counter-Reformation. Prerequisite, Art 246 or permission of instructor.

255. BAROQUE ART AND ARCHITECTURE IN ITALY (C).
Art and architecture in Italy from 1600 to 1750, with emphasis on Rome. Students are encouraged to take Art 113 or 115 before this course.

261. THE ARTS OF AFRICA, OCEANIA, AND PRE-COLUMBIAN AMERICAS (C).
An introduction to the so-called "primitive arts" of traditional peoples of Africa, Oceania and pre-Columbian Americas.

263. AFRICAN ART (C).
A survey of ancient, traditional, and contemporary art and architecture of Western and Central Africa, with emphasis on art in its cultural context.

265. BAROQUE ART AND ARCHITECTURE IN NORTHERN EUROPE (C).
Art and architecture in France, Flanders, Holland, Germany, and Austria from 1600 to 1750. Students are encouraged to take Art 113 or 115 before this course.

271. ART OF INDIA (C).
The effect of the great Eastern religious movements on art in India and surrounding territories. Some attention to secular art and architecture in modern times.

273. THE HINDU TEMPLE (C).
The conception and development of the Hindu Temple in South and Southeast Asia, with emphasis on the structural traditions of the regions covered.

275. CHINESE PAINTING (C).
Shang tomb paintings, Han, Sung, Yuan, Ming and Ch'ing dynasty art, and the interplay between the art of Japan and the West.

277. ART OF BUDDHISM (C).
The development of Buddhist arts as they spread through Central Asia into East Asia and through Southeast Asia. The influence of the changing religion on the arts.

285. EUROPEAN ART, 1780-1880 (C).
Major developments in painting from David to Post-Impressionism in France, England, and Germany.

287. MODERN ART, 1880 TO THE PRESENT (C).
Major artists such as late Cezanne and Gauguin, Picasso, Matisse, Klee, Jackson Pollock, Optical and Pop artists. Main developments of style in relation to these artists.

291. 19th CENTURY ARCHITECTURE (C).
Developments in the late 18th century, and history of changes in style, technical advances, and aesthetic principles during the 19th century in Europe and America.

293. 20th CENTURY ARCHITECTURE (C).
Developments in modern architecture in Europe and America from 1900 to the present, including influential personalities, social and political influences, structural innovations, and aspects of city planning.

295. AMERICAN ART (C).
The earliest colonial art, the impact of later European influences, regional art of the 19th and 20th centuries, and contemporary developments.

305. ART OF EARLY MEDITERRANEAN CULTURES (C).
Brief consideration of Paleolithic-Neolithic background; emphasis on the high cultures of the Bronze Age; Egypt (and related Tigris-Euphrates lands); Minoan and Helladic; Hittite and derived. Also, Cyprus, Assyrian and Syro-Palestinian in first millenium. Prerequisite, Art 115 or permission of instructor.

325. MEDIEVAL PAINTING (C).
Early Christian murals and mosaics; Byzantine painting; early and later medieval painting in Western Europe; stylistic parallels in manuscript illumination and stained glass. Prerequisites, Art 111, 115, 225, 227 or permission of instructor.

363. SEMINAR ON AFRICAN ART (C).
Emphasis on methodology, authentication, and in-depth stylistic analysis of traditional African art. Prerequisite, Art 263 or permission of instructor.

365. ASPECTS OF NORTHERN EUROPEAN BAROQUE (C).
Selected aspects of Art or Architecture in France, Flanders, Holland, Germany, or Austria from 1600 to 1750. Treated in a combination lecture-seminar of limited size. Prerequisite, Art 255, 265 or permission of instructor.

371, 373. GREAT THEMES IN ART HISTORY (C).
Central themes, issues, and problems of an important area in the history of art. Prerequisite, a survey level course bearing on the particular theme to be examined, or permission of instructor.

375, 377. MASTERS OF WESTERN ART (C).
Intensive study of the work of a master in the field of art. Permission of instructor. 1 or 2 class hours.

381, 383. METHODS OF ART HISTORY (C).
An introduction to the methods of study in this field, emphasizing different approaches to the work of art. Recommended for art history majors; open to other qualified students. Permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391. ROMAN ART (C).
Origins and development of Roman architecture, portraiture, historical relief, painting and mosaics. Prerequisites, Art 115 or 205, or Ancient History or permission of instructor.

393. CRITICISM OF MODERN ART (SEMINAR).
Practical exercises in the evaluation of modern paintings. Discussion of the results.

397. ASPECTS OF AMERICAN ARCHITECTURE (C).
Selected aspects of the history of changes in style, technical advances, or aesthetic principles of architecture in the United States. Prerequisite, permission of instructor.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

Asian Studies

Chairmon of Progrom: Associate Professor William Naff. Assistant Professors Cohen, Kitagawa, Lynn, Ozawa, Teng; Associated Faculty: Maki (Political Science), Miller (Comparative Literature).

Major programs can be arranged in either Chinese or Japanese language and literature in which students may place emphasis on either modern or classical language. Students in either major program receive training designed to provide them with a substantial foundation in reading, speaking, and understanding the language, as well as with a basic knowledge of the respective literatures and their cultural contexts. Students are encouraged to acquire a background in the history, government, society, religion, and arts of China and Japan—a background essential for an understanding of the cultures and literatures of the Chinese and Japanese people. Assistance in designing a major program may be obtained at the Asian Studies Program Office, 804 Thompson Hall.

In addition to the courses listed below, various departments in the University (and Five College system) offer courses dealing with specific aspects of China, Japan, and other parts of Asia. Consult the offerings of the Departments of Anthropology, Art, Comparative Literature, Geography, History, Political Science, and Sociology.

LANGUAGE AND LITERATURE

CHINESE

126 (I). INTENSIVE ELEMENTARY CHINESE (C).
For those with no previous training in Chinese. Intensive introduction to the standard language (Mandarin) of China. 5 class hours.
Credit, 6. Mr. Teng.

146 (II). INTENSIVE ELEMENTARY CHINESE (C).
Intensive training in conversational Mandarin and in composition. Systematic introduction of 600 basic Chinese logograms. Prerequisite, Chinese 126. 5 class hours.
Credit, 6. Mr. Teng.

226 (I). INTENSIVE INTERMEDIATE CHINESE (C).
Intensive instruction in Mandarin. Development of skills in reading, writing, and speaking Chinese. Prerequisite, Chinese 146 or equivalent. 5 class hours.
Credit, 6. Mr. Lynn or Mr. Miller.

227 (II). INTENSIVE INTERMEDIATE CHINESE (C).
Intensive introduction to modern Chinese literature. Analysis and discussion of basic modern literary texts. Prerequisite, Chinese 226 or equivalent. 5 class hours.
Credit, 6. Mr. Lynn or Mr. Miller

275 (I). SYNTACTIC STRUCTURES OF CHINESE (C).
Synchronic study of the syntactic structures of Mandarin. Survey of the development of Chinese syntactic theories during this century. Critical investigation of current issues in Chinese syntax. Prerequisite, Chinese 227. Mr. Teng.

326 (I). READINGS IN CONTEMPORARY CHINESE LITERATURE (C).
Intensive introduction to modern essays and short stories by famous modern writers such as Lu Hsun, Mao Tun, and Kuo Mo-jo. Prerequisite, Chinese 227. 5 class hours.
Credit, 6. Mr. Miller or Mr. Lynn.

327 (II). READINGS IN CHINESE COMMUNIST LITERATURE (C).
Intensive introduction to literary, social, and political writings by important Chinese Communist writers and thinkers. Prerequisite, Chinese 326. 5 class hours.
Credit, 6. Mr. Miller or Mr. Lynn.

350 (I). ELEMENTARY CLASSICAL CHINESE (C).
Introduction to the literary language of China that was used in all types of literature, scholarship, and documents until the 20th century. Stress on grammar with introduction to various tools for philological analysis of texts. Prerequisite, Chinese 146 (or two semesters of any modern Chinese language); or Japanese 227 (or equivalent). 4 class hours.
Credit, 4. Mr. Cohen.

351 (II). INTERMEDIATE CLASSICAL CHINESE (C).
Readings in a variety of prose and verse mostly selected from medieval Chinese writings. Emphasis on increasing reading speed and extending vocabulary. Prerequisite, Chinese 350. Mr. Cohen.

370 (II). INTRODUCTION TO CHINESE PHILOLOGY AND BIBLIOGRAPHY (C).
Development of familiarity with a wide range of philological methods relevant to the interpretation of Chinese texts and with the basic reference and bibliographic works necessary for efficient use of Chinese primary source materials. Prerequisite, Chinese 350. Mr. Cohen.

375 (II). HISTORY OF THE CHINESE LANGUAGE (C).
Survey of modern Chinese dialectology. Diachronic studies of the grammatical and phonological structures of Chinese in three stages: Archaic, Ancient, and Modern. Prerequisite, two years of Chinese (Cantonese or Mandarin). Mr. Teng.

JAPANESE

126 (I). INTENSIVE ELEMENTARY JAPANESE I.
For those with no previous training in Japanese. Intensive introduction to Japanese. 5 class hours.
Credit, 6. Mr. Kitagawa.

146 (II). INTENSIVE ELEMENTARY JAPANESE II (C).
Intensive study and review of the basic structure of Japanese: reading, writing and conversation. Prerequisite, Japanese 126. 5 class hours.
Credit, 6. Mr. Kitagawa.

226 (I), 227 (II). INTENSIVE INTERMEDIATE JAPANESE I, II (C).
Intensive reading and analysis of literary texts; discussion in Japanese. Prerequisite, Japanese 146; 226 is prerequisite to 227. 5 class hours.
Credit, 6 each. Mr. Ozawa.

320 (I), 321 (II). READINGS IN HUMANITIES I, II (C).
Intensive reading and discussion, in Japanese, of modern Japanese literary, scholarly and journalistic materials. Prerequisite, Japanese 227; 320 is prerequisite to 321. Mr. Naff.

LECTURE COURSES (Knowledge of an Asian language not required)

ASIAN STUDIES 150. THE DEVELOPMENT OF MODERN ASIA (D).
Problems of the nations of East and Southeast Asia created by the transition from traditional, pre-modern status to modern nationhood and full involvement in world affairs. Primarily for students with no background of study of modern Asia. Mr. Maki.

JAPANESE 230 (I), 231 (II). JAPANESE ART AND CULTURE (C).
The development of Japanese art (mainly painting, sculpture, and architecture) from the Archaeological Age to the end of the Muromachi Period in 1573 (I), and then to the present day (II). Particular attention to cultural and historical background and to the relations between written materials and artistic works. Class organized around lectures, slides, and discussions. (230 is *not* prerequisite to 231.) Mr. Ozawa.

ASIAN STUDIES 269 (I). INDIA AND SOUTH ASIA (D).
Recent political, economic, and social developments in India and countries of South and Southeast Asia. By permission may be counted for major credit in political science and sociology. Prerequisites, at least two semester courses in one or more of the following fields: economics, political science, sociology. Mr. Driver.

ASIAN STUDIES 385 (I), 386 (II). SPECIAL PROBLEMS.

ASIAN STUDIES 398 (I). DEPARTMENTAL HONORS.
Credit, 1-9.

ASIAN STUDIES 399 (II). DEPARTMENTAL HONORS.
Credit, 1-6.

RELATED COURSES:
COMPARATIVE LITERATURE
240 (I). Fiction East and West (C).
241 (I). Contemporary Chinese Literature (C).
242 (II). Chinese Traditional Vernacular Literature (C).
243 (I). Japanese Literary Tradition I (C).
244 (II). Japanese Literary Tradition II (C).
251 (I). Contemplative Prose East and West (C).

Biochemistry

Head of Department: Professor R. C. Fuller; Professors Little, Westhead; Associate Professors Gawienowski, Nordin, Robinson; Assistant Professors Fournier, Mason, Parsons, Silverstone.

The sample curriculum outlined below conforms to college requirements and closely follows recommendations made at the Symposium on Pregraduate Education in Biochemistry held by the American Society of Biological Chemists in 1965.

First Year: Chemistry 113-114, Mathematics 135-136, Elementary Biology (I-II) (selected from Botany, Microbiology, Zoology, in any order), German 101-120, Rhetoric (I, II).

Second Year: Chemistry 165-166 or 261-262, Chemistry 167-168 or 263-264, Mathematics 165, Physics 141-142, German 130-140 and Humanities (I, II).

Third Year: Biochemistry 223-224, Biochemistry 225-226, Chemistry 210 (I)—Elementary Biological Science (II), Chemistry 281-282 or 285-286, 287, Social Sciences (I, II), Humanities (I or II), Computer Science (II).

Fourth Year: Advanced Chemistry and/or Biology (I, II), Biochemistry 388 (I), 385 (I), 386 (II), Social Science (I or II).

120 (II). INTRODUCTION TO BIOCHEMISTRY (E).
A brief introduction to biochemistry as a terminal course for students whose professional objectives do not necessitate more extensive training in chemistry. Prerequisite, Chem 112 or 110. 3 class hours, 1 3-hour laboratory period.
Credit, 4.

220 (I). ELEMENTARY BIOCHEMISTRY (E).
The more important facts relating to the chemistry of biological materials and processes. Primarily for students not eligible for Chemistry 223. Not open to chemistry majors. Prerequisite, Chem 160 or 261. 3 class hours, 1 3-hour laboratory period.
Credit, 4. Mr. Nordin.

222 (II). GENERAL BIOCHEMISTRY (E).
A special section of Biochemistry 223 primarily for Zoology majors. Prerequisite, Chem 261 and 262 (concurrently).

223 (I), 224 (II). GENERAL BIOCHEMISTRY (E).
A broad introduction to the general field of biochemistry for students majoring in chemistry or in the biological sciences, and a background for more advanced or specialized study in this field. Prerequisites, Chem 166 or equivalent. Required of all biochemistry majors. Mr. Little.

225 (I), 226 (II). GENERAL BIOCHEMISTRY LABORATORY.
For biochemistry majors and beginning graduate students in biological sciences. Lab material on laboratory techniques useful in solving problems in biochemical research.
Credit, 1. Mr. Nordin.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-6.

388 (I). SENIOR SEMINAR.
Topics of current biochemical interest.
Credit, 1-3.

Botany

Head of Department: Professor Otto L. Stein. Professors Bierhorst, H. Bigelow, Davis, Livingston, Lockhart, Schuster, Shapiro, Smith, Swanson, Tippo; Associate Professors M. Bigelow, Klekowski, Mulcahy, Stern, Wilce; Assistant Professors Barrett, Fultz, Godfrey, Raudzens, Rubinstein, Thompson, Walker, Webster. Herbarium Curator Ahles.

Programs in Botany prepare students for teaching and/or research in high school, colleges, universities, industry or experiment stations. Specific departmental major requirements are currently being reevaluated, thus changes might be anticipated and interested students should contact the Chief Adviser for last minute changes. At present majors preparing for graduate training in Botany (rather than for secondary school teaching) must take:

Chemistry: 111-112

Chemistry: 261-262 or 160 and one of the following: Botany 212, Biochemistry 220, Physical Chemistry 281

Mathematics: Math 127-128 (Calculus for Life and Social Sciences), or two of the following courses, Math 112 (Finite Math), Statistics 231 (Intro. to Fundamentals of Stat.), or Comp. Sci. 120 (Intro. to Problem Solving)

Physics: 141-142

Zoology: 240 (Genetics)

Foreign language: (See below)

Botany: 100 or 101 or 103, 211 (Physiology), 303 (Morphology, one semester), 221 or 222 (Ecology), 291 (Anatomy), 281 (Taxonomy), 311 (Cytology), 228 (Principles of Evolution)

Students are strongly encouraged to take a course in Microbiology (Microbiology 250 is preferred, but 140 is acceptable). Students who have had no high school Zoology or who believe their background in Zoology to be inadequate, should take Zoology 101. For the concentrate in Botany, knowledge of a foreign language is strongly recommended and German, Russian, French or Spanish, in that order, are preferred.

Students planning to teach in secondary schools taking a concentration in Botany must take the following courses:

Chemistry: 111-112, 160, Biochemistry 220 or Botany 212 or Physical Chemistry 281

Mathematics: Math 127-128 (Calculus for Life and Social Sciences), or two of the following courses, Math 112 (Finite Math), Statistics 231 (Intro. to Fundamentals of Stat.), or Comp. Sci. 120 (Intro. to Problem Solving)

Physics: 141-142

Zoology: 101, 240 and one other zoology course with Zoology 101 as a prerequisite or Microbiology 140 or 250

Botany: 100 or 101 or 103, 125 (Plant Kingdom) or 303 (Morphology), 126 (New England Flora), 221 (Physiology), 228 (Principles of Evolution) and at least 9 additional credits in Junior-Senior botany courses

Additional requirements for certification must be completed in Psychology and in Education. The requirements in Psychology are: Psych. 101 (Elementary Psychology), and either Psych. 263 (Adolescent Psychology) or Psych. 301 (Educational Psychology), to be completed in the sophomore year. Education requirements are: Educ. 387 (Prepracticum—Kids, Schools, and the School of Education: An Introduction), either in freshman year or first semester sophomore year; Educ. 251 (Foundations of Education) or equivalent, either in sophomore or first semester junior year; Educ. 386 (Teaching Science in Secondary Schools), second semester junior year; and Educ. 285 (Student Teacher Internship Program), a full semester, senior year. Approval for the Internship assignment should be arranged in the junior year.

For additional information concerning this or other programs designed for teacher training, see John M. Adams, Coordinator of Academic Affairs, CAS/Education, E-26 Machmer Hall.

100 (I), (II). INTRODUCTORY BOTANY (E).
Structure, function and reproduction of plants, dealing primarily with the flowering plants. Basic biological principles emphasized. Not to be taken serially with Botany 101. 3 class hours, 1 3-hour laboratory period.
Credit, 4.

101 (I), (II). GENERAL BOTANY (E).
An introduction to basic biological principles of organization, development and evolution, using botanical illustrations. The foundations and approach in biological research, and the consequence of this research on human thought and experience. Not open to science majors without permission of major department. Not to be taken serially with Botany 100. 2 class hours, 1 demonstration-discussion hour.

121. PLANTS AND ENVIRONMENT (E).
The interrelationships between plants and their environment, emphasizing the impact of man's influence and control on the economy of natural biological areas. Designed for non-science majors. 2 class hours, 1 3-hour laboratory period. Not open to science majors without permission of major department. Mr. Livingston.

125. THE PLANT KINGDOM (E.)
A general survey of the morphology, reproduction, distribution, and importance of the slime molds, bacteria, algae, fungi, lichens, liverworts, mosses, ferns and seed plants. Prerequisite, Botany 100 or 101. 2 class hours, 1 2-hour laboratory period.
Mr. Davis, Mr. Bigelow.

126 (I), (II). NEW ENGLAND FLORA (E).
Identification of local flora (vascular) with emphasis on terminology of fruits, leaves, flowers, etc. Prerequisite, Botany 100 or 101. 2- and 3-hour laboratory periods with lecture combined. Several field trips. Mr. Ahles.

175 (I), (II). GENETICS AND EVOLUTION (E).
Survey of the cell and those fundamental genetic principles which are the basis of evolution. Origin and history of organic evolution. Mechanisms of evolution. Intended for non-science majors.
Mr. Stein, Mr. Klekowski, Mr. Webster.

200 (I). NATURAL HISTORY (E).
See Zoology 200. Mr. Godfrey.

211 (II). INTRODUCTORY PLANT PHYSIOLOGY.
Differentiation, growth, nutrition, and the communication between plant and environment used to illustrate the means by which plants function. Prerequisites, Botany 100 or 101, and at least one semester of Organic Chemistry. 3 class hours, 1 3-hour laboratory period.
Credit, 4. Mr. Rubinstein, Mr. Stern, Mr. Thompson.

212 (I), (II). PLANT METABOLISM.
The chemical operation of plants, emphasizing the enzymatic processes involved in the synthesis and breakdown of the more important chemical constituents of plants. Prerequisites, Botany 211, Chem 160 or equivalent. 2 class hours, 1 4-hour laboratory period.
Credit, 4. Mr. Stern, Mr. Jennings, Mr. Marsh, Mr. Rubinstein, Mr. Thompson.

215. PLANT GROWTH.
The physiology, kinetics and energetics of plant growth. The growth of plant cells, whole plants, assemblages of plants, and plant productivity. Prerequisites, Botany 211, one year of introductory chemistry, and one year of introductory physics. Courses in differential calculus, statistics, and/or biochemistry are recommended. Mr. Lockhart.

219. ECOLOGICAL PLANT PHYSIOLOGY.
Physiology of plants in relation to the classes of problems they face and the various strategies evolved for survival and growth. Prerequisite, Botany 211, one semester of differential calculus.
Mr. Lockhart.

221 (I). PLANT ECOLOGY.
Interrelationships between plants and their environment, with emphasis on the structure and development of plant communities. Prerequisite, Botany 100 or Botany 101; Botany 126 and 211 recommended. 2 3-hour class-laboratory periods. Mr. Godfrey, Mr. Mulcahy.

222. AUTECOLOGY.
Plant behavior in relation to the physical and biological environment, with emphasis on the ecology of individual plants. Prerequisites, Botany 211 and 221.
Mr. Godfrey, Mr. Livingston.

226. PLANT GEOGRAPHY.
Principles governing the development and natural distribution of plants and plant communities. Consideration of the vegetation of North America. Prerequisite, Botany 221; Botany 281 recommended.
Mr. Godfrey, Mr. Livingston.

228. PRINCIPLES OF EVOLUTION.
Ecological phenomena through the application of genetic concepts. The adaptation of individuals, populations, and communities as functional units.

Prerequisite, Introductory Genetics or permission of instructor.
Mr. Mulcahy.

231 (II). MYCOLOGY.
Fungi, their life history and distribution, their significance in disease, their utilization by man. Prerequisite, Botany 125 or permission of instructor. 2 class hours, 1 3-hour laboratory period.
Mr. Bigelow, Mrs. Bigelow.

240 (I), (II). PRINCIPLES OF GENETICS.
Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution. Prerequisites, Botany 100 or Botany 101, Zool 101, Chem 112 or 114. See Zoology 240

241 (I). PHYCOLOGY.
The phylogeny, taxonomy, morphology and ecology of the major group of the marine and fresh-water algae. Field work. 2 class hours, 1 2-hour laboratory period. Mr. Wilce.

251 (II). THE ARCHEGONIATES.
The morphology, evolution and systematics of bryophytes, ferns and their allies. 2 class hours, 1 3-hour laboratory period. Mr. Schuster.

255. EXPERIMENTAL PTERIDOLOGY.
Physiological and genetical parameters of the pteridophyte life cycle, integrated to give an overall biological view. The research potential of these organisms will be stressed. Prerequisites, Botany 240 or Zool 240, and Botany 211.
Mr. Klekowski.

261 (I). BIOLOGY OF LOWER PLANTS.
The use of fungi and algae as experimental organisms for investigations in physiology and genetics. Prerequisite, Botany 211, Zool 360, or Chem 224. 2 class hours, 2 3-hour laboratories.
Credit, 4. Miss Fultz.

270 (II). CYTOGENETICS.
Correlation of genetic data with the behavior of chromosomes, including an analysis of the mechanism of crossing over. Consideration of the evolution of chromosomal systems, including the following: genetic control of meiotic behavior, karyotype modifications, structural changes, sex-determining mechanisms, polyploidy, deviant meiotic behaviors, and primate systems. Prerequisites, Botany 311 and either Botany 240 or Zool 240. Mr. Swanson.

280. ORIGIN, EVOLUTION, AND DISTRIBUTION OF FLOWERING PLANTS.
Survey of evolutionary history of primitive flowering plants and the significance of their geographic distribution. Prerequisite, Botany 125 or equivalent. Recommended, Botany 281, 291. 3 class hours, 1 2-hour seminar/discussion.
Credit, 4. Mr. Smith.

281 (II). INTRODUCTORY ANGIOSPERM SYSTEMATICS.
The evolution and systematics of flowering plants emphasizing families and their relationships. Prerequisite, Botany 100 or 101. 3 class hours, 1 3-hour laboratory period. *Credit*, 4. Mr. Walker.

291 (I). PLANT ANATOMY AND HISTOLOGICAL METHODS.
Origin and structure of vegetative and reproductive organs of seed plants coordinated with exercises in preparation of stained slides for microscopic studies. Prerequisite, Botany 125 or permission of instructor. 2 class hours, 3 2-hour laboratory periods.
Credit, 4. Mr. Bierhorst.

301 (I). MORPHOGENESIS.
The development of plant form and structure at the level of cells and organs. Illustrations drawn from controlled experiments on the contribution of internal and external factors. 2 class hours, 1 3-hour laboratory-discussion period. Mr. Stein.

303, 304. PLANT MORPHOLOGY.
The life cycles of various plant taxa, the dynamics of their evolution and the interpretation of various morphological structures. Prerequisite, Botany 100 or permission of instructor. 2 class hours, 2 2-hour laboratory periods.
Credit, 4. Mrs. Bigelow, Mr. Bierhorst, Mr. Schuster, Mr. Wilce.

311 (I). CYTOLOGY.
Introduction to microscopy; nuclear duplication and division; nuclear function in cell development; structure, function and development of cellular membrane systems, with special reference to chloroplasts and mitochondria. 2 class hours, 1 2-hour laboratory period.
Mr. Webster.

335 (I). AQUATIC VASCULAR PLANTS.
Systematics, ecology and fundamental importance of aquatic plants. Designed for majors in Wildlife. Prerequisites, Botany 100, 126. 2 3-hour class-laboratory periods. *Credit*, 1-3. Mr. Ahles.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-4.

387. NATURAL HISTORY OF MAN.
Man's changing view of himself as a result of scientific discoveries; his reorientation in space and time; his origin within the vertebrate group; his uniqueness as a species and as an individual, based on anatomical, cytological and genetic evidence; his biological antecedents which made the development of culture possible; and his future as an animal and a human being in an environment of finite capacity.
Mr. Swanson.

399. DEPARTMENTAL HONORS.
By arrangement. *Credit*, 1-4.

Chemistry

Head of Department: Professor William E. McEwen. Professors Archer, Brandts, Cannon, Carpino, Chien, Holmes, Lillya, Miller, Ragle, Rausch, Richason (Associate Head), Roberts, Siggia, Smith, Stein, Stengle; Associate Professors Cade, Chandler, Curran, George, MacKnight, McWhorter, Rowell, Stidham, Uden, Wood; Assistant Professors D. Barnes, R. Barnes, Collins, Hixson, Oberlander, Rhodes, Williams, Wynne, Zajicek; Instructors Bernasconi, Reed, Turner.

Information on the chemistry curriculum may be obtained from Professor George Richason, the departmental Chief Adviser.

101 (I), 102 (II). GENERAL CHEMISTRY FOR NON-SCIENCE MAJORS (E).
The fundamental chemical laws and theories, as taught through the discussion of such topics as "Our Environment", "Energy Sources", "The Chemistry of Life", etc. Chem 102 is a continuation of Chem 101. The sequence does not satisfy the prerequisites for advanced chemistry courses. 2 class hours. 1 2-hour quiz-demonstration. Mr. Richason.

110 (II). GENERAL CHEMISTRY (E).
The fundamental chemical laws and theories. Meets minimum prerequisite requirements of Chem 160 and Biochem 120 or 220. 2 class hours, 2 quiz hours, 1 2-hour laboratory period.
Credit, 4. Mr. Richason.

111, 112. GENERAL CHEMISTRY (E).
The fundamental chemical laws and theories. Provides a sound scientific training. For engineers and other students planning to take advanced courses in chemistry. 2 class hours, 1 quiz hour, 1 2-hour laboratory period.
Mr. Richason.

113 (I), 114 (II). GENERAL INORGANIC CHEMISTRY (E).
The fundamental chemical laws and theories, including the elements of qualitative analysis. For students planning to major in chemistry and others for whom the course is a departmental requirement. Prerequisite, secondary school chemistry. 2 class hours, 2 3-hour laboratory periods.
Credit, 4. Mr. Richason.

127 (I), (II). ANALYTICAL CHEMISTRY (E).
The principles of analytical chemistry, for students not majoring in chemistry. Basic laboratory techniques and operations of quantitative analysis. Prerequisite, Chem 112 or 114. 2 lectures, 2 3-hour laboratory periods. *Credit*, 4.

160 (I). ORGANIC CHEMISTRY (E).
For students whose major department does not require a year course in organic chemistry. Concurrent enrollment in Chem 162 required. Prerequisite, Chem 110 or 112.

162 (I). ORGANIC CHEMISTRY LAB.
A laboratory survey of the chemistry of the major functional groups. Concurrent enrollment in Chem 160 required. 1 3-hour laboratory period. *Credit*, 1.

165 (I), 166 (II). ORGANIC CHEMISTRY FOR MAJORS (E).
The chemistry of carbon compounds with an emphasis on relationships between molecular structure, chemical properties and reaction mechanisms. Surveys the types of problems a modern organic chemist can solve and his methods of attack. Concurrent enrollment in Chem 167 or 168 required. Prerequisite, Chem 112 or 114.

167 (I), 168 (II). ORGANIC LAB FOR MAJORS.
Application of the experimental techniques of organic chemistry to the preparation, purification and identification of organic compounds. Concurrent enrollment in Chem 165 or 166 required. 1 3-hour laboratory period. *Credit*, 1.

210 (I). QUANTITATIVE CHEMICAL ANALYSIS.
The principles and practices of titrimetric and gravimetric analysis; separation methods; introduction to physical methods. Primarily for chemistry majors and others needing more detailed treatment than given in Chem 127. Prerequisite, Chem 114 and 166. 2 lectures, 2 4-hour laboratory periods. *Credit*, 4.

213 (I). INSTRUMENTAL ANALYSIS.
The theory and practice of modern analyses utilizing optical, electrical, and thermal properties. Selected modern separation methods may also be included. Prerequisites, Chem 210, 286. 2 class hours, 1 4-hour laboratory period.

215 (II). THEORY OF ANALYTICAL PROCESSES.
A detailed consideration of analytical topics, such as chemical equilibrium, precipitate formation, chelating agents, multistage separation, etc., having general applicability in chemical investigations. Prerequisites, Chem 166 and 286. (Laboratory optional, 1 extra credit.)

216 (I), (II). CHEMICAL MICROSCOPY.
Optics of the microscope, micrometry, microscopic study of fibers, crystals, physicochemical phenomena, qualitative analysis and an introduction to electron microscopy. Prerequisite, Chem 213 or permission of instructor. 2 3-hour laboratory periods. *Credit*, 2. Mr. Roberts.

217 (I), (II). MICROQUANTITATIVE ANALYSIS.
Quantitative determination of carbon, hydrogen, oxygen, nitrogen, sulfur, halogens and phosphorus. Both organic and inorganic compounds will be included in microgram scale analyses. Prerequisite, Chem 213 or permission of instructor. 1 4-hour laboratory period. *Credit*, 1.

219 (I). ELECTRONICS INSTRUMENTATION FOR SCIENTISTS.
Laboratory oriented course designed for scientists which begins with electronic principles and leads through servo-systems, operational amplifiers, digital circuits, and other measurement devices. Prerequisite, one year of physics and permission of instructor. 1 class hour, 1 4-hour laboratory period. Mr. Curran.

244 (II). RADIOCHEMISTRY.
The character of atomic nuclei, nuclear reactions, radiation and its detection, and techniques for the study and utilization of radionuclides. Prerequisite, Chem 127 or 210, or permission of instructor. 3 class hours, 1 3-hour laboratory period. *Credit*, 4. Mr. Richason.

246 (I), (II). THEORETICAL INORGANIC CHEMISTRY.
A survey of theoretical aspects of inorganic chemistry. Topics include electronic structure and its relation to periodic properties, chemical bonding, molecular structure, coordination chemistry, acid-base theory, non-aqueous systems, and reaction mechanisms. Prerequisite, Chem 285.

247 (II). INORGANIC CHEMISTRY OF THE COMMON ELEMENTS.
The common elements and their compounds; the periodic relationships and modern concepts of structure and bonding. An optional two-credit laboratory provides an introduction to inorganic laboratory techniques and practices. Prerequisite, Chem 246, or permission. 3 class hours (6 laboratory hours optional). *Credit*, 3 (or 5).

261, 262. ORGANIC CHEMISTRY FOR NON-MAJORS (E).
A two-semester sequence. The chemistry of carbon compounds, with emphasis on the relationship between molecular structure and chemical properties. A background for understanding organic systems encountered in other fields. Concurrent enrollment in Chem 263 or 264 required. Prerequisite, Chem 112 or 114.

263, 264. ORGANIC LAB FOR NON-MAJORS.
Application of the experimental techniques of organic chemistry to the preparation, purification, and analysis of organic compounds. Concurrent enrollment in Chem 261 or 262 required. 1 3-hour laboratory period. *Credit*, 1.

269 (II). ADVANCED ORGANIC CHEMISTRY LABORATORY.
Continuation of Chem 168. Preparations involving special techniques and use of the literature of organic chemistry. Prerequisite, Chem 166, 168. 2 3-hour laboratory periods. *Credit*, 2.

271 (II). ADVANCED ORGANIC CHEMISTRY.
An intensive survey of aliphatic and aromatic chemistry with emphasis on scope and limitations of reactions; mechanisms and recent developments. Prerequisite, one year of Organic Chemistry.

272 (I). QUALITATIVE ORGANIC CHEMISTRY.
Identification of unknowns, both single and mixtures of organic compounds, by physical properties, reactions and preparation of derivatives. Prerequisite, one year of Organic Chemistry. 2 class hours, 2 3-hour laboratory periods. *Credit*, 4.

281 (I). ELEMENTARY PHYSICAL CHEMISTRY.
For students with a limited mathematical background. Not open to chemistry majors. Prerequisites, Chem 112 or 114; Physics 142; Math 136.

282 (II). ELEMENTARY PHYSICAL CHEMISTRY.
A continuation of Chem 281. 2 class hours, 1 3-hour laboratory period.

285 (I), 286 (II). PHYSICAL CHEMISTRY.
The fundamental theories and laws of physical chemistry. Prerequisites, Math 165; Physics 142 or 162. Corequisites, Chem 210 or 127.

287 (I), (II), 288 (I), (II). PHYSICAL CHEMISTRY LABORATORY.
Experience in modern physicochemical techniques. Prerequisites, Chem 210; Math 165; Physics 142 or 162; or permission of instructor. Concurrent enrollment in Chem 285, 286. 1 4-hour laboratory period. *Credit*, 2.

294 (II). ADVANCED PHYSICAL CHEMISTRY.
A survey of modern physical chemistry with emphasis on the fundamentals of quantum mechanics and statistical mechanics. For students not taking further advanced work in these areas. Prerequisite, Chem 286.

295 (I). ADVANCED PHYSICAL CHEMISTRY.
Topics such as chemical thermodynamics, statistical mechanics, introductory quantum chemistry and theories of gases, liquids and solids. Prerequisite, Chem 286.

381 (I). CHEMICAL LITERATURE.
Intended to give facility in the location of information of a chemical nature. Prerequisites, Chem 166, 286, and a reading knowledge of German, or permission of instructor. 1 class hour. *Credit*, 1. Mr. Uden.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit*, 1-3.

388 (II). INTRODUCTION TO RESEARCH.
Admission by permission of department. Each student assigned some special subject or problem in one of the several fields of chemistry. By arrangement. 10 laboratory hours. *Credit*, 5.

398, 399. DEPARTMENTAL HONORS.
By arrangement. *Credit*, 6.

RELATED COURSES:
BIOCHEMISTRY
120 (II). Introduction to Biochemistry.
220 (I). Elementary Biochemistry.
223 (I), 224 (II). General Biochemistry.
225 (I), 226 (II). General Biochemistry Laboratory.

Classics

Head of Department: Professor Gilbert Lawall; Professors Dyer, Phinney; Associate Professor Cleary; Assistant Professors Goar, Will; Instructors Beck, Isbell, Marry; Lecturers Artinian, Baron, Reiner.

The Classics major offers considerable program flexibility. Emphasis may be placed on Greek and/or Latin language and literature, ancient history, ancient art and archaeology, ancient philosophy, ancient religion and mythology, the classical tradition, or a comparative study of ancient and modern literatures. All majors are expected to complete work in Latin or Greek through the 160 level. Students majoring in Classics as a general liberal arts major might wish to terminate their study of the language at the 160 level and complete their major with courses that require no specific knowledge of Greek or Latin. Students wishing to teach Latin in secondary schools or to prepare for graduate work in Classics would continue with further reading courses in Latin and/or Greek. All majors complete 30 upper level credits in courses chosen in consultation with their adviser to make up a coherent program of classical studies.

The Classics major can be designed to serve any of the following purposes:

1) To provide a meaningful humanistic core in a liberal arts education,
2) To provide training for professional careers in teaching Latin and Classical Humanities on the elementary or secondary levels, or
3) To provide preparation for graduate work in the field leading to a Ph.D. in Classics and teaching on the college level.

Students wishing to teach Latin language and literature or Classical Humanities on the secondary level are strongly urged to equip themselves with a minor (18 credits) in another teaching field, such as Spanish, French, English, history, or social science. For teaching Latin on the elementary school level it is advisable to major in Elementary Education and minor in Classics. Students wishing to teach Latin on the high school level are urged to plan on spending an extra year and a summer or two years in the Master of Arts in Teaching program in Latin and Classical Humanities. As preparation for this program it is recommended that students take educational or adolescent psychology and foundations of education on the undergraduate level. Students preparing for graduate work in Classics leading to the Ph.D. degree should take at least four upper level courses in one ancient language plus at least two in the other and at least four courses in ancient history, art, or philosophy.

CLASSICS

The following courses require no knowledge of Greek or Latin.

100 (I). GREEK CIVILIZATION (C).
A survey of ancient Greek culture and civilization. The impact of the Greek experience on the cultural life of the Western world.

102 (I). ROMAN CIVILIZATION (C).
A survey of ancient Roman culture and civilization. The impact of the Roman experience on the cultural life of the Western world. Mr. Goar.

105 (I). GREEK AND LATIN ELEMENTS IN ENGLISH.
Historical survey of the induction of Greek and Latin words into English; Greek and Latin roots, prefixes, and suffixes which most often appear in the English language; patterns of changes of spelling and meaning; special problems. 1 lecture and 1 practice session. Credit, 2. Mr. Goar.

200 (I). THE HUMANITIES (C).
The humanities and liberal arts in the Greek and Roman world: goals, methods, and successes. Adaptations of humanistic education for leaders down to our own days. Discussion of contemporary educational goals in studying the humanities; uses of "classical" value systems, mythologies, and literary forms. Mr. Dyer.

205 (I). THE MATERIAL WORLD OF THE ROMANS.
The Romans as people on the basis of the archaeological evidence about their daily lives (their houses, pottery, coins, glass, textiles). Special attention to the finds from Pompeii. Mrs. Will.

206 (II). THE ANCIENT CITY.
The city and the rise of city-planning in antiquity in the Near East, Greece, and Italy; stress on sociological and economic aspects. Special attention to the city of Rome and its urbanization in the Roman Empire. Mrs. Will.

225 (I). MYTHOLOGY IN THE ANCIENT WORLD I (C).
A survey of ancient Greek myths with their Babylonian or Hebrew prototypes; authority of written or visual sources; structure of myth; religious, artistic, and social observances. Mr. Phinney.

226 (II). MYTHOLOGY IN THE ANCIENT WORLD II (C).
A survey of ancient Egyptian myths with their Indo-Iranian, Greco-Roman, and early Christian survivals; authority of written or visual sources; structure of myth; religious, artistic, and social observances. May be taken independently of Classics 225. Mr. Phinney.

261 (I). GREEK LITERATURE IN TRANSLATION (C).
Homer, lyric poetry, the major dramatists, selected dialogues of Plato, Herodotus, Thucydides, and their relations to the classical tradition. Mr. Dyer.

262 (II). LATIN LITERATURE IN TRANSLATION (C).
The development of Latin literature from Greek models; the emergence of uniquely Roman forms of comedy, tragedy, epic, lyric, pastoral, satire, history, biography, and novel; their influence on later literatures. Mr. Cleary.

265 (II). GREEK DRAMA IN TRANSLATION (C).
Thematic analysis of Greek tragedies and comedies; typal characterization; cultural, political, and social values as expressed in the plays. Mrs. Reiner.

267 (I). THE ANCIENT NOVEL (C).
The ancient "short story" and the collections of interbraided stories that formed the original prose-fiction novels; the authors' artistic goals and limitations; the nature and needs of the ancient fiction-reading audience; competition with more traditional literary forms; informing contributions to the modern genre of Western novel. Mr. Phinney.

275 (I) or (II). THEMES IN CLASSICAL LITERATURE (C).
Study of a major theme in Classical literature, such as the hero or anti-hero, women, the individual and society, urban problems, the rise of science, religious or philosophical issues.

285 (II). THE DEEP STRUCTURES OF GREEK THOUGHT (C).
The development of thought in the ancient Greek world from the time of Homer down to Aristotle, tracing the evolution of mental concepts and ways of thinking about man and the world around him. Mr. Dyer.

295 (II). INTERPRETING ANCIENT MYTH (C).
A view of what thinkers have said about ancient myth for over 3,000 years; possible reasons for their misreading ancient myth; their prejudices and presuppositions; their shaping of popular modern views of ancient myth; their inability to reach a common definition of myth; future trends of myth interpretation. Mr. Phinney.

The following courses require a reading knowledge of Greek and/or Latin.

308 (II). THE TEACHING OF CLASSICAL HUMANITIES IN SECONDARY SCHOOLS.
Guidance in preparing enrichment

material in Latin language classes and in designing and teaching courses dealing with classical life and institutions, drama, art, mythology, and literature in translation on the secondary school level. Mr. Dyer.

310 (I) or (II). STUDENT TEACHING: CLASSICS.
Supervised practice teaching in secondary schools. By arrangement. Credit, 1-12.

385 (I), 386 (II). SPECIAL PROBLEMS.
Directed independent or group study of some problem or topic in Classical civilization. Credit, 1-3.

GREEK

110 (I). INTENSIVE ELEMENTARY GREEK.
An introduction to the elements of the Greek language. 5 class hours and optional laboratory sessions. Credit, 4. Mrs. Reiner.

140 (II). INTENSIVE INTERMEDIATE GREEK (C).
Mastery of the basic structures of the Greek language and attainment of intermediate competence in reading Greek prose. Prerequisite, Greek 110. 5 class hours and optional laboratory sessions. Credit, 4. Mrs. Reiner.

150 (I), 160 (II). THE READING OF GREEK (C).
The development of increased competence in reading Greek prose.

210 (I). GREEK POETRY (C).
Selections from Homer's *Iliad*.

220 (II). GREEK PROSE (C).
Selections from Herodotus.

385 (I), 386 (II). SPECIAL STUDIES.
Directed independent or group study of some problem in Greek language or literature. Credit, 1-3.

LATIN

110 (I), (II). INTENSIVE ELEMENTARY LATIN.
An introduction to the elements of the Latin language. 3 class hours plus 2 practice periods and optional laboratory sessions. For students with no previous experience with Latin. Credit, 4.

111 (I), (II). INTENSIVE ELEMENTARY LATIN.
Same as 110, but for students who have had 1 or 2 years of Latin in high school. Credit, 4.

112 (I), (II). INTENSIVE ELEMENTARY LATIN: INDEPENDENT STUDIES.
Same course as 111, except that students in 112 will do the work on an independent study basis. 1 class hour. Credit, 4.

113 (I). INTENSIVE ELEMENTARY LATIN: MEDIEVAL.
An introduction to Latin for students wishing to do reading in Medieval Latin authors. Offered on an independent study basis; open only to students who have had some Latin before. 1 class hour. Credit, 4.
(Only one of the four courses above may be taken for credit.)

115 (I), 125 (II). LATIN AS A BASIC LANGUAGE.
An introduction to the elements of the Latin language especially designed for students who are learning a foreign language for the first time and for students who have experienced difficulty in learning foreign languages. Aims at better understanding and use of the English language and a firm basis for further language study. Students move from Latin 125 to any course on the 140 level. May not be taken for credit by students taking Latin 110, 111, 112 or 113.

140 (I), (II). INTENSIVE INTERMEDIATE LATIN (C).
Mastery of the basic structures of the Latin language and attainment of intermediate competence in reading Latin prose. Prerequisites, any one of the above five courses, or 2-3 years of Latin in high school. 3 class hours plus 2 practice periods and optional laboratory sessions. Credit, 4.

142 (I), (II). INTENSIVE INTERMEDIATE LATIN: INDEPENDENT STUDIES (C).
Same course as 140, except that students in 142 will do the work on an independent study basis. 1 class hour. Credit, 4.

143 (II). INTENSIVE INTERMEDIATE LATIN: MEDIEVAL (C).
Graded readings in Medieval Latin authors, accompanied by grammar review. Some of the readings will be chosen to accommodate special interests of the students in the course. 5 class meetings per week. Credit, 4. Mrs. Will.

(Only one of the above three courses may be taken for credit.)

150 (I), (II), 160 (I), (II). THE READING OF LATIN (C).
The development of increased competence in reading Latin prose; extended selections from Livy, Cicero, Sallust, and others. Prerequisites, Latin 140 or 142 or 143 or 3-4 years of Latin in high school. 3 class hours plus optional laboratory sessions.

201 (I), 202 (II). LATIN POETRY (C).
Selections from poets such as Catullus, Horace, Vergil, Tibullus, and Ovid. Prerequisites, Latin 160 or 4-6 years of Latin in secondary school. Open to qualified freshmen. Mr. Cleary, Mr. Goar, Mr. Lawall.

205 (II). ORAL INTERPRETATION OF LATIN LITERATURE.
Practice in the expressive reading of Latin texts. 1 or more class hours. Credit, 1; may be repeated up to 3 credits. Mr. Phinney

215 (I) or (II). GRAMMAR AND STYLE.
The structure of the Latin sentence in representative Latin prose authors. Mr. Dyer.

307 (I). TEACHING THE LATIN LANGUAGE.
Methods and materials for teaching the Latin language in secondary schools. May be coordinated with practice teaching experiences. Credit, 3-6. Mr. Cleary.

308 (II). TEACHING LATIN LITERATURE.
Methods and materials for teaching Latin literature in secondary schools. May be coordinated with practice teaching experiences. Credit, 3-6. Mr. Cleary.

310 (I) or (II). STUDENT TEACHING: LATIN.
Supervised practice teaching in secondary schools. By arrangement. Credit, 1-12.

Two of the following Latin courses (325-333) will be offered each semester.

325. THE LATIN POLITICAL TRACT (C).
Selections from Sallust and Caesar accompanied by an historical and literary analysis of their works.

326. LATIN DIDACTIC EPIC (C).
Selections from Lucretius, Vergil's *Georgics*, and Ovid's *Ars Amatoria*.

327. LATIN HISTORY AND BIOGRAPHY (C).
Selections from Livy, Tacitus, and Suetonius.

328. LATIN DRAMA (C).
Selected plays of Plautus, Terence, and Seneca.

329. LATIN ESSAYS AND LETTERS (C).
The Roman mind as revealed in the philosophical works of Cicero and the moral epistles of Seneca; Roman private life and personal concerns as revealed in the letters of Cicero and Pliny.

330. LATIN ELEGIAC POETRY (C).
Selections from Catullus, Tibullus, Propertius, and Ovid.

331. CICERO'S ORATIONS (C).
The major orations of Cicero; their social and political background.

332. LYRIC POETRY (C).
Selected lyrics of Catullus and Horace.

333. VERGIL'S *AENEID* (C).
The entire poem with attention to traditional and contemporary critical perspectives and evaluations.

385 (I), 386 (II). SPECIAL STUDIES.
Directed independent or group study of some problem in Latin language or literature. Credit, 1-3

391 (I), 392 (II). LATIN SEMINAR. Advanced study of some aspect of Latin literature.

Comparative Literature

Chairman of Department: Professor Warren Anderson. Professor Will; Associate Professors Beekman, Moebius; Assistant Professors Lenson, Levine, Lucid, Martin, Miller; Associated Faculty: Cassirer, S. Lawall, Mankin, Porter (French and Italian), Naff (Asian Studies), Page (English), Schiffer (Germanic Languages).

The undergraduate major in Comparative Literature seeks to provide a more accurate sense of literary history than may be derived from the study of one single literature; it encourages detailed scrutiny of literary masterworks selected from more than one language, place, or time; and it embodies a variety of approaches to an understanding of the meaning and function of literature, considered both in itself and in its interdisciplinary dimensions.

Two different types of major program lead to the B.A. degree in Comparative Literature. One is designed for the student who plans to go on to graduate school in comparative literature or a closely allied field. The other is designed for the student who does not plan to go on to graduate school but wishes to read widely and deeply in two or more literatures during his undergraduate career. A detailed statement concerning these two programs and related requirements may be obtained at the Comparative Literature office.

101. THE FUNCTION OF LITERATURE IN OUR WORLD (C).
The art of literature in the face of other modes of cultural expression. Comparisons and contrasts drawn from contemporary cinematography, practical theater, music, and graphic art as well as from older works of art, both from the Occidental and the Oriental traditions.

201 (I), (II). MODERN EUROPEAN LITERATURE I (C).
The ways in which twentieth-century literature and philosophy have posed and answered questions about the human condition. The political and artistic consequences of the loss of tradition and community. The role of the arts in an age of technology and revolutionary ideology. Readings from Marx, Nietzsche, Malraux, Camus, Brecht, Artaud, and less well-known representative works of Italian literature.

202 (I), (II). MODERN EUROPEAN LITERATURE II (C).
The tradition of aestheticism in modern literature, particularly fiction, focusing on the conflict between beauty and ethics; the Decadent hero as an ancestor and prototype of the passive protagonists of modern narrative; the illusory relationship between art and social deviance.

203 (I), (II). THE EUROPEAN NOVEL: MAN VERSUS SOCIETY (C).
French, Spanish, German, Russian, and English novels of the seventeenth to the twentieth centuries, in the context of the consciousness they reflect, describe, and transcend.

204 (I), (II). CLASSICS OF EUROPEAN LITERATURE (C).
Major works from the earlier literatures of Europe in English translation, with emphasis on a major genre such as the epic or drama. The interdependence of art and general culture, shown through lectures on religion, sociology, politics, and economics.

205. THE ARTIST NOVEL (C).
The artist's search for his roots in landscape and in mythical and legendary prototypes. An introduction to the cultural milieu of the displaced, superculti-vated European of the late nineteenth and twentieth centuries, with emphasis on Joyce and Proust.

211 (I). EUROPEAN LITERATURE OF THE MIDDLE AGES I (C).
Medieval courtly romance and lyric in translation from French, German, Italian, and Middle English. Close analysis of texts; the literary, social, and psychological conventions of courtly poetry. The altered perspectives on those conventions expressed in late medieval poetry.

212 (II). EUROPEAN LITERATURE OF THE MIDDLE AGES II (C).
Medieval allegory and drama in translation from Latin, French, Italian, and Middle English. The development, from the early Christian period, of the allegorical tradition and of the dramatic tradition which evolved from it. The medieval imaginative conventions as expressed in allegory, and the failure of those conventions in allegories and drama of the fourteenth century.

214 (II). DANTE, CHAUCER, AND SHAKESPEARE (C).
Dante's *Commedia*, several of Chaucer's *Canterbury Tales*, and several plays of Shakespeare. Close analysis of texts in their literary and historical contexts. The authors as representative of stages in the development of literary imagination which took place in European literature between the fourteenth and seventeenth centuries.

231 (I). MODERN AFRICAN LITERATURE (C).
An introduction to the modern literature of Africa south of the Sahara, examining such topics as the role of literature and the writer in an emergent country, the blending of Western and indigenous elements in a new literature, and the literary expression of color consciousness.

240. FICTION EAST AND WEST (C).
A comparative approach to major works of fiction and their evolution within the Oriental and Occidental traditions, investigating the various forms, meanings, and uses of traditional fiction in Eastern and Western literature. Special consideration will be given to the encounter of Orient and Occident in twentieth-century examples of prose fiction from the works of Hesse, Forster, Malraux, Salinger, Kerouac, and Brautigan. Readings from Chinese fiction in English translation include *The Way of Chuong-tzu, All Men Are Brothers, Monkey, Prayer Mat of Flesh,* and *Red Chamber Dream.*

241 (I). CONTEMPORARY CHINESE LITERATURE (C).
An introduction to continuity and change in twentieth-century Chinese fiction, drama, and poetry, including both Communist and non-Communist literature of the Chinese mainland. The impact of Western literature on China and the resultant Chinese "Literary Renaissance." The relation between literature and politics in modern China. Special consideration of Chairman Mao Tse-tung's concept of literature as "Revolutionary Power" and of the role of the Red Guards in the Chinese Cultural Revolution. Reading in English translation includes Mao Tse-tung, Lu Hsun, Lao-she, Pa Chin, Mao Tun, Kuo Mo-jo, Shen Ts'ung-wen, Andre Malraux, and Pearl Buck.

242. CHINESE TRADITIONAL VERNACULAR LITERATURE (C).
The development of Chinese fiction and drama from the medieval storyteller tradition through the modern period of literary symbolism. Chinese concepts of the novel and theatre; the relation between erotic and allegoric literature in the evolution of Chinese society.

243. JAPANESE LITERARY TRADITION I (C).
Japanese literature from 500 A.D. to 1600 A.D. Readings, in English translation, in court poetry, the *Tale of Genji*, the military tale, and the No theatre. The impact of Buddhism and of Chinese thought and literature on the course of Japanese literary development; the role of Zen in medieval Japanese aesthetics, and early and medieval Japanese literature as an expression of Japanese civilization.

244. JAPANESE LITERARY TRADITION II (C).
Japanese literature from 1600 to the present. Linked verse and Haiku, the rise of popular theatre and fiction in the townsmen's culture in the seventeenth and eighteenth centuries. The modern novel (since 1885) and the interaction of Japanese and Western intellectual and artistic traditions. Novelists include Natsume Soseki, Tanizaki, Jun'ichiro, Kawabata Yasunati, and Mishima Yukio.

251. CONTEMPLATIVE PROSE EAST AND WEST (C).
A critical reading of contemplative prose written by contemplatives and monks of the Oriental (Buddhist, Taoist, Confucian) and Occidental (Christian) traditions. Comparisons between the imaginative presentation of concepts of reality, the self, and salvation in selected Eastern and Western prose. A consideration of how mystics of different traditions perceive ultimate reality and how an approach may be made to such reality.

291 (II). MYTH AND LITERATURE (C).
The myths of creation and of self-development; emphasis on the literary treatment of mythical experience. Mythical trends and models identified in ancient literary texts and in very recent poetry and fiction.

321. RENAISSANCE PERSPECTIVES (C).
The tradition of the Middle Ages, the heritage of the Renaissance — the rhetoric of writing and the arts of reading and interpretation as handed down to the Renaissance.

322. THE SHAPE OF THE RENAISSANCE (C).
Diversity and changes of literary style in the fifteenth and sixteenth centuries, with emphasis on cultural continuity, and with an examination of critical methods.

331 (I). THE ENLIGHTENMENT (C).
Characteristic themes, ideas, and attitudes in eighteenth-century European literature. Focus on major representatives of the Age of Reason such as Pope, Swift, and Johnson in England; Montesquieu, Voltaire, and Diderot in France; Wieland and Lessing in Germany.

341 (II). ROMANTICISM (C).
The Western Romantic movement as exemplified by its principal figures from the age of Rousseau to 1850.

342. POST-ROMANTIC TRENDS IN EUROPEAN LITERATURE (C).
Such developments as realism, naturalism, aesthetics, and neo-romanticism in the literatures of England, France, Germany, and Russia.

347 (I). LITERATURE AND MUSIC (C).
Relations between music and literature from Plato to Samuel Beckett. The aesthetics of Schopenhauer and the synthesis of Wagner are taken as the crux of a modern problem of meaning and structure in both literature and music.

351. SYMBOLISM (C).
The development of symbolism during the nineteenth and twentieth centuries as seen in the poetry of France (Baudelaire, Verlaine, Mallarmé, Rimbaud), Germany (George, Hofmannsthal, Rilke), and England (Yeats, Pound, Eliot).

352 (I). MODERN DRAMA (C).
Currents in Western drama since Ibsen, with emphasis on one or more of the following topics: naturalism, symbolism, neo-romanticism, expressionism, folk drama and fantasy, epic realism, the "grotesque" and "absurd" theatre.

361 (II). THE CONTEMPORARY EUROPEAN NOVEL (C).
Commitment and innovation in the modern novel. Among authors considered are Proust, Gide, Camus, Mann, Hesse, Kafka, and the Bloomsbury Group.

371. EUROPEAN EPIC POETRY (C).
Literary analysis of major classical and Renaissance epics (by Homer, Vergil, Dante, Milton) and three related heroic poems ("Gilgamesh," "Beowulf," "Chanson de Roland"), with emphasis on their intrinsic qualities as works of art. Specific epic techniques and the general epic tradition related to other genres and literary problems; examination of the sources of many later patterns and themes.

375 (II). ANGLO-GERMAN LITERARY RELATIONSHIPS SINCE 1750 (C).
Subjects and problems common to English and German literature since the middle of the eighteenth century; some attention to German-American literary relationships. May be counted for major credit in English and German by permission.

376. THEORIES OF COMPARATIVE LITERATURE.
A survey and critique of various theories of the nature of comparative literature; practical discussions of the methodology of research and speculation in the discipline.

380. THEORIES OF LITERATURE (C).
Problem-oriented discussion. Students compare and employ some of the main critical theories in Western literary history. Initial discussion of the students' own approaches to literature; subsequently, several areas of literary analysis (e.g., formalism, expressionism, historicism) considered against a background of literary and critical texts ranging from Plato to contemporary authors. Prerequisites, three upper-division courses in literature, of which one must be in a language other than English.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Economics

Department Administrative Officer: Associate Professor Norman Aitken. Professors Barkin, Holesovsky, Howard, Kindahl, Smith, Sonnenschein; Associate Professors Blackman, Ehrenberg; Assistant Professors Best, Burghardt, Cox, Duston, Gale, Gunderson, Kane, Kihlstrom, Mirman, Oaxaca, Ray, Treyz, Tsao, Wright.

Students planning to take one or two economics courses will normally choose courses with numbers in the one hundreds. Those students who plan to take several economics courses will normally take Economics 103 (formerly 126) and then take courses in the two or three hundreds for which this is the required prerequisite.

Economics majors must take Economics 103 and 104 (formerly 125), 203 (formerly 201), 204 (formerly 214) and at least 12 additional credits from the economics curriculum. All majors are required to take one mathematics course containing calculus (Math 127 or 135). Normally economics majors will not take more than two courses with numbers in the one hundreds. No more than three such courses will be credited toward the major. Students contemplating graduate study in economics or business administration are advised to take mathematics at least through introductory calculus, linear algebra (Mathematics 167) and two semesters of statistics (preferably Statistics 315B and 316B).

With the exception of Economics 103 and 104, declored Economics majors may not elect any Economics Department course on a pass/fail basis, nor may the required credits in mathematics be elected on a pass/fail basis. Students who become economics majors after previously passing one or more upper-division economics courses on a pass/fail basis must offer at least six graded upper-division economics courses (18 credits) for graduation.

100 (I), (II). ELEMENTS OF ECONOMICS (D).
A one-semester introduction to economics. The elements of the discipline; how the economy is structured and how it functions.

103 (I), (II). INTRODUCTION TO MICROECONOMICS (D).
Introductory analysis of resource allocation and income distribution through microeconomic theory. Specific problems illustrate the use of the theoretical precepts developed.

104 (I), (II). INTRODUCTION TO MACROECONOMICS (D).
An introduction to the economic theory used to explain the behavior of the American economy. Emphasis on the macroeconomic goals of full employment, price stability, economic growth and balance of payments equilibrium.

105 (I), (II). HONORS SECTION OF ECONOMICS 103 (D).
Permission of instructor required.
Mr. Treyz.

106 (I), (II). HONORS SECTION OF ECONOMICS 104 (D).
Permission of instructor required.
Mr. Treyz.

121 (I). THE INTERNATIONAL ECONOMY (D).
An historical and analytical introduction to international institutions, trade, finance and policy. Current problems and recent developments treated extensively. Mr. Aitken.

131 (II). THE ECONOMICS OF INSECURITY AND POVERTY (D).
Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes and economic contingencies. Mr. Blackman.

141 (I). LABOR PROBLEMS (D).
Background of the labor movement and problems involved in the management-labor relationship and the efforts of management, unions and government to solve them. Mr. Blackman.

172 (II). THE SOVIET ECONOMY (D).
Resource allocation through centralized planning in the Soviet economic system. A case history of economic development. Current problems of economic reform. Mr. Wright, Mr. Holesovsky.

181 (II). ECONOMICS AND URBAN PROBLEMS (D).
The structure of the urban economy; goals, processes, problems and policy in urban economic development.

192. SEMINAR FOR INTRODUCTORY STUDENTS (D).
On petition of 15 students or on the recommendation of a faculty member the department may offer a one-semester course on a topic area of the students' or faculty member's choice, subject to finding appropriate staff and departmental approval.

203 (I), (II). INTERMEDIATE MICROECONOMIC THEORY (D).
Microeconomic analysis of consumers, firms, industries, and markets; rational decision-making under conditions of certainty; balancing forces in a free enterprise economy. Prerequisite, Econ 103.

204 (I), (II). INTERMEDIATE MACROECONOMIC THEORY (D).
Formulation and empirical testing of static and dynamic theories of aggregative income, employment, and prices with reference to fluctuations, growth, and economic forecasting. Prerequisites Econ 103 and 104.

205 (II). MARXIAN ECONOMICS (D).
Exposition of the Marxian economic theory in modern idiom. Comparison of methodological assumptions and conceptualization of economic phenomena in Marx and in "mainstream economics." Prerequisites, Econ 103 and 104.

211 (I). MONEY AND BANKING (D).
The development and operation of the monetary and banking systems of the United States; problems of achieving full employment and price stability through monetary controls. Prerequisite, Econ 104.

212 (II). MONEY, INCOME AND MONETARY POLICY (D).
The relationships among money, income and monetary policy, and among individuals, banks, money markets, governments and central banks. Prerequisites, either Econ 211 or Finance 210.

231 (I), (II). SOCIAL CONTROL OF BUSINESS (D).
The formal and informal methods and efforts to maintain, supplement and moderate competition, and the substitution of regulation and public enterprises for competition. Prerequisite, Econ 103. Mr. Howard.

232 (I), (II). THE STRUCTURE OF AMERICAN INDUSTRY (D).
Business enterprise, market competition, and economic development in American industries. The social effectiveness of industries analyzed through measures of industrial structure and market performance. Prerequisite, Econ 103 recommended, 203. Mr. Gale.

242 (II). LABOR LAW AND LEGISLATION (D).
Economic effects and historical survey of Federal and state laws and an analysis of important court decisions. Prerequisites, Econ 141, or permission of instructor. Mr. Blackman.

251 (I), (II). MATHEMATICAL METHODS IN ECONOMICS.
The applications of various mathematical concepts and techniques in macroeconomic and microeconomic analysis. Emphasis on the design and interpretation of mathematical models of economic phenomena. Prerequisites, Econ 103, Math 127, 135, or permission of instructor. Mr. Sonnenschein.

252 (II). ECONOMETRICS.
The application of mathematical and statistical methods to economic theory, applied to both microeconomic and macroeconomic policy issues. Permission of instructor.

261 (I). EUROPEAN ECONOMIC EVOLUTION (D).
Evolution of economic organization in agriculture, industry and commerce; the surrounding social and institutional life. Prerequisites, History 100 and 101, or an economics course.

262 (II). AMERICAN ECONOMIC HISTORY (D).
An analytical approach to structural change, economic growth, and the development of market institutions in the United States from colonial times to the present. Prerequisite, Econ 100 or 103. Mr. Gunderson.

266 (I). ECONOMIC DEVELOPMENT (D).
Economic problems of underdeveloped countries and the policies necessary to induce growth. Individual projects required. Prerequisite, Econ 100 or 103 or 104.

267 (II). LATIN AMERICAN ECONOMIC DEVELOPMENT (D).
Development of the Latin American economies. Emphasis on the central problems of the various economies and proposed economic programs. Prerequisite, Econ 266 or permission of instructor. Mr. Best.

270 (I), (II). ECONOMICS OF SOVIET PLANNING (C, D).
Theoretical analysis of selected aspects of the Soviet economy: growth models applicable to the Soviet case; problems of measurement of growth and factor productivity; coordination of economic activities through centralized planning and decentralization; investment allocation criteria; conduct of foreign trade; other. Prerequisites, Econ 103, 104 and 203. Mr. Holesovsky.

271 (I). COMPARATIVE ECONOMIC SYSTEMS (D).
Evaluation of the performance of alternative economic systems in theory and practice. Problems of planning in the advanced economies of the United States, Western Europe, and Soviet area. Prerequisite, Econ 103.
Mr. Wright, Mr. Holesovsky.

281 (I). REGIONAL ECONOMICS (D).
The process of regional economic growth; location theory and basic techniques of regional analysis; public and private area development programs. Prerequisite, Econ 103 recommended, 203. Mr. Kane.

301. (I). DECISION THEORY IN ECONOMICS (D).
The modern theory of rational decision-making under conditions of uncertainty, risk, and conflict. Applications to the theory of the firm and the theory of oligopoly. Prerequisites, Econ 103, one year of college mathematics, or permission of instructor.

306 (I). DEVELOPMENT OF ECONOMIC THOUGHT (D).
The evolution of contemporary theory from its classical beginnings; neoclassicism and its chief variants; dissenters Marx, German historical school, Veblen. Emphasis on relation of economic thought to other kinds of social theories. Prerequisite, Econ 103.

312 (I). PUBLIC FINANCE (D).
Principles of public revenues and expenditures; systems and problems of taxation; use of taxes, expenditures, debt policy to provide full employment; economic growth and price stability. Prerequisites, Econ 103 and 104.
Mr. Cox, Mr. Ray.

314 (II). STATE AND LOCAL PUBLIC FINANCE (D).
State and local government revenue

and expenditure programs. Individual research projects relating to Massachusetts or surrounding states required. Prerequisites, Econ 100 or 103. Mr. Ray.

321 (II). INTERNATIONAL MONETARY THEORY AND POLICY (D).
The theory of international monetary economics, including an analysis of foreign exchange markets, adjustment mechanisms, capital flows, speculation, and transfer problems. Emphasis on the relationship of the balance of payments to national income, exchange rates, and relative price levels. Prerequisites, Econ 103, 104, or 204.

322 (II). INTERNATIONAL TRADE AND ECONOMIC POLICY (D).
Intermediate theory of international trade, including the analysis of the balance of payments mechanism, pure non-monetary theory and its application to problems of commercial policy. Prerequisites, Econ 203 and 321.
Mr. Aitken.

338 (II). ECONOMICS OF HEALTH (D).
Application of economic theory to resource allocation in the health services industry. Survey of performance of this industry as measured by costs and various health indices. Market failure in health care. Alternative delivery systems. Prerequisite, permission of instructor.
Mr. Duston.

345 (I), (II). HUMAN RESOURCE ECONOMICS (D).
An economic analysis of private and social means for providing access to higher education, housing, medical care and an improved environment. Poverty, population concentration, and discrimination as barriers to the achievement of these ends. Policies and priorities in human resource development. Prerequisite, Econ 103. Mr. Duston.

347 (I). ECONOMICS OF THE LABOR MARKET (D).
A theoretical and empirical analysis of labor markets, utilizing primarily the tools developed in microeconomics. Topics covered include the determinants of the personal distribution of income, the level and structure of unemployment, dynamic wage determination, the impact of trade unions and other imperfections in the labor market, and an economic analysis of existing and proposed government legislation or programs, which affect the operation of labor markets. An introduction to labor market data and to the formulation and testing of economic models. Prerequisite, Econ 203. Mr. Ehrenberg.

372 (I). NATIONAL ECONOMIC POLICIES OF ADVANCED EUROPEAN COUNTRIES AND PROGRAMS.
Evaluation of the economic objectives, instruments, measures and results of economic policy and decision-making mechanisms in the United States in comparison with Norway, Sweden, Netherlands, United Kingdom and Canada and such other advanced non-socialist countries as the students may select. Prerequisites, Econ 103 and 104.
Mr. Barkin.

382 (II). URBAN ECONOMIC ANALYSIS (D).
Economic analysis or urban markets and investigation of how urban problems result from the breakdown and imperfections of those markets. Topics covered include: the urban economy, urban land and housing markets, urban transportation, and the urban public economy. Prerequisite, Econ 103 or permission of instructor. Mr. Kane.

383 (I), 384 (II). TOPICS IN APPLIED ECONOMICS (D).
The application of principles of microeconomics to diverse problems and policies to exhibit the uses of economic theory. Topics may include: automobile model changes, supersonic transport, solid waste disposal, conscription to the armed forces, the heroin trade, cable television systems, flight insurance, and wild game conservation. Prerequisite, Econ 103. Mr. Rottenberg.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). SEMINAR.
Research in economic theory, problems of labor, commerce, and industry. If desirable, some other economic study may be substituted. Prerequisite, Econ 103. 1 or 2 2-hour conferences.
Credit, 1-3.

398. DEPARTMENTAL HONORS.
Credit, 1-9.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

RELATED COURSES:
AGRICULTURAL AND FOOD ECONOMICS
352. Agricultural Policy.
373. Resource and Conservation Economics.
381. International Agricultural Development.

English

Head of Department: Professor Joseph Frank. Professor and Dean, Faculty of Humanities and Fine Arts, College of Arts and Sciences, Jeremiah Allen; Professors Barnard, Brogan, Campbell, Chametzky, Clark, Copeland, Creed, Duckert, Emerson, Gibson, Golden, Haven, Helming, J. Hicks, Hoopes, Kaplan, Koehler, Langland, Lesser, Mayer, McCarthy, Mitchell, Musgrave, O'Donnell, Page, Plumstead, Porter, Rudin, B. Spivack, C. Spivack, Varley, Weston, M. Wolff; Associate Professor and Associate Head of Department Hofer; Associate Professors Aczel, Aho, Ashton, Bagg, Barron, Berlin, Carey, Cheney, Clayton, Collins, Donohue, Fetler, French, Gallo, Gozzi, Hogan, Horrigan, J. Hunt, Junkins, Kinney, Leheny, Lowance, Mariani, Moran, Neugeboren, Noland, Pinkham, Politella, Raymond, Saagpakk, Silver, Swaim, Tucker, Turner, Ziff; Assistant Professors Beaty, Bell, Cameron, Culley, Current, Diamond, DiMarco, L. Edwards, Eidsvik, Emmart, Farrell, Freeman, Gern, Green, Harrington, P. Hicks, Jayne, Jenkins, Jorgens, Keefe, Louis, Matlack, Nelson, Paroissien, Quick, Quigley, Reed, Robinson, Shadoian, Sitter, C. K. Smith, Tate, C. Wolff; Part-time Assistant Professor B. Hunt; Instructors Adams, DuBois, Grahame, P. Edwards; Full-time Lecturer Gat; Part-time Lecturers Allen, Associate Dean Shaw.

The English Department offers courses in the study of English and American literature, courses in the relationship between literature and other disciplines and art forms, and courses in creative and expository writing. Innovative and experimental courses are taught under the rubrics of English 390-391 and 380-384. Descriptions of these courses are available shortly before pre-registration at the English Department Undergraduate Studies Office in Bartlett 252.

The English major will normally take between 30 and 45 hours of upper-class English courses. Among these courses he or she will normally take 1) a course in the literature of a period before 1800; 2) a course in non-English literature (the department recommends English 125); and three of the following four options: i) one course in the study of a genre such as tragedy, comedy, satire, lyric poetry, or prose fiction; ii) one course in the study of a single British or American author; iii) one course in the study of the English language; iv) one course in the works of Shakespeare. A list of particular courses that fulfill these requirements may be picked up at the Department's Undergraduate Studies Office.

The English major is encouraged to work within the flexible framework of the major to create a coherent program of study. The Department offers concentrations within the major, such as American Studies, Journalistic Studies, Literature and Psychology, and the Renaissance; other concentrations can be designed. The Department's main advisers keep regular office hours to help the undergraduate plan a program.

125 (I), (II), 126 (I), (II). MASTERPIECES OF WESTERN LITERATURE (C).
Selected masterpieces, from Homer and the Bible to James Joyce or Robert Frost. Aims to enrich appreciation of literary values and develop understanding of abiding human issues.

131 (I), (II). SOCIETY AND LITERATURE (C).
Literature that deals with man's relationship to society. Topics may include: the utopian vision; the notion of the self; politics and literature. Readings may include works by Mailer, Sophocles, Austen, Thoreau, Marx.

135 (I), (II), 136 (I), (II). MASTERPIECES OF WESTERN LITERATURE (C).
The same as 125, 126 as to content and credit, but conducted in weekly evening sessions to facilitate the discussion method.

141 (I), (II). MAN AND WOMAN IN LITERATURE (C).
Literature treating the relationship between man and woman. Topics may include the nature of love, the image of the hero and of the heroine, and definitions, past and present, of the masculine and the feminine. Readings may include works by Lawrence, Freud, Shakespeare, Cummings, Homer, the Brontës.

152 (I), (II). READING FICTION (C).
An introduction to themes and techniques of fiction through a reading of selected short stories and novels with emphasis on such matters as structure, style, point of view, and the like.

153 (I), (II). READING POETRY (C).
An introduction to themes and forms of poetry through a reading of selected English and American poems. Emphasis on such poetic techniques as word choice, imagery, and structure, and on such modes as the ballad, lyric, sonnet, ode and dramatic monologue.

154 (I), (II). READING DRAMA (C).
An introduction to themes and techniques of drama through a reading of selected plays. Emphasis on such matters as structure, style, staging, and tragic and comic modes.

161 (I), (II). NATURE AND LITERATURE (C).
Literature that deals with man's relationship to his environment. Topics may include changing conceptions of nature, changing attitudes toward nature. Readings may include works by Conrad, Darwin, Thoreau, Shakespeare, Frost, Homer, Faulkner.

171 (I), (II). LITERATURE AND REALITY (C).
Literature that deals with man's attempt to understand what is real, what is illusory, what illusions are profitable, necessary, dangerous. Readings may include works by Cervantes, Virginia Woolf, Plato, Shakespeare, Wallace Stevens, Kerouac.

201 (I), (II). MAJOR BRITISH WRITERS (C).
Such leading British writers before 1700 as Chaucer, Spenser, Donne, Milton, and Dryden (excluding the plays of Shakespeare).

202 (I), (II). MAJOR BRITISH WRITERS (C).
Such leading British writers after 1700 as Pope, Johnson, Wordsworth, Tennyson, Browning, Arnold, and T. S. Eliot. Normally to follow English 201.

203 (I), (II). THE BIBLE: MYTH, LITERATURE AND SOCIETY.
The several main genres of Biblical literature in their historical setting; attention to the principles of literary, mythological, and sociological interpretation; the literary influence of the Authorized Version.

213 (I). EARLY ENGLISH LITERATURE IN TRANSLATION (C).
Readings (in translation) of works from English literature before 1100 A.D. Religious and social ideas of the period as reflected in several types of poetry. Introduction to Old English prose.

214 (II). MIDDLE ENGLISH LITERATURE EXCLUSIVE OF CHAUCER (C).
Readings of selected works written in the later Middle Ages in England, exclusive of Chaucer's.

215 (I). CHAUCER'S *TROILUS AND CRISEYDE* AND OTHER LOVE POEMS (C).
The complaints, dream visions, later short poems, the translation of Boethius, and *Troilus* as combinations of medieval art and thought with pre-Renaissance motifs.

216 (II). CHAUCER'S *CANTERBURY TALES* (C).
A close study of the General Prologue and representative tales as examples of the poet's mature techniques and extraordinary realism.

221 (I). SHAKESPEARE (C).
Examination of Shakespeare's dramatic art and leading ideas through a study of approximately a dozen plays.

222 (II). SHAKESPEARE (C).
Same method as English 221 but with a different group of plays. Either semester or both may be taken for credit.

225 (I). SIXTEENTH CENTURY ENGLISH LITERATURE (C).
Selections from the non-dramatic prose poetry of the early English Renaissance through the Age of Elizabeth, including such writers as Skelton, Wyatt, Surrey, More, Gascoigne, Spenser, Sidney, Ralegh, Marlowe and Shakespeare. Emphasis on the rise of humanism.

226 (II). ELIZABETHAN AND JACOBEAN DRAMA (C).
The drama of the English Renaissance. Selected works by several major Elizabethan and Jacobean playwrights, including Marlowe, Jonson, Chapman, Middleton, Webster, and Ford. Emphasis on the artistic and intellectual character of the English Renaissance as reflected in drama.

233 (I), (II). SEVENTEENTH CENTURY ENGLISH LITERATURE (C).
Selections from the poetry and prose of the late Renaissance in England, including works by such authors as Donne, Jonson, Browne, Burton, Marvell, and Milton. Emphasis on the challenge of the new science to the traditional humanism.

236 (I), (II). MILTON (C).
Development of the mind and art of Milton as a figure of the English Reformation and the late Renaissance. Emphasis on *Paradise Lost.*

238 (I). DRAMATIC LITERATURE OF THE RESTORATION AND THE EIGHTEENTH CENTURY (C).
Approximately twenty works illustrating themes and techniques of Restoration comedy, sentimental drama, and the heroic play. Emphasis on Dryden, Wycherley, Congreve, and Sheridan.

241 (I). ENGLISH LITERATURE OF THE EIGHTEENTH CENTURY (C).
The literature of the Augustan Age. Emphasis on Swift and Pope.

242 (II). ENGLISH LITERATURE OF THE EIGHTEENTH CENTURY (C).
The literature of the later eighteenth century, with emphasis on the Johnson Circle. A continuation of English 241; may be elected independently.

243 (I), (II). THE RISE OF THE NOVEL (C).
Significant representative novels, including works of such authors as Richardson, Fielding, Sterne, Smollett and Austen.

251 (I). THE ROMANTIC POETS (C).
The Romantic Movement as revealed in the poetry of Wordsworth, Coleridge, and the other early Romantics.

252 (II). THE ROMANTIC POETS (C).
The Romantic Movement, with particular attention to Byron, Shelley, and Keats.

253 (I), (II). THE ENGLISH NOVEL FROM SCOTT THROUGH HARDY (C).
The reading and discussion of significant representative novels, including works of such authors as Dickens, Thackeray, the Brontës, Eliot, and Hardy.

255 (I). ENGLISH PROSE OF THE ROMANTIC PERIOD (C).
The techniques and ideas of the chief prose writers (from 1798 to 1837), including Wordsworth, Coleridge, Lamb, Hazlitt, DeQuincey, and the early Carlyle.

256 (II). ENGLISH PROSE OF THE VICTORIAN PERIOD (C).
The chief Victorian prose writers (from 1837 to 1900), including Macaulay, Carlyle, Newman, Arnold, Mill, Ruskin, Huxley, and Pater.

259 (I), (II). VICTORIAN POETRY (C).
The chief poets from 1837 to 1900. Emphasis on Tennyson, Browning, Arnold, and the Pre-Raphaelite Movement.

261 (I). THE MODERN NOVEL: 1890-1930 (C).
The expanding form of the novel and increasing interest in social causes as exhibited in some twelve novels.

262 (II). THE MODERN NOVEL: 1930-1960 (C).
Analysis of some twelve novels. A continuation of English 261, but may be elected independently.

263 (II). MODERN BRITISH AND AMERICAN DRAMA (C).
Representative dramatists since the late nineteenth century, including Shaw, O'Casey, O'Neill, Williams, and others. Emphasis on trends in twentieth-century dramatic art.

264 (I). MODERN EUROPEAN DRAMA (IN TRANSLATION) (C).
Major modern dramatists beginning with Ibsen and including Chekhov, Pirandello, Strindberg, Giraudoux. Emphasis on comparative currents in various European nations.

265 (I). TWENTIETH-CENTURY LITERATURE OF IRELAND IN ENGLISH (C).
Nineteenth-century background; the Irish Renaissance; such major figures as Yeats, Synge, Joyce, and O'Casey; recent and contemporary writing.

266 (I), (II). MODERN POETRY (C).
Twentieth-century poetry to 1945; such authors as Hardy, Hopkins, Whitman, and Emily Dickinson.

267 (I), (II). CONTEMPORARY POETRY (C).
Poetry in English since 1945.

268 (I), (II). JAMES JOYCE (C).
Major works of James Joyce in prose, drama, and lyric poetry, emphasizing *Ulysses* or *Finnegans Wake*.

271 (I). EARLY AMERICAN LITERATURE (C).
From the Puritan, Colonial, and Federalist periods. Authors include Edward Taylor, Cotton Mather, Jonathan Edwards, John Woolman, Benjamin Franklin, Charles Brockden Brown, Philip Freneau, and Washington Irving.

272 (I), (II). AMERICAN POETRY (C).
American poetry from 1800 to the emergence of a modern style early in the twentieth century.

273 (I), (II). NINETEENTH-CENTURY AMERICAN LITERATURE (C).
Significant productions in expository prose, fiction, and poetry; the emergence of an American literature.

274 (II). TWENTIETH-CENTURY AMERICAN LITERATURE (C).
Movements, modes, and representative voices in prose, fiction, and poetry. A continuation of English 273; may be elected independently.

275 (I), (II). MAJOR AMERICAN WRITERS (C).
Emerson, Hawthorne, James, and any of the following by announcement each semester: Howells, Adams, Dos Passos, Lewis, Anderson, Fitzgerald, Hemingway.

276 (I), (II). MAJOR AMERICAN WRITERS (C).
Thoreau, Melville, Whitman, and any of the following by announcement each semester: Cooper, Poe, Dickinson, Twain, Crane, Dreiser, Faulkner, Wolfe.

280 (I), (II). INTRODUCTION TO FOLKLORE (C).
Beginning with the ballad as the nucleus of other folklore genres.

281 (II). AMERICAN FOLKLORE (C).
Oral traditions in America, with emphasis on surviving British lore, American Indian lore, Negro lore, and recent folk materials.

282 (I). LITERARY CRITICISM: CLASSIC AND NEO-CLASSIC (C).
An introduction to literary criticism; emphasis on the major philosophical critics from Plato and Aristotle to the nineteenth century.

283 (II). MODERN LITERARY CRITICISM (C).
Theories and techniques of modern criticism; emphasis on the twentieth century.

284 (I). LITERATURE AND PSYCHOLOGICAL CRITICISM (C).
An examination and application of theories and techniques of psychological criticism to selected works of literature. The theoretical focus is psychoanalytic (Freudian); other theories (Jungian, phenomenological, existential) used as time permits.

287 (I), (II). WOMAN AS HERO (C).
The concept of heroism as modified and developed in literary works having women as central characters.

288 (I). THE POLITICAL NOVEL (C).
Relationships between politics and the novel. Political setting vs. political meaning. Social change, power politics and institutions, and the personal dilemma. Emphasis on literary analysis and class discussion.

289 (I). FILM AND LITERATURE (C).
The historical, formal, and aesthetic relationships between literature and the cinema. Emphasis on problems raised in literary aesthetics as a result of film.

312 (I), (II). HISTORY OF THE ENGLISH LANGUAGE.
The development of English; vocabulary and usage levels, grammars, and dictionaries. Attention to matters crucial to the teaching of English in secondary schools.

321 (I). STRUCTURE OF MODERN ENGLISH.
Introduction to applied English linguistics; sounds, forms, and word-order of modern Standard American English; modern grammatical theory.

331 (I), (II). TECHNICAL WRITING.
For majors in engineering. Factual and inductive exposition, with emphasis on research, federal, and industrial reports. 2 class hours. Credit, 2.

334 (II). ADVANCED TECHNICAL WRITING.
Case studies in engineering and industrial reporting and in the writing of technical and professional articles.

337 (I), (II). EXPOSITORY WRITING.
The writing of informative prose in the forms expected in the students' major fields: reports, articles, essays.

339 (I), (II). ARTICLE WRITING.
Magazine journalism combined with instruction in writing feature or magazine articles. Prerequisite, permission of instructor at pre-registration.

341 (I), (II). CREATIVE WRITING.
Intensive practice in writing prose fiction, poetry, and occasionally other forms, supplemented by discussion of ideas and techniques in contemporary literature.

345 (I or II per demand). CREATIVE WRITING.
A continuation of English 341, with emphasis on fiction. Prerequisite, a grade of B or better in English 341.

346 (I or II per demand). CREATIVE WRITING.
A continuation of English 341, with emphasis on poetry. Prerequisite, a grade of B or better in English 341.

347 (I or II per demand). CREATIVE WRITING.
A continuation of English 341, with emphasis on drama. Prerequisite, a grade of B or better in English 341.

Note: English 345, 346, and 347 may be repeated for credit.

360 (I). THE ENGLISH LYRIC (C).
The lyric as a personal expression of the poetic imagination within a continuing tradition. Important forms of the lyric, such as sonnet, elegy, and ode; examples selected from the whole range of poetry in English.

361 (I). THE ENGLISH EPIC TRADITION (C).
Substantial readings in three or four long English poems (such as *Beowulf*, *Faerie Queene*, *Parodise Lost*, *The Prelude*) against the background of classical

epic (e.g., *The Aeneid*). Emphasis on the ways in which each poet employs traditional epic motifs as a means of defining his own contemporary vision of man and society.

362 (I). TRAGIC DRAMA (C).
An examination of plays (mostly Greek, Elizabethan and modern) and critical theories (modern, but with attention to Aristotle and Hegel) in an attempt to sharpen perception of the genre "tragedy."

363 (II). PROSE FICTION (C).
The substance and theory of prose fiction. Sections may read works that illustrate the range of possibilities within the genre, works that seek to extend the limits of the genre, or works that illustrate one or more types of fiction, such as the historical novel, the novel of manners, the picaresque novel, or the regional novel.

364 (II). SATIRE, THEORY AND PRACTICE (C).
Theory and practice of satire, drawing upon a wide range of representative works, largely British and American, from several periods, including novels, short stories, poems, plays and essays, as well as songs, graphics, and when available, film.

380 (I), (II). ASPECTS OF LITERATURE (C).
An aspect of literature in English, both British and American, including literary movements, the relations of literature to particular cultural developments, and thematic criticism.

381 (I), (II). ASPECTS OF BRITISH LITERATURE (C).
An aspect of British literature. Specific subject announced at pre-registration.

382 (I), (II). INDIVIDUAL BRITISH AUTHORS (C).
Intensive study of one British author, announced at pre-registration.

383 (I), (II). ASPECTS OF AMERICAN LITERATURE (C).
An aspect of American literature, announced at pre-registration.

384 (I), (II). INDIVIDUAL AMERICAN AUTHORS (C).
Intensive study of one American author, announced at pre-registration.

385, 386. INDEPENDENT STUDY.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). SEMINAR.
Normally, several seminars each semester. Topics and instructors announced at pre-registration. For majors, but open to others. Prerequisite, permission of instructor at pre-registration.

393 (I) or (II). WRITING SEMINAR.
Writing for publication and training in editing related to professional and to University student publications. Prerequisite, permission of instructor at pre-registration. 2 class hours, 1 laboratory period.

398, 399 (I), (II). ENGLISH HONORS.
The Senior Honors Thesis: a two-semester project normally carrying six to nine credits upon completion. Qualified students are invited to join the project in the spring of their junior year.
Credit, 1-9.

JOURNALISTIC STUDIES
The Journalistic Studies requirements are under review and a student should check with the Journalistic Studies adviser to learn of any changes.

The concentration in Journalistic Studies offers a double major (15 credits in Journalistic Studies and the requirements of the associated department). The interdepartmental major is open to upper-class students on written approval from the adviser for Journalistic Studies.

Students electing this concentration must elect at least three of the following seven courses in Journalistic Studies: 201, 202, 208, 210, 385, 386, 392.

Any two of the advanced writing courses offered by the Department of English are acceptable in meeting the major requirements of 15 credits in Journalistic Studies; but only one such course may be elected each semester.

201 (I), (II). INTRODUCTION TO MASS COMMUNICATION.
The communications revolution and freedom of the press, the communication process, methods of reporting and writing, communication theory and research.

202 (I), (II). LANGUAGE AND COMMUNICATION.
Analysis of several approaches to language study, with emphasis on empirical research.

208 (I or II as enrollment warrants). COMMUNICATIONS THEORY.
Introduction to journalism as a social and behavioral science concerned with the way in which communications are arranged in our society.

210 (I or II as enrollment warrants). INTERNATIONAL COMMUNICATIONS.
Comparative study of mass media in countries other than the United States, and of the flow of communications among nations.

385 (I), 386 (II). INDEPENDENT STUDY AND RESEARCH.
Individual work for well-qualified juniors and seniors. Prerequisite, permission at pre-registration of staff member who is to supervise.

391 (I), (II). SEMINAR.
Normally, several seminars each semester. Topics and instructors announced at pre-registration. For majors, but open to others. Prerequisite, permission of instructor at pre-registration.

392 (II). FREEDOM OF THE PRESS.
Seminar in freedom of the press: its history, major theories, key cases in Anglo-American law, and recent trends toward redefinition.

French and Italian

Chairman of Department: Professor Micheline Dufau.

FRENCH
Professors Cassirer, Dufau, R. Johnson, Marks, Taylor, Weiner; Associate Professors Busi, Carre, Garaud, P. Johnson, S. Lawall, Mankin, Porter, Raymond, Rountree, Smith, Sturm; Assistant Professors Berwald, Bragger, Braude, Chen, Gugli, Lamb, Lansing, O'Connell; Instructor Tedeschi.

Information on the French curriculum may be obtained from Professor Micheline Dufau, Department Chairman.

Two programs are available: one is designed principally for those who wish to teach in elementary or secondary schools, the other for those who are primarily interested in continuing their studies in graduate school.

110, 120. ELEMENTARY FRENCH.
For those with no previous creditable training in French. Intensive practice in the four language skills. 3 class hours, 2 laboratory periods.

111, 121. ELEMENTARY FRENCH FOR VOICE MAJORS.
Special sections of 110 and 120.

123 (I), (II). INTENSIVE REVIEW OF FRENCH.
Intensive review of French for those who are not ready for third semester work.

126 (I), (II). INTENSIVE ELEMENTARY FRENCH.
For those with no previous training in French. Intensive practice in the four language skills. Credit, 6.

130 (I), (II). INTERMEDIATE FRENCH.
Intensive study and review. Readings in modern French literature. Prerequisite, either French 123 or 126, or equivalent.

131 (I), (II). INTERMEDIATE FRENCH: ORAL.
A third semester course for those primarily interested in developing their oral skills in French.

132 (I). INTERMEDIATE FRENCH — HONORS or MAJORS.

For honor students and majors. Intensive review of grammar with emphasis on all four skills.

141 (I), (II). INTERMEDIATE FRENCH: ORAL (C).
A continuation of 131.

142 (I), (II). INTERMEDIATE FRENCH: HONORS or MAJORS (C).
For honor students and majors. Stresses composition as well as reading and discussion.

144 (I), (II). INTERMEDIATE FRENCH: FICTION (C).
Stresses the reading of contemporary fiction.

145 (I), (II). INTERMEDIATE FRENCH: READINGS IN THE HUMANITIES (C).
Stresses reading of non-fiction.

146 (I), (II). INTENSIVE INTERMEDIATE FRENCH (C).
Covers third and fourth semesters in one. Credit, 6.

147 (I), (II). INTERMEDIATE FRENCH: READINGS IN THE SOCIAL SCIENCES (C).

148 (II). INTERMEDIATE FRENCH: READINGS IN MATHEMATICS AND SCIENCES (C).

150. LANGUAGE AND LITERATURE (C).
Intensive study of short literary texts beyond the intermediate level for students not prepared to take French 171, 172, but who desire to further develop the four language skills. Prerequisite, a French 140 level course. 3 class hours, 1 laboratory session.

161 (I), (II). ORAL FRENCH, PHONETICS AND PHONEMICS.
Intensive practice of French pronunciation through a knowledge of its sound system.

162 (I), (II). CONVERSATION.
Practice in conversational French. Prerequisite, French 161.

171 (I), (II). GREAT WORKS — POETRY, NOVEL (C).
Selected complete works of several periods in poetry and novel. Prerequisite for advanced courses in French.

172 (I), (II). GREAT WORKS — THEATER, ESSAY (C).
Selected complete works of several periods in non-fiction and the theater. Prerequisite for advanced courses in French.

261 (I), (II). ADVANCED GRAMMAR.
For students who feel the need of more formal French grammar beyond the intermediate level.

262 (I), (II). ADVANCED CONVERSATION.
Additional oral practice for students who have completed French 161-162. (Students who have completed 161 and who have a strong background in oral production may be excused from 162 by permission of the Department.)

263 (I), (II). FRENCH COMPOSITION.
Advanced composition, required of French majors.

264 (I), (II). COMPOSITION AND TRANSLATION.
Advanced composition, required of French majors.

270 (I) or (II). THEMES IN FRENCH LITERATURE (IN TRANSLATION) (C).
A given theme in French literature as illustrated in a series of translated works. Themes announced in advance. Not to be taken for major credit in French.

271 (I). FRENCH CIVILIZATION.
French civilization to 1800. Designed for an intelligent understanding of the literature and thought of France through a knowledge of the background.

272 (II). FRENCH CIVILIZATION.
Designed for an intelligent understanding of contemporary French literature through a knowledge of its recent background.

274 (I) or (II). MASTERPIECES IN TRANSLATION (C).
The vision of man in French literature from the Renaissance to the twentieth century. Not open to French majors or to students who have completed either French 171 or 172.

301, 302. FRENCH LITERARY MOVEMENTS.
The characteristics and definitions of a selected movement or period (e.g., Baroque, Romanticism) in French literary history.

303. EXPLICATION DE TEXTES.
The principles of textual analysis and practice in that exercise. Required of students in Teacher Training.

304. THE ART OF LITERATURE.
The structure of the literary works of art; emphasis on the esthetic.

311 (I) or (II). INTRODUCTION TO MEDIEVAL FRENCH LITERATURE.
Representative masterpieces from the various genres, read in modern French translation. Relation of literature to other aspects of medieval culture.

314 (I). FRENCH PROSE OF THE RENAISSANCE.
Renaissance French prose. Rabelais, Bonaventure des Périers, Marguerite de Navarre, Monluc, Les Estienne, Montaigne.

317 (II). FRENCH POETRY OF THE RENAISSANCE.
Renaissance French poetry. Marot, Scève, Du Guillet, Du Bellay, Ronsard, Belleau, Baïf, Agrippa d'Aubigné, Du Bartas, Sponde.

321. COMIC VISION — 17th CENTURY.
Representative works of the classical period with a comic vision of society in prose and poetry: Molière, La Fontaine, La Bruyère and others.

322. TRAGIC VISION — 17th CENTURY.
Examples of the classical tragic vision in the theater and the novel; Corneille, Racine, Mme. De La Fayette.

324. PHILOSOPHERS AND MORALISTS OF THE 17th CENTURY.
Writers whose ideas are most important in classical thought: Descartes, Pascal, La Rochefoucauld and others.

334. FRENCH LITERATURE OF THE 18th CENTURY.
Development of ideas of the French Enlightenment.

335. FRENCH NOVEL OF THE 18th CENTURY.
The satirical novel as represented by LeSage, Montesquieu, Voltaire, and Diderot, and the sentimental novel as represented by Prevost, Marivaux, Rousseau and Bernardin de Saint-Pierre.

339. FRENCH DRAMA OF THE 18th CENTURY.
Readings in French theater from LeSage to Beaumarchais.

340. THEMES IN 19th CENTURY FRENCH POETRY.
In-depth consideration of themes in 19th century French poetry such as nature, the religious experience, the role of the poet, romantic imagery, etc. Themes vary from semester to semester.

344. PARNASSIANS AND NERVAL.
Development of poetry between Romanticism and Symbolism.

345. 19th CENTURY ROMANTIC NOVEL.
The novel of the first half of the century: Chateaubriand, Balzac, Hugo, Dumas Stendhal.

346. 19th CENTURY REALISTIC-NATURALISTIC NOVEL.
The novel of the second half of the century from Flaubert to Zola.

347. FRENCH POETRY OF THE EARLY 19th CENTURY.
Nineteenth century French Romantic poetry: LaMartine to Hugo.

348. SYMBOLIST POETRY.
The poetry of Baudelaire, Rimbaud, Mallarmé, Verlaine.

349. FRENCH THEATER OF THE 19th CENTURY.
Development of theater from Hugo to Rostand and his contemporaries.

354. LITERATURE IN FRENCH FROM AFRICA AND THE CARIBBEAN.
Survey of contemporary literature written in French by African writers, and its literary and ideological background.

355. MAJOR FIGURES OF THE CONTEMPORARY FRENCH NOVEL.
Novels of Romains, Martin du Gard, Duhamel, Gide, Proust, Montherlant, Giraudoux.

356. MAJOR FIGURES OF THE CONTEMPORARY FRENCH NOVEL.
Novels of Malraux, Camus, Sartre, Simone de Beauvoir, Bernanos, Mauriac, and Julien Green.

357. CONTEMPORARY FRENCH POETRY — 20th CENTURY.
Major French poets from the turn of the century to Surrealism. A study of Valéry, Apollinaire, Claudel, Reverdy, Eluard, Desnos, Cendrars, and the beginnings of Surrealism with the first manifesto in 1924.

358. CONTEMPORARY FRENCH POETRY — 20th CENTURY.
French poetry from Surrealism to the present: Breton, Char, Michaux, Perse, Ponge, Bonnefoy, and selected contemporary poets. Surrealism as a movement in itself and as a precursor of more recent poetry.

359. FRENCH THEATER — 20th CENTURY.
French theater from Scribe to the present.

361. APPLIED FRENCH LINGUISTICS.
French linguistics applied to the teaching of French in secondary schools.

362. BASIC METHODS.
An introduction to audio-lingual techniques of teaching French at the secondary level (Educ 307).

363. ADVANCED METHODS.
Methods of teaching intermediate and advanced French at the secondary level. The second of a two-semester sequence devoted to teaching French. Prerequisite, French 362 (Educ 307).

374. FRENCH-CANADIAN LITERATURE.
Survey of contemporary literature written in French by Canadian poets, novelists and dramatists.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391, 392. SENIOR SEMINAR.
French literature for advanced students. Subject announced the preceding semester.
Credit, 1-3.

398, 399. FRENCH SENIOR HONORS.
Credit, 1-6.

ITALIAN

Associate Chairman for Italian: Professor Zina Tillona. Associate Professor Sturm; Assistant Professors Bongiorno, Fata, Terrizzi; Instructors Severino, Triolo.

Information on the Italian curriculum may be obtained from Professor Zina Tillona, Associate Chairman for Italian.

110, 120 (I), (II). ELEMENTARY ITALIAN.
For students with no previous creditable training in Italian. Intensive practice in language skills.

126 (I), (II). INTENSIVE ELEMENTARY ITALIAN.
For students with no previous creditable training in Italian. Intensive training in all language skills. Equivalent of 110, 120.
Credit, 6.

130, 140 (I), (II). INTERMEDIATE ITALIAN (140:C).
For students with one year of college Italian or equivalent. Training in the language skills; emphasis on speaking and understanding; readings in cultural and literary texts.

146 (I), (II). INTENSIVE INTERMEDIATE ITALIAN (C).
For students with one year of college Italian or equivalent. Reinforcement of basic language skills, further training in all skills. Reading and discussion of literary and cultural texts. Equivalent of 130, 140.
Credit, 6.

161 (I), 162 (II). INTRODUCTION TO ITALIAN LITERATURE (C).
Close reading of representative works in Italian literature. Training in the techniques of literary analysis of the main literary forms. Prerequisite for advanced courses in Italian.

181 (I), 182 (II). ORAL ITALIAN.
Oral aspect of the language; pronunciation, vocabulary building, speeches, discussions, debates. This course may only be taken pass/fail.

250. ITALIAN CIVILIZATION.
Historical, literary, philosophic and artistic aspects of Italian civilization. Provides understanding of Italian life and culture.

255. ITALIAN COMPOSITION.
Advanced composition. Primarily for Italian majors; open to all qualified.

289. ITALIAN LITERATURE IN TRANSLATION I (C).
Representative works of Italian literature through 1700. Not open to Italian majors.

291. ITALIAN LITERATURE IN TRANSLATION II (C).
Representative works of Italian literature from 1700 to the present. Not open to Italian majors.

292. DANTE IN TRANSLATION.
The works of Dante Alighieri in English translation; emphasis on the *Divine Comedy*.

301 (I), 302 (II). DANTE AND THE DUECENTO.
Selections from the works of Dante and his contemporaries; intensive study of the *Divine Comedy*.

307. BASIC METHODS.
Introduction to audio-lingual techniques of teaching Italian at the secondary level and contrastive analysis of the structures of Italian and English (Educ 307).

310. PRE-HUMANISM AND THE EARLY RENAISSANCE.
Literature of the fourteenth and early fifteenth centuries: Petrarca, Boccaccio, Poliziano, Alberti, Sacchetti.

315. THE HIGH RENAISSANCE.
Literature of the late fifteenth and sixteenth centuries: Machiavelli, Castiglione, Ariosto, Tasso.

330. ITALIAN LITERATURE OF THE EIGHTEENTH CENTURY.
Significant currents and authors from Goldoni to Alfieri.

335. NEO-CLASSICISM AND ROMANTICISM.
Intensive study of the works of Foscolo, Leopardi and Manzoni.

340. MODERN THEATER.
Italian theater from Verga to the present.

345. MODERN POETRY.
Italian poetry from Carducci to the present. Emphasis on hermetism.

350. MODERN ITALIAN NOVEL.
Development of the novel from Verga to the present.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391. SEMINAR IN ITALIAN LITERATURE.
Italian literature for advanced students. Subject announced the preceding semester.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

Geology and Geography

Head of Department: Professor Joseph H. Hartshorn. Professors Bromery, Farquhar, Hubert, Jaffe, McGill, Webb, Wise; Associate Professors Hall, Morse, Motts, Pitrat, Robinson; Assistant Professors Doehring, Haggerty, Nelson, Niedoroda, Perry; Instructor Rice.

Geography Faculty: In charge of program: Associate Professor Terence Burke. Associate Professor Wilkie; Assistant Professors Hafner, Meyer, Nostrand, Platt.

GEOLOGY

100 (II). PHYSICAL GEOLOGY (E). Geology as both physical science and history; review of current ideas concerning origin and modification of the earth's materials and landforms; use of current processes as clues to earth history. 2 class hours, 1 2-hour laboratory period, 1 1-hour quiz-discussion, and field trips.

101 (I), (II). PHYSICAL GEOLOGY (E). The nature and origin of the landscape features of the earth and their underlying rocks and structures, including the work of rivers, waves and currents, wind, and glaciers; the role of earthquakes, volcanoes, and the processes of mountain-building. 2 class hours, 1 3-hour laboratory period, and field trips. Mr. Rice.

105 (I). GEOLOGY AND MAN (E). Evidence for selected mineral-forming processes; minerals in industry; developments in mineral research and technology; geologic considerations in such engineering works as mines, foundations, tunnels, waterways, and airfields. Mr. Farquhar.

106 (I). THE FACE OF THE EARTH (E). Survey of selected physical processes that shape the world we live in, as shown in a study of the landforms of the United States. Includes, but not limited to, streams and rivers, the wind, coastal erosion, ground water, volcanism, earthquakes, and glaciers. Attention to landforms in New England, to arid regions, and to our National Parks and Monuments. Mr. Hartshorn.

107 (II). ORGANIC EVOLUTION AND THE GEOLOGIC RECORD (E). The adaptations of selected lineages of animals to the changing environments of the geologic past. Emphasis on those groups which best illustrate evolutionary principles or unsolved problems. Not open to those who have taken Geol 240. 2 class hours, 1 2-hour laboratory period. Mr. Pitrat.

108 (I). EVOLUTION OF THE EARTH'S CRUST (E). Application of geologic and oceanographic studies to problems of crustal evolution, including continental drift, the origins of mountains, continents, and ocean basins, and the formation of fossil fuels. 2 class hours, 1 2-hour laboratory-discussion period. Mr. Webb.

120 (II). ENVIRONMENTAL GEOLOGY (E). Principles of geology applied to regional planning in areas of conservation, land use, water resources, and water pollution; preservation of open spaces, wilderness areas, state and national park systems. Prerequisite, Geol 100, 101, or 130. Mr. Motts.

121 (I). LUNAR AND PLANETARY GEOLOGY (E). Application of basic geologic principles to study of terrestrial planets; processes acting on the moon and terrestrial planets; geologic history of the moon. 2 class hours, 1 2-hour laboratory-discussion period. Prerequisite, 1 semester of geology or permission of instructor. Mr. McGill.

130 (I), (II). SEMINARS IN GEOLOGY (HONORS) (E). Topics in geology, as determined by faculty and students involved. 2 class hours, 1 4-hour laboratory period, and field trips. Mr. Wise.

160 (I), (II). INTRODUCTORY FIELD METHODS. Interpretation and use of topographic maps and sections in laboratory and field; use of basic field equipment and techniques. 1 class hour, 1 5-hour laboratory period. Prerequisite, an introductory geology course. Credit, 2. Mr. Rice.

191 (I), (II). AN INTRODUCTION TO ROCKS AND MINERALS (E). General survey of rock-forming minerals, the rock classes, common ore minerals, gem minerals, and semi-precious stones. Not for geology majors, but designed for foresters, landscape architects, archeologists, botanists, wildlife and natural resources students, and those interested in natural history. 2 class hours, 1 2-hour laboratory period. Mr. Nelson.

192 (I), (II). MINERALOGY (E). Chemical composition, physical properties, crystallography, and genesis of common minerals. Laboratory technique for recognition of minerals. Prerequisites, an introductory geology course; Chem 111 and 112 (may be taken concurrently). 2 class hours, 2 2-hour laboratory periods, and field trips. Credit, 4. Mr. Haggerty, Mr. Nelson.

220 (I), (II). INTRODUCTORY PETROLOGY. Rocks, with emphasis on constituent minerals, textural and structural features, classification, mode of occurrence, and origin. Laboratory includes introduction to petrographic methods. A sequel to Geol 192, as the second half of a one-year study of minerals and rocks. Prerequisite, Geol 192. 2 class hours, 2 2-hour laboratory periods, and field trips by arrangement. Credit, 4.. Mr. Jaffe, Mr. Morse.

230 (I). FIELD AND STRUCTURAL GEOLOGY I. Basic methods of field geology; occurrences and recognition of geologic structure; preparation and interpretation of geologic maps; solution of simple structural problems. Prerequisites, Math 123; either Geol 100, 101, or 130; or alternatively Geol 105, 106, 107, or 108 and 160. 2 class hours, 1 5-hour laboratory period, week-end and holiday field trips. Credit, 4. Mr. Hall, Mr. McGill, Mr. Wise

231 (II). FIELD AND STRUCTURAL GEOLOGY II. Structural and dynamic analysis of deformed rocks; introduction to tectonics; field study of complex areas. Prerequisites Geol 220, 230. 1 class hour, 1 5-hour laboratory period, week-end and holiday field trips. Mr. Hall, Mr. Robinson, Mr. Wise

240 (I). INVERTEBRATE PALEONTOLOGY. The history, development, and identification of invertebrate animal fossils. Field trips by arrangement. Prerequisites, either Geol 100, 101, or 130; or alternatively Geol 105, 106, or 108 and 160. 3 class hours, 1 2-hour laboratory period. Credit, 4. Mr. Pitrat

250 (I). SEDIMENTOLOGY. Analysis and origin of primary sedimentary structures; composition and classification of sedimentary rocks; and criteria for identification of depositional environments in the rock record. Prerequisite, Geol 220. 2 class hours, 1 2-hour laboratory period, and field trips. Mr. Huber

251 (II). STRATIGRAPHY AND HISTORICAL GEOLOGY. Principles of stratigraphic correlation; methods of reconstruction of earth history; tectonic evolution of selected regions. Prerequisites, Geol 220, 230, 240, 250, or permission of instructor. 2 class hours, 1 3-hour laboratory period. Mr. Webb

280 (II). ENGINEERING GEOLOGY. Not open to geology majors. Materials and surface features of the earth with emphasis on engineering problems; map reading as related to the phenomena of physical geology. 2 class hours, 1 3-hour laboratory period or field trip. Mr. Farquhar

311 (I). OPTICAL MINERALOGY. Principles of optics; optical properties of minerals and methods for their measurement; relationship between optical properties and crystallography; microscopic techniques for mineral identification; crystal chemistry of rock-forming minerals. Prerequisites, Geol 220, Physics 141 and 142. 3 class hours, 1 3-hour laboratory period. Mr. Hall, Mr. Jaffe, Mr. Morse

321 (II). PETROGRAPHY. Identification of minerals in thin section; common igneous, sedimentary, and metamorphic rocks in thin section; petrographic calculations and measurements; introduction to petrogenetic theory. Field examination of selected igneous and metamorphic rocks. Prerequisites, Geol 220 and Geol 311. 3 class hours, 1 3-hour laboratory period, and field trips. Mr. Robinson

330 (II). TECTONICS.
Past and present mechanisms creating the broader framework of global geology, mountain-building, ocean-basin structure, continental drift, mantle processes, continental evolution, early history of the earth, structural geology of selected key regions of the globe. Prerequisites, Geol 231, 220. 2 2-hour class meetings. Given in alternate years with Geol 334.
Mr. Wise.

332 (I). ADVANCED GEOLOGIC MAPPING.
The complete series of operations required for the publication of a geologic map, including field location and accurate drawing of contacts, collection and interpretation of field notes, automated reduction of geologic data, preliminary and final drafting, and methods of reproduction, will be carried out. Field studies in areas of well defined stratigraphic units near Amherst. Prerequisites, Geol 220 and 231 or equivalent training. Seniors can incorporate mapping done in this course into an Honors Thesis to be completed 2nd semester. 1 class hour, 1 8-hour laboratory period.
Mr. Robinson.

334 (I). ASTROGEOLOGY.
Geology of the solar system with emphasis on the solid bodies: age, sequence of events, composition, surficial and internal geologic processes. Photogeologic mapping of selected portions of Moon and Mars using recent imagery from the space program. Prerequisites, Geol 231, 220. 2 2-hour class meetings. Given in alternate years with Geol 330.
Mr. Wise.

351 (I). GEOMETRICS.
Design of geological experiments; the collection and analysis of quantitative data in geology. Prerequisite, upperclass standing in geology. Mr. Hubert.

355 (I). DESCRIPTIVE PHYSICAL OCEANOGRAPHY.
Physical properties of sea water and their variations; water masses and their circulation patterns; interaction between ocean and atmosphere; dynamics of waves, tides, and ocean currents; techniques of oceanographic study. Prerequisites, Physics 141 or 161, upper class standing or permission of instructor. Marine Science 225 and calculus recommended. 3 class hours and field trips.
Mr. Niedoroda, Mr. Perry.

360 (I). GEOMORPHOLOGY.
Origin and development of landforms in relation to geological processes, climate, and tectonic history. Application of geomorphic methods to interpretation of geologic history. 2 class hours, 1 3-hour laboratory period. Prerequisites, Geol 230 or permission of instructor.
Mr. Doehring.

366 (II). GLACIAL GEOLOGY.
Sedimentary deposits related to glaciers; erosional and depositional processes and the recognition of erosional and constructional landforms; the origin of glaciers and forms of glaciers; Pleistocene history and stratigraphy. Peripheral subjects include shifting sea level, radiocarbon dating, palynology, the paleontological record, and Early Man. Prerequisite, either Geol 100, 101, 130, or permission of instructor. 2 class hours, 1 3-hour laboratory period. Field trips by arrangement. Mr. Hartshorn.

368 (II). PHOTOGEOLOGY AND REMOTE SENSING.
Techniques for making measurements and preparing base maps and geologic maps from vertical and oblique aerial photos; interpretation of cultural, geologic, and geomorphic features; introduction to remote sensing methods, including multispectral aerial photography, infrared imagery, and radar. Prerequisite, Geol 231; Geol 360 recommended. 6 laboratory and lecture hours to be arranged. Mr. Smith.

370 (I). GEOPHYSICS.
The physics of the earth and the gravitational, magnetic, electrical, and seismic methods of geophysical exploration. Laboratory problems and computations. Prerequisites, Physics 141, 142; Geol 230 and 220 or permission of instructor. 3 class hours and laboratory work by arrangement. Mr. Bromery.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

389 (I), (II). FIELD PROBLEMS.
Directed field study and/or research. With permission of the department may be used to satisfy B.S. field experience requirement. Prerequisites, Geol 220 and 230. Credit, 2-6.

391 (I), 392 (II). SEMINAR.
Participation in department's professional seminar. Prerequisites, Geol 220, 230, or permission of department.
Credit, 1 each semester (limited to 2 credits toward graduation).

399 (I), (II). DEPARTMENTAL HONORS.
Open to students of high academic standing by invitation of the department. Two semesters of supervised independent research leading to an Honors Thesis. Credit, 6 in second semester.

GEOGRAPHY

135 (I), (II). FUNDAMENTAL CONCEPTS AND PATTERNS.
The fundamental physical and human patterns of the earth's surface. Fundamental geographic concepts of region, spatial association, and spatial interaction. 2 class hours, 1 2-hour laboratory period, and field trips.

155 (I), (II). INTRODUCTION TO HUMAN GEOGRAPHY (D).
The spatial attributes of human societies; population, cultural characteristics, settlement, and economic activity. Selected regional case studies. 2 class hours, 1 2-hour laboratory period, and field trips.

156 (I), (II). HUMAN GEOGRAPHY (D).
Honors student section with an individual lab meeting time, but joint lectures with Geog 155.

200 (II). GEOGRAPHY OF ANGLO-AMERICA (D).
The contemporary physical and cultural geography of the United States and Canada approached by region and topic. Mr. Nostrand.

205 (I). HISTORICAL GEOGRAPHY OF THE UNITED STATES (D).
The development of basic physical, biotic, and cultural processes that have shaped successive demographic and cultural patterns in America's changing geography. Mr. Nostrand.

220 (I). GEOGRAPHY OF LATIN AMERICA (D).
A survey of the spatial organization of cultural and physical regions of Latin America. Emphasis on the dynamic change processes affecting man's horizontal linkages and use of the environment. Mr. Wilkie.

231 (I). GEOGRAPHY OF EAST ASIA (D).
An introductory examination of the geographical components of East Asia, China, Japan, and Korea with emphasis on physical, human, and economic resources and their continuity. Prerequisites, Geog 135 or 155 or permission of instructor. Mr. Hafner.

232 (II). GEOGRAPHY OF SOUTHEAST ASIA (D).
An introductory survey of the cultural, economic, and human geographic components of Southeast Asia that contribute to regional uniformity and diversity. Emphasis on contemporary problems of regional development and integration. Prerequisites, Geog 135 or 155 or permission of instructor. Mr. Hafner.

240 (II). QUANTITATIVE METHODS IN GEOGRAPHY.
Applications of statistical techniques to geographic problems: probability functions useful in geographic analysis, methods of spatial sampling, point pattern analysis, and spatial relations and areal associations. Prerequisites, Stat 121 or 232 or permission of instructor.
Mr. Meyer.

250 (I), (II). CARTOGRAPHY.
A systematic introduction to the presentation of physical and human variables cartographically. Emphasis on drafting techniques, map making, and problems of compilation, analysis, and graphic presentation of data. 2 2-hour lecture and laboratory periods. Mr. Wilkie.

260 (I). ECONOMIC GEOGRAPHY (D).
The distribution, production and utilization of the natural resources and commodities on which man's livelihood depends and the problems which they pose. Mr. Burke.

270 (I). URBAN SPATIAL ORGANIZATION (D).
Discussion of concepts of systems of cities including evolution of the urban pattern, city types, settlements as manufacturing and service centers and concepts of the internal structure of urban areas including land use systems, location of residences, location of commercial and manufacturing areas, intraurban movements. Mr. Meyer.

271 (II). SEMINAR IN URBAN GEOGRAPHY.
A selected topic in urban geography. For example, cross-cultural spatial structure of cities, Afro-American urban spatial organization, or urban regional development. Prerequisite, Geog 270 or permission of instructor. Mr. Meyer.

280 (II). POLITICAL GEOGRAPHY (D).
The spatial interaction between political regions and geographic space considered in its physical and cultural components. Emphasis on the nation-state and on problems between nation-states. Prerequisites, Geog 135 or 155 or Pol Sci 160–161 or permission of instructor. Mr. Burke.

380 (I). PROBLEMS IN POLITICAL GEOGRAPHY (D).
The political geography of selected regions or selected problems of general significance. Prerequisites, Geog 280 or permission of instructor. Mr. Burke.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

391 (I), 392 (II). SEMINAR.
Some restricted problem or region within geography. Prerequisites, two upper-division courses in geography or permission of geography staff.

Germanic Languages and Literatures

Head of Department: Carroll E. Reed. Professors Denkler, Malsch, Paulsen, Ryan; Associate Professors Beekman, Born, Cathey, Lea, von Kries, Meid, Reh, Schiffer; Assistant Professors Bauschinger, Haupt, Hugus, Peter, Seelig, Wilkinson.

To fulfill an undergraduate major in German, a student must complete 35 credits in the department's junior-senior courses. Two programs are available: Program A is designed principally for those who wish to teach in elementary or secondary schools, Program B for those who are primarily interested in continuing their studies in graduate school.

Students selecting Program A should take 161, 201, 202, 211, 221, 241, 283 and 284, and a minimum of three courses in German literature, one of which must be in the twentieth century (331, 332, 333, or 334).

Students selecting Program B should take 161, 201, 202, 211, 221, 284, 321, and 391, and one course in each of the following categories: (a) 331, 332, 333, 334, (b) 311, 312, 313, (c) 301, 302, 303.

One course in history or philosophy is required of all German majors.

Freshmen who fulfill the language proficiency requirement upon entrance should take 161 or 201.

Students are urged to supplement their course work with at least one summer session at an approved summer school of German or by participating in a summer program abroad, such as the University offers in Freiburg, Germany.

GERMAN

110, 120. ELEMENTARY GERMAN.
For the non-German major who has no previous training in German. Emphasis on understanding and reading. Sequence to be followed: German 110, 120, 130, 140. 3 class hours, 1 drill period.

112, 122. ELEMENTARY CONVERSATIONAL GERMAN.
For Honor students and prospective German majors, and those interested in intensive practice in the four language skills and who have no previous training in German. Emphasis on understanding and speaking. Sequences to be followed: German 112, 122, 132, 142 or German 112, 136, 142. 3 class hours, 1 drill period.

126 (I). INTENSIVE ELEMENTARY GERMAN.
For non-German majors. Intensive training in all language skills. Equivalent of 110, 120. 6 class hours. *Credit, 6.*

130, 140. INTERMEDIATE READING COURSE IN GERMAN (140:C).
Intensive review and readings in modern German literature for the non-German major. Prerequisite, German 120 or equivalent.

132, 142. INTERMEDIATE GERMAN (142:C).
For Honor students and prospective German majors, and those interested in an intensive practice in the four language skills. Emphasis on speaking and reading. Intensive review. Readings and discussion (in German) of modern German literature. Prerequisite, German 122 or equivalent. Use of tape library in the language laboratory.

136 (II). ACCELERATED GERMAN.
Recommended for Honor students and prospective German majors. Accelerated course for students interested in intensive practice in the four language skills who are selected on the basis of superior achievement in German 112. Covers the contents of German 122 and 132. Emphasis on understanding and speaking. Students completing this course qualify for German 142. 6 class hours. Use of tape library in the language laboratory. *Credit, 6.*

146 (II). INTENSIVE INTERMEDIATE GERMAN (C).
A thorough review for non-German majors of grammar, reading and discussion of literary texts; emphasis on the cultural background of German speaking countries. Equivalent of 130, 140. Prerequisite, German 120, 126, or advanced placement. 6 class hours. *Credit, 6.*

138, 148. SCIENTIFIC GERMAN (148:C).
Recommended for Science majors. Intensive review. Readings in Mathematics and Natural Sciences with exercises in translation from German into English. Prerequisite, German 120 or 122 or equivalent.

151. FREIBURG PREPARATORY COURSE IN GERMAN.
For students planning to attend the University's Freiburg Program the following year. Concurrent registration in a German language course required. Prerequisite, 120-level proficiency in German. Hours by arrangement.

161. READINGS IN GERMAN LITERATURE (C).
An introductory course, intended to increase reading comprehension and fluency. Based on selected literary texts mainly from the 19th and 20th centuries. Prerequisites, 140 or equivalent (to be established by an examination administered by the department).

201, 202. ADVANCED GERMAN.
Advanced grammar, extension of vocabulary, exercises in translation into German and in free composition and conversation. Prerequisite, German 142 or equivalent. 4 class hours. Use of tape library in the language laboratory. *Credit, 4.*

211. ADVANCED COMPOSITION, TRANSLATION AND CONVERSATION.
Continuation of 201 and 202. Emphasis on the writing of German (translation into German and free composition). Prerequisite, German 202 or equivalent. Use of tape library in the language laboratory.

221 (I). SURVEY OF GERMAN LITERATURE FROM 800 TO 1700 (C).
Prerequisite, German 161, 201 or equivalent.

222. SURVEY OF GERMAN LITERATURE FROM 1700 TO THE PRESENT (C).
Prerequisite, 161, 201 or equivalent.

231, 232. GERMAN MASTERPIECES IN TRANSLATION (C).
An introduction to selected masterpieces of German literature from the Middle Ages to the present. Different reading material in both semesters. Primarily for non-majors; majors may elect but not have major credit. May be repeated.

241. GERMAN CIVILIZATION I (C).
The political and cultural development of Germany and her role in the European tradition from the beginning to 1648. Readings in German and English. Conducted in English. Prerequisite, German 140 or equivalent.

242. GERMAN CIVILIZATION II.
The political and cultural development of Germany and her role in the European tradition from 1648 to the present. Readings in German and English. Conducted in English. Prerequisite, German 140 or equivalent.

283. METHODS OF TEACHING GERMAN.
The various methods of teaching a foreign language based on recent developments of applied linguistics and programmed learning. Emphasized are: the development of teaching materials by the individual student and the application of textbooks to the needs of various language courses. Prerequisite, German 140 or equivalent.

284. THE GERMAN LANGUAGE (C).
An introduction to the history of the German language. Prerequisite, German 140 or equivalent.

285. THE STRUCTURE OF GERMAN.
German phonetics and phonemics, with an introduction to German morphology. Prerequisite, German 140 or equivalent.

301. LESSING AND HIS TIME (C).
The preclassical German literature of the eighteenth century with emphasis on Lessing. Prerequisite, German 161, 201 or equivalent.

302. GOETHE (C).
A literary analysis of selected poems, plays and prose of the early and classical Goethe. Prerequisite, German 161, 201 or equivalent.

303. SCHILLER (C).
Selected poems, plays and essays by Schiller. Prerequisite, German 161, 201 or equivalent.

311. THE GERMAN POEM (C).
An historical survey based on a close reading of selected poems from the major phases of German poetry after 1500. Prerequisite, German 161, 201 or equivalent.

312. GOETHE'S *FAUST* (C).
Reading of Foust, Part I and selections of Part II. Prerequisite, German 161, 201 or equivalent.

313. ROMANTICISM (C).
Poetry and prose of the Romantic period. Prerequisite, German 161, 201 or equivalent.

321. 19th CENTURY LITERATURE (C).
Poetry, drama and prose with emphasis on Kleist, Büchner, Heine, Keller. Prerequisite, German 161, 201 or equivalent.

331. THE EARLY 20th CENTURY (C).
Main literary trends at the turn of the century with emphasis on Hauptmann, Hofmannsthal, George, Rilke and the early Thomas Mann. Prerequisite, German 161, 201 or equivalent.

332. BRECHT AND MODERN DRAMA.
Plays by Brecht, Frisch, Dürrenmatt and Weiss. Prerequisite, German 161, 201 or equivalent.

333. 20th CENTURY PROSE (C).
Works by authors such as Thomas Mann, Kafka, Musil and Grass. Prerequisite, German 161, 201 or equivalent.

334. CONTEMPORARY GERMAN LITERATURE.
A study of the contemporary literary scene in Germany. Prerequisite, German 161, 201 or equivalent.

385 (I), (II). SPECIAL PROBLEMS.
Guided reading and research in areas of specialization. *Credit, 1, 2 or 3.*

391 (II). SEMINAR.
In-depth study of a particular author, problem, theme, or genre. For seniors; open to juniors by permission of instructor. Prerequisite, two literature courses on the 300 level. May be repeated for credit.

398. DEPARTMENTAL HONORS.
Credit, 1-9.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

DANISH

110, 120. ELEMENTARY DANISH.
Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY DANISH.
Covers the material of Danish 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE DANISH (140:C).
Reading, conversation, composition. Grammar review. Prerequisite, Danish 120 or 126.

146 (II). ACCELERATED INTERMEDIATE DANISH (C).
Covers the material of Danish 130 and 140. Prerequisite, Danish 120 or 126. 6 class hours. *Credit, 6.*

251. DANO-NORWEGIAN LITERATURE (C).
Masterpieces of Danish and Norwegian literature, with emphasis on Ibsen, Holberg, and some attention to the modern authors. Prerequisite, Danish 140 or 146 or equivalent.

DUTCH

110, 120. ELEMENTARY DUTCH.
Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY DUTCH.
Covers the material of Dutch 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE DUTCH (140:C).
Reading, conversation, composition. Grammar review. Prerequisite, Dutch 120 or 126.

146 (II). ACCELERATED INTERMEDIATE DUTCH (C).
Covers the material of Dutch 130 and 140. Prerequisite, Dutch 120 or 126. 6 class hours. *Credit, 6.*

251. DUTCH AND FLEMISH LITERATURE (C).
Masterpieces of Dutch and Flemish (Belgian) literature. Prerequisite, Dutch 140 or 146 or equivalent.

268. MODERN DUTCH FICTION IN TRANSLATION.
Masterpieces of modern and contemporary Dutch fiction in English translation. No knowledge of Dutch required.

SWEDISH

110, 120. ELEMENTARY SWEDISH.
Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY SWEDISH.
Covers the material of Swedish 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE SWEDISH (140:C).
Reading, conversation, composition. Grammar review. Prerequisite, Swedish 120 or 126.

146 (II). ACCELERATED INTERMEDIATE SWEDISH (C).
Covers the material of Swedish 130 and 140. Prerequisite, Swedish 120 or 126. 6 class hours. *Credit, 6.*

Hispanic Languages and Literatures

Chairman of Department: Professor H. L. Boudreau. Professors Bancroft, Greenfield, Piccus, Rothberg, Wexler; Associate Professors Barreda-Tomás, De Puy, Fernández-Turienzo, Sturm; Assistant Professors Algarín, Scott, Soons, Zamora; Instructors Bradford, Galvin, Loureiro, MacLeod, Pollock, Rauchwarger; Lecturer Collins.

PORTUGUESE

At present no major in Portuguese exists. Students wishing to do further work in this field may take approved courses at Smith College.

110 (I), 120 (II). ELEMENTARY PORTUGUESE.
For students with no previous creditable training in Portuguese. Intensive practice in the language skills. 3 class hours, laboratory.

130 (I), 140 (II). INTERMEDIATE PORTUGUESE (140:C).
For students with one year of college Portuguese or equivalent. Training in the language skills; emphasis on speaking and understanding; readings in cultural and literary texts.

161 (I), 162 (II). INTRODUCTION TO PORTUGUESE LITERATURE (C).
Selected masterpieces of Portuguese literature presented integrally, in literary-historical perspective. Conducted in Portuguese. Either semester may be elected independently. Prerequisite, Portuguese 140 or permission of department.

SPANISH

The major in Spanish offers programs for students in any one of three interest areas: Literature, Language and Linguistics, and Bilingual Studies. Further information about provisional offerings not listed below is available from the department.

110, 120 (I), (II). ELEMENTARY SPANISH.
For students with no previous creditable training in Spanish. Intensive practice in language skills. To fulfill the language requirement, upon completion of the course most students are required to continue by taking Spanish 130, 140. 3 class hours, 2 laboratory sessions.

126 (I), (II). ELEMENTARY SPANISH — INTENSIVE.
Emphasis on the oral aspect. Designed to allow completion of Spanish 110 and 120 in one semester. 10 class hours. Open to all. *Credit*, 6.

130, 140 (I), (II). INTERMEDIATE SPANISH (140:C).
For upperclassmen who have completed Spanish 110-120, and freshmen and transfer students found qualified by placement examination. Training in language skill, with emphasis on speaking and understanding; readings in cultural and literary texts. Students completing Spanish 140 fulfill the language requirement.

131 (I), 141 (II). GRAMMAR.
A review of basic elements of grammar. For Spanish majors and others who plan to continue with Spanish beyond Spanish 140. To be taken concurrently with Spanish 130 and 140. 2 class hours. *Credit*, 1.

132 (I), 142 (II). INTERMEDIATE SPANISH (Honors Section) (142:C).
See Spanish 130, 140 for description.

133 (I), (II). INTERMEDIATE SPANISH (Remedial).
See Spanish 130 for description. For students who are not fully qualified for placement in Spanish 130. 4 class hours.

134 (I), (II), 144 (I), (II). INTERMEDIATE SPANISH (144:C).
Social sciences reading track.

146 (I), (II). INTERMEDIATE SPANISH — INTENSIVE (C).
An intensive intermediate course. Emphasis on conversation in Spanish and readings in Hispanic literature. Systematic review of grammar. Successful completion of this course satisfies the foreign language qualification. 8 class hours. *Credit*, 6.

161 (I), 162 (II). INTRODUCTION TO SPANISH LITERATURE (C).
Selected complete works in several genres studied analytically and critically to develop intensive reading skills and extend ability to interpret and explicate in Spanish both orally and in writing. Prerequisite, Spanish 140 or equivalent.

181 (I), 182 (II). ORAL SPANISH.
Oral aspects of the language: pronunciation, vocabulary building, speeches, discussions, debates. Grammatical elements required for correct and fluent use of American and Peninsular Spanish. Prerequisite, Spanish 140 or permission of department. 4 class hours.

191 (I). COMPOSITION.
Study and practice of the basic principles of writing in Spanish. Required of Spanish majors; open to others qualified. Prerequisite, Spanish 131, 141.

200 (I). CULTURAL BACKGROUNDS: SPAIN (C).
The diverse factors that have shaped Spanish culture. In Spanish. Prerequisite, Spanish 140 or permission of instructor.

201 (II). CULTURAL BACKGROUNDS: LATIN AMERICA (C).
The unity and diversity of Latin American civilization and the different cultural factors that have shaped it. In Spanish. Prerequisite, Spanish 140 or equivalent.

251 (I). CONVERSATIONAL SPANISH. (Course 1)
For Spanish majors and others interested in developing fluency in the spoken language. Prerequisite, Spanish 181-182 or permission of department. *Credit*, 1.

252 (II). CONVERSATIONAL SPANISH. (Course 2)
For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181-182 and Spanish 251 or permission of department. *Credit*, 1.

253 (I). CONVERSATIONAL SPANISH. (Course 3)
For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181-182 and Spanish 251 and 252 or permission of department. *Credit*, 1.

254. CONVERSATIONAL SPANISH.
For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181-182 and Spanish 251, 252 and 253 or permission of department. 2 class hours. *Credit*, 1.

291 (II). SPANISH MASTERPIECES IN TRANSLATION (C).
Detailed study of masterpieces of Spanish literature from various periods. Not open to majors in Spanish nor to students who have taken or plan to take Spanish 161-162.

307. THE TEACHING OF SPANISH.
Analysis of the major problems anticipated in the teaching of Spanish, and their solutions.

308 (I). SPANISH PHONETICS: PHONOLOGY AND PHONEMICS.
A systematic study of sounds, articulation and graphic representation. Highly recommended for teachers of Spanish.

309 (I). ADVANCED GRAMMAR.
Finer details and shades of Spanish grammar. Highly recommended for Spanish majors planning to teach; open to all qualified. Prerequisite, Spanish 131 and 141.

310 (I). ADVANCED COMPOSITION.
Intensive study of composition and style. Highly recommended for Spanish majors planning to teach; open to all qualified.

315. SPANISH LITERATURE FROM ITS BEGINNINGS TO 1500.
Poema de mío Cid, Libro de buen amor, Celestino and other selected texts.

317. SPANISH MEDIEVAL POETRY.
Spanish epic, lyric poetry and other verse of the period.

318. SPANISH MEDIEVAL PROSE.
Narrative, historical and didactic prose works of medieval Spain.

325. PROSE OF THE GOLDEN AGE.
Major prose works in sixteenth and seventeenth century Spain. Emphasis on the novel, excluding the *Quijote*.

330. CERVANTES.
Intensive reading of *Don Quijote*.

335. LYRIC POETRY OF THE GOLDEN AGE.
Spanish poetry of the sixteenth and seventeenth centuries from Garcilaso to Gongora.

340. DRAMA OF THE GOLDEN AGE.
Deals primarily with the comedia during the period of maximum creation, 1556-1681.

355. SPANISH LITERATURE FROM 1700 THROUGH ROMANTICISM.
Spanish literature and thought in the eighteenth century and the Romantic movement.

365. NINETEENTH CENTURY SPANISH NOVEL.
Prose fiction in the second half of the nineteenth century.

370. SPANISH-AMERICAN LITERATURE TO 1900.
A survey from pre-Columbian times to the Modernist movement.

371. THE *MODERNISTA* MOVEMENT.
Modernismo in Spanish America, including a comparative study of its manifestations in Spain.

372. MAJOR SPANISH-AMERICAN WRITERS.
Intensive study of major figures in Spanish-American literature.

373. SPANISH-AMERICAN POETRY AND DRAMA SINCE *MODERNISMO*.
The principal authors and movements in the twentieth century.

374. MODERN SPANISH-AMERICAN PROSE FICTION.
Spanish-American prose fiction in the late nineteenth and early twentieth centuries.

375. CONTEMPORARY PROSE FICTION IN SPANISH AMERICA.
The recent novel and short story.

381. MODERN SPANISH THEATRE.
Development of the theatre in Spain from the post-Romantic period to the present.

382. TWENTIETH-CENTURY SPANISH PROSE FICTION.
The novel in Spain from the Generation of '98 to the present.

383. MODERN SPANISH POETRY.
Poetry in Spain from Bécquer to the present.

384. THE ESSAY AS A LITERARY GENRE.
The essay as a vehicle for Spanish thought in the late nineteenth and twentieth centuries.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391. SENIOR SEMINAR.
Independent work on special problems in Hispanic literatures.

399. DEPARTMENTAL HONORS.
Open to students of high academic standing by invitation of the department.
Credit, 1-6.

History

Chairman of Department: Professor Robert McNeal; Professors Albertson, Bernhard, Cantor, Chrisman, Gordon, Greenbaum, Hanke, Hart, Ilardi, Kirk, Lewis, Oates, Potash, Quint, F. Wickwire; Associate Professors Boyer, Davis, DePillis, Griffith, Hernon, Johnston, Jones, McFarland, Minear, Nissenbaum, Richards, Sarti, Tager, Ware, M. Wickwire, Wyman; Assistant Professors Bell, Berkman, Biddle, Drake, Fox, Laurie, Loy, Pelz, Rearick, Shipley, Stepan, Story, Swartz, Swenson, Thompson, VanSteenberg, White; Instructor Bowlus; Lecturer Bunkle.

History majors must take as required courses in their freshman and sophomore years two year-long sequences chosen from History 100-101 or 110-111, 115-116, 120-121, 140-141, 150-151. The history major will select one of five areas of specialization (European, British, American, Latin American, or East Asian history) and take within it a minimum of 15-18 credits of upper-level course work. Students specializing in European history will be required to include in their program at least 3 credits in ancient or medieval history and an additional 3 credits in the early modern period (from the Renaissance through the 18th century). An additional 6-9 credits in electives outside the area of specialization are required, for a total of at least 36 credits in lower and upper-level history courses. (A more complete statement of requirements for the history major is available from the department.)

100 (I), 101 (II). HISTORY OF WESTERN THOUGHT AND INSTITUTIONS (C).
The historical development of the western European countries, their ideas, and institutions. Either semester may be elected independently. Admission to honors sections of these courses (102, 103) by permission of department.

102 (I), (II), 103 (I), (II). HONORS SECTION OF HISTORY OF WESTERN THOUGHT AND INSTITUTIONS (C).

106 (I), 107 (II). HONORS SEMINAR IN MODERN EUROPEAN HISTORY (C).
A thematic approach to the history of Europe since 1715. Open to Commonwealth scholars and selected students.

110 (I), 111 (II). PROBLEMS IN WORLD CIVILIZATION (C).
A comparative study of both the common and distinctive aspects of the world's great civilizations at critical phases of their development. Either semester may be elected independently.

115 (I), 116 (II). HISTORY OF EAST ASIAN CIVILIZATION (C).
An introductory survey of China, Japan, and related regions. First semester: survey of Chinese history; second semester: survey of Japanese history. Either semester may be elected independently.

120 (I), 121 (II). HISTORY OF LATIN AMERICAN CIVILIZATION (C).
An introduction to the history of Latin America. First semester: from pre-conquest times to the close of the colonial era; second semester: the evolution of Latin America in the nineteenth and twentieth centuries. Either semester may be elected independently.

140 (I), 141 (II). EUROPEAN HISTORY, 1500 TO THE PRESENT (C).
The historical development of Western European thought and institutions. First semester: from 1500 to 1815; second semester: 1815 to the present. History majors are strongly urged to take this course before registering for advanced European courses.

150 (I), 151 (II). THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).
A survey of the American national growth. Either semester may be elected independently. Admission to honors sections of these courses (152, 153) by permission of department.

152 (I), 153 (II). HONORS SECTIONS OF THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).

185 (I), 186 (II). NEW APPROACHES TO THE STUDY OF HISTORY (C).
Learning history by doing it. Each semester devoted to analysis of a single event; these have included the Salem witch trials and the Lizzie Borden murder case. Either semester may be elected independently.
Mr. Boyer, Mr. Nissenbaum, Mr. Laurie, Mr. Story.

200 (I). THE ANCIENT WORLD TO 500 B.C. (C).
From origins of human society to the Greek confrontation with the Persian Empire. Mr. Kirk.

201 (II). THE ANCIENT WORLD: PERICLES TO CONSTANTINE (C).
The successive assertions and breakdowns of leadership in the Greek and Roman worlds. Mr. Kirk.

202 (I). EARLY MIDDLE AGES, 300-1100 (C).
Spread of Christianity; pagan and early Christian culture; Germanic kingship; the Carolingian world; early feudalism; monasticism and ecclesiastical centralization.
Mr. Ware.

203 (I). THE LATER MIDDLE AGES, 1100-1350 (C).
Revival of towns and commerce; the growth and development of the feudal monarchies and ecclesiastical authority; rise of secularism. Mr. Lewis, Mr. Ware.

205 (I), 206 (II). THE AGE OF THE RENAISSANCE AND REFORMATION, 1300-1600 (C). The changes in European thought and institutions during the development of Humanism and the Protestant and Catholic Reformations. Either semester may be elected independently. Mr. Ilardi.

207 (I). EUROPE IN THE ENLIGHTENMENT, 1685-1789 (C). Civilization of western Europe in the eighteenth century, its social milieu, intellectual setting, institutional forces, religious tendencies, aesthetic contributions, and the growth of the revolutionary spirit. Mr. Greenbaum.

208 (II). THE FRENCH REVOLUTION AND NAPOLEON (C). Political change in Europe from the Old Regime and the French Revolution to the fall of Napoleon.

209 (II). HISTORY OF EUROPE, 1815-1870 (C). Major developments in the internal and international affairs of the European states from the Congress of Vienna to the Franco-Prussian War. Mr. Rearick.

210 (I). EUROPE, 1870-1918 (C). Internal developments of the principal countries; conditions and diplomacy which led to the World War; military and diplomatic history of the war years. Mr. VanSteenberg.

211 (II). EUROPE SINCE 1918 (C). Major developments in the internal and international affairs of the European states since World War I. Mr. VanSteenberg.

212 (I). EUROPEAN INTELLECTUAL HISTORY IN THE NINETEENTH CENTURY (C). Chief intellectual currents in Europe; romanticism, liberalism, religious revival, socialism, Darwinism, racism, and mass culture. Mr. Rearick, Mr. Johnston.

213 (II). EUROPEAN INTELLECTUAL HISTORY IN THE TWENTIETH CENTURY (C). Philosophical, academic, literary, aesthetic, political and popular currents since 1900. By permission of instructor. Mr. Johnston.

214 (I), 215 (II). THE HISTORY OF RUSSIA (C). A survey of Russian political, social, economic, and intellectual history from the ninth century to the present. First semester: the origin, growth, and development of Russia to 1815; second semester: the impact of modernization on Russia in the nineteenth and twentieth centuries. Either semester may be elected independently. Mr. Jones.

216 (I). THE RUSSIAN REVOLUTION (C). Origins, course, and impact of the Bolshevik Revolution. Mr. McNeal.

217 (II). SOVIET RUSSIA (C). Major social, political, intellectual developments, and the international relations of Soviet Russia since the Bolshevik Revolution. Mr. McNeal.

218 (I). EARLY MODERN GERMANY (C). From the end of the Thirty Years' War to the revolutions of 1848. Mr. Gordon.

219 (II). THE HISTORY OF MODERN GERMANY (C). The evolution and development of Germany since 1848, with emphasis upon diplomatic, political, military and social-economic trends and problems. Mr. Gordon.

220 (I). MODERN SCANDINAVIA (C). The major issues of domestic and foreign politics of the states of northern Europe in the nineteenth and twentieth centuries. Mr. VanSteenberg.

221 (II). FRANCE SINCE 1789 (C). Selected, formative political crises from 1789 to the present, and their settings in the economic, social, and intellectual life of modern France. Mr. Rearick.

222 (I), 223 (II). THE HISTORY OF SPAIN. (Not offered 1973-1974.)

224 (I). EUROPEAN DIPLOMATIC HISTORY, 1870-1914 (C). The internal politics and foreign policies of the major European powers. Emphasis on nationalism, liberalism, imperialism, alliance systems, and the origins of World War I. Mr. Swartz.

225 (II). EUROPEAN DIPLOMATIC HISTORY, 1914-1956 (C). The internal politics and foreign policies of the major European powers. Emphasis on the importance of World War I, the polarization of national and international politics, the origins, course, and aftermath of World War II, and the post-war world. Mr. Swartz.

226 (I), 227 (II). MILITARY HISTORY OF MODERN EUROPE (C). Development of European military theory and practice. First semester: Napoleonic era to 1914; second semester: 1914 to the present. Mr. Gordon.

228 (II). SEVENTEENTH CENTURY EUROPE (C). Europe from the Wars of the Counter-Reformation to the Glorious Revolution. Civilization of the Baroque in its social, political, economic, religious and intellectual settings. Mr. Greenbaum.

229 (II). SOCIAL HISTORY OF EARLY MODERN EUROPE (C). The social institutions of Europe as they change from a system of feudal organization to pre-industrial society, including the evolution of the town to the city, the changing role of the church, the changing role of agrarian life, the development of an intellectual class. Mrs. Chrisman.

230 (II). HISTORY OF MODERN ITALY (C). From the origins of the Risorgimento in the eighteenth century to the "opening to the left" of the 1960s, with particular reference to domestic problems after the unification, to Italian foreign policy up to the Second World War, and to the rise and consolidation of fascism. Mr. Sarti.

231 (I), 232 (II). ENGLISH HISTORY (C). Emphasis on economic, social, and cultural influences, as well as on constitutional development. Either semester may be elected independently. Mr. Shipley, Mr. Wickwire.

233 (II). MEDIEVAL ENGLAND (C). England from the fifth to the fifteenth century, with particular attention to the Anglo-Saxon period, the Norman Conquest, and the evolution of government to the accession of the Tudors. Mr. Ware.

234 (I), 235 (II). TUDOR-STUART ENGLAND, 1485-1688 (C). Selected aspects of the constitutional, social, intellectual, and imperial history of England in this period. Either semester may be elected independently. Mr. Shipley.

236 (I). BRITAIN IN THE EIGHTEENTH CENTURY (C). Selected aspects of social, intellectual, imperial, and constitutional history, including the Acts of Union. Impact of the Industrial and French Revolutions. Mr. Wickwire, Mrs. Wickwire.

237 (I), 238 (II). MODERN BRITAIN (C). Selected topics on the political, social, and intellectual development of Britain in the nineteenth and twentieth centuries. Either semester may be elected independently. Mr. Hernon, Mrs. Berkman.

239 (II). HISTORY OF THE BRITISH EMPIRE AND COMMONWEALTH SINCE 1783 (C). Evolution of British imperial policy; growth of the Dominions, the Commonwealth, and the dependent Empire; role of the Empire in world politics. Mr. Wickwire, Mrs. Wickwire.

240 (I). SOCIAL HISTORY OF EUROPE SINCE THE FRENCH REVOLUTION (C). The appearance, disappearance, rise and fall and alteration of social classes and major subclasses during the period. The causes and results of such developments. The interrelationships of political, economic, and social developments; differences of social systems within the European framework and their reverberations. Mr. Gordon, Mr. Sarti.

301 (II). ARGENTINA IN THE NINETEENTH AND TWENTIETH CENTURIES (C). The emergence of the major South American states. Political organization and economic change; the contemporary growth of nationalism and mass-based political movements. Mr. Potash.

302 (I). THE HISTORY OF MEXICO (C). Mexico from the end of the eighteenth century to the present. Emphasis on political, economic, and social developments. Mr. Potash.

303 (I). THE CARIBBEAN (C).

The Caribbean as a focus of conflict and adjustment from the fifteenth century to the present. Mrs. Loy.

304 (II). HISTORY OF GRAN COLOMBIA (C).
Colombia, Venezuela and Ecuador from colonial settlement to the present. Mrs. Loy.

305 (II). HISTORY OF THE ANDEAN REPUBLICS (C).
Peru, Bolivia, and Chile from the late colonial period to the present. Emphasis on political, social and economic developments with particular attention to institutions.

307 (I). THE HISTORY OF THE PORTUGUESE EMPIRE (C).
The colonial empire Portugal created in Morocco, West Africa, Mozambique, India, Brazil, and the Far East — from the capture of Centa in 1415 until Portugal recognized the independence of Brazil in 1825. Comparative treatment of economic affairs, political institutions, race relations, and cultural developments. Mr. White.

308 (II). THE HISTORY OF BRAZIL (C).
The cultural, economic, and political development of Brazil since 1822. How the largest and most populous nation in Latin America has become a significant power. Mr. White.

316 (I). AMERICAN COLONIAL HISTORY TO 1763 (C).
Discovery and exploration; early European settlements; system of political and economic control; religious and intellectual development; Anglo-French rivalry. Mr. Bernhard, Mr. Bell.

317 (II). THE AMERICAN REVOLUTIONARY ERA (C).
Coming of the Revolution; War for Independence; evolution of American federalism. Mr. Bernhard, Mr. Bell.

318 (II). THE EARLY NATIONAL PERIOD, 1789-1828 (C).
The development of the United States in its formative years, emphasizing political, intellectual, and diplomatic factors. Mr. Bernhard.

319 (I). JACKSONIAN AMERICA (C).
Political, economic, and social developments in the period before the Civil War. Mr. Richards.

320 (I). CIVIL WAR AND RECONSTRUCTION, 1860-1877 (C).
Conduct of the war; political problems; national reunification. Mr. Oates, Mr. Swenson.

321 (II). THE GILDED AGE (C).
The emergence of modern political issues during the final decades of the nineteenth century. Emphasis on the role of industrialization, corporate consolidation, urban growth, and labor, agrarian, and genteel protests. Mr. McFarland.

324 (I). THE PROGRESSIVE AGE, 1900-1920 (C).
The political response to the changing economic and social conditions in American life. Mr. Thompson, Mr. Tager.

325 (II). THE UNITED STATES BETWEEN THE WORLD WARS, 1920-1941 (C).
American political, economic, and intellectual life between the two World Wars. Mr. Griffith, Mr. Wyman.

326 (I), 327 (II). AMERICAN THOUGHT AND CULTURE (C).
The basic strands of American thought and their reflection in American culture. First semester: the period before 1865; second semester: Gilded Age and Twentieth Century. Either semester may be elected independently.
Mr. Cantor, Mr. Boyer, Mr. Nissenbaum.

328 (I), 329 (II). UNITED STATES CONSTITUTIONAL HISTORY (C).
Origins and development of American constitutionalism. First semester: Seventeenth century to the outbreak of armed sectional conflict; second semester: Evolution of constitutional power in modern America. Mr. Cantor.

330 (I), 331 (II). SOCIAL HISTORY OF THE UNITED STATES (C).
The evolving status of individuals and groups and problems of migration, livelihood, urbanization, and social conflict. Either semester may be elected independently. Mr. DePillis.

332 (I). THE SOUTH IN AMERICAN HISTORY (C).
From early settlement to contemporary regional problems. Mr. Thompson.

333 (II). HISTORY OF AMERICAN WESTWARD EXPANSION, 1763-1893 (C).
Advance of settlement from the Appalachians to the Pacific and the influence of the frontier upon social, economic, and political conditions.
Mr. Davis, Mr. DePillis, Mr. Oates.

334 (I), 335 (II). DIPLOMATIC HISTORY OF THE UNITED STATES (C).
Development of American foreign relations, 1776 to the present. Either semester may be elected independently.
Mr. Hart, Mr. Pelz.

336 (II). HISTORY OF THE AMERICAN LABOR MOVEMENT (C).
Evolution of trade unionism in American life from late eighteenth century origins through post-Civil War developments to the present. Critical evaluation of changes in labor history. Mr. Laurie.

337 (II). THE CITY IN THE MODERN UNITED STATES (C).
The industrial city and the full-scale urbanization of the modern United States. Effect of city life on the social, political and economic institutions of America. Emphasis on the historical origins of the problems of modern urban existence. Mr. Tager.

339 (II). UNITED STATES SINCE PEARL HARBOR (C).
Emphasis on political, economic, and social currents since World War II. Mr. Griffith, Mr. Wyman.

340 (I). CIVILIZATION OF ISLAM (C).
From the "revolutionary idea" of Islam and its conquest of an Arab empire to eighteenth century decay and the Western challenge. Mr. Biddle.

341 (II). THE MODERN MIDDLE EAST (C).
From the impact of eighteenth century Europe on the Islamic empire to the emergence of twentieth century Arab nationalism and socialism and the decline of Western influence. Mr. Biddle.

342 (II). THE OTTOMAN EMPIRE (C).
Ottoman history and institutions from the origins of the state to the proclamation of the Turkish Republic, ca. 1280 to 1923. Emphasis on political, economic and social history and the problems of westernization.

360 (I). HISTORY OF MODERN CHINA TO 1900 (C).
Explores the nature of the "traditional" Chinese order inherited by China's alien Manchu rulers; China's response to the West; rise of rebellions; failure of conservative reform; disintegration of an ancient civilization. Prerequisite, History 115 and 116 or permission of instructor. Mr. Drake.

361 (II). HISTORY OF MODERN CHINA: THE TWENTIETH CENTURY (C).
Examines twentieth century China's revolutions — intellectual, social, economic, political — and their settings up to the present. Prerequisite, History 115 and 116 or permission of instructor. Mr. Drake.

362 (I). HISTORY OF JAPANESE CIVILIZATION (C).
The development of Japanese civilization from its origins to the mid-nineteenth century. Mr. Minear.

363 (II). HISTORY OF MODERN JAPAN (C).
Japan's modernization from the mid-nineteenth century. Mr. Minear.

370 (I), 371 (II). HISTORY OF SCIENCE (C).
Development of major scientific achievements from antiquity to the present. Emphasis on scientific theory; conceptual developments in philosophical, cultural, sociological and scientific contexts. Prerequisite, one year of physical science. Mrs. Stepan.

386 (I), (II). SPECIAL TOPICS.
Special topics to be arranged, chiefly for advanced history majors.

395 (I), (II). SENIOR SEMINAR.
For seniors specializing in history. Intensive study in area of specialization, with emphasis on research papers.

399 (I), (II). SENIOR HONORS.
Independent study, research, and writing, culminating in senior honors' thesis. Participants selected by the History Department. *Credit, 1-6.*

Honors Program

Director: Prof. Cynthia Griffin Wolff; Prof. W. B. O'Connor and Prof. M. Sirridge, Assistant Directors.

Honors Program courses are usually open only to Commonwealth Scholars in the Honors Program.

181 (I), 182 (II), 183 (I), 184 (II), 185 (I), 186 (II). HONORS — STUDIES IN THE HUMANITIES (C).
An area of one or more of the humanistic disciplines, such as art, literature, music, history, or philosophy. For Honors Program freshmen and sophomores, and others by permission of the Director of Honors.

187 (I), 188 (II), 189 (I), 190 (II), 191 (I), 192 (II). HONORS — STUDIES IN THE SOCIAL SCIENCES (D).
An area of one or more of the social sciences, such as economics, psychology, sociology, or anthropology. For Honors Program freshmen and sophomores, and others by permission of the Director of Honors.

193 (I), 194 (II), 195 (I), 196 (II), 197 (I), 198 (II). HONORS — STUDIES IN THE SCIENCES AND MATHEMATICS (E).
An area of one or more of the sciences, such as physics, chemistry, botany, astronomy, geology, or zoology, or of mathematics. For Honors Program freshmen and sophomores, and others by permission.

385 (I), 386 (II). HONORS — INTERDISCIPLINARY STUDIES: JUNIOR COLLOQUIUM.
An interdisciplinary seminar for Honors Program juniors, open by invitation only.

387 (I), 388 (II). HONORS — INTERDISCIPLINARY STUDIES: SENIOR COLLOQUIUM.
An interdisciplinary seminar for Honors Program seniors, open by invitation only.

391 (I), 392 (II), 393 (I), 394 (II). HONORS — INTERDISCIPLINARY SEMINAR.
Study through the seminar method of a problem requiring the use of several disciplines. For Honors Program juniors and seniors, and others by permission.

Judaic Studies

The University of Massachusetts does not have a department of Judaic Studies, but an interdepartmental major is available. The major is administered by the following members of the Judaic Studies Committee, under the chairmanship of Professor Gilbert Lawall of the Department of Classics:

Leora Baron, Department of Classics
David Biddle, Department of History
Leonard Ehrlich, Department of Philosophy
Joel Halpern, Department of Anthropology
Charles Isbell, Department of Classics
George Kirk, Department of History
Henry Lea, Department of Germanic Languages and Literatures
Leila Meo, Department of Political Science
Edward Phinney, Department of Classics
Jules Piccus, Department of Hispanic Languages and Literatures
Robert Rothstein, Department of Slavic Languages and Literatures

Students majoring in Judaic Studies may choose any of the above professors as a faculty adviser, with whom to arrange their programs of study. The major consists of a minimum of 24 upper level credits in courses chosen from the list below. Normally the major will include some courses at the neighboring colleges. Judaic Studies 100, 101 is prerequisite to the major, and students must take at least three years or the equivalent of courses in Hebrew. Special problems courses may be arranged in the area of the student's particular interests with any of the professors listed above.

JUDAIC STUDIES

100 (I), 101 (II). THE JEWISH PEOPLE (C).
Selected topics in the history, religion, philosophy, art, and music, and in the social, economic, and political life of the Jewish people from their earliest origins to the present. Either semester may be elected independently.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the Judaic Studies Committee. *Credit, 1-3.*

HEBREW

110 (I), 120 (II). ELEMENTARY HEBREW.
An introduction to the Hebrew language. 3 class hours, 1 laboratory period.
Mr. Isbell.

126 (I). INTENSIVE ELEMENTARY HEBREW.
An intensive introduction to modern Hebrew. 4 class hours, 2 laboratory periods and open laboratory practice.
Credit, 6. Mrs. Baron.

130 (I), 140 (II). INTERMEDIATE HEBREW (140:C).
Emphasis on speaking and understanding; readings in cultural and literary texts.
Mrs. Baron.

146 (II). INTENSIVE INTERMEDIATE HEBREW (C).
Intensive reading in modern Hebrew. 5 class hours, 1 laboratory period and open laboratory practice.
Credit, 6. Mrs. Baron.

200 (I), 201 (II). MODERN HEBREW LITERATURE (C).
Readings in modern Hebrew writers.
Mrs. Baron.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. *Credit, 1-3.*

Related Courses:
The following courses in other departments may be taken for major credit in Judaic Studies:
History 341. The Modern Middle East. Mr. Biddle.
Near Eastern Studies 203. The Bible: Myth, Literature, and Society. Mr. Phinney.
Political Science 233. Governments and Politics of the Middle East. Miss Meo.
The following courses at Amherst, Mount Holyoke, and Smith colleges may be taken for major credit in Judaic Studies:
A History 53. The History of Israel.
MHC Religion 217f. Postbiblical Judaism.
MHC Religion 305s. The Old Testament Prophets.
SC Religion 210a. Introduction to the Bible, I.
SC Religion 235a and b. Jewish Thought, I and II.
SC Religion 285a and b. Hebrew Religious Texts.
SC Religion 310a. The Book of Job (Seminar).
SC Religion 311a. The Book of Genesis (Seminar).
SC Religion 328b. Directed Readings in Religious Texts: Hebrew.
SC Religion 335a. Selected Trends in Classical Jewish Sources (Seminar).
SC Religion 335b. Problems in Modern Jewish Thought (Seminar).

Latin American Studies

Undergraduates interested in Latin America may enroll in the Latin American Studies Program. The Program does not constitute a major and is designed to supplement the work done in a regular discipline. However, those students who fulfill the requirements of the Program will be awarded the Certificate in Latin American Studies attesting to their attainment in area and language studies. To earn a certificate a student must 1) satisfactorily demonstrate a practical working knowledge of Spanish or Portuguese and elementary proficiency in the other, 2) satisfactorily complete four courses focused on Latin America, and 3) participate in the Interdisciplinary Seminar on Latin America. The requirements of the Program are to be met partly through courses that fulfill existing requirements of the College and partly through the careful use of electives.

The Committee on Latin American Studies administers the Program and advises interested students. Members of the Committee are: R. Bancroft (Hispanic Languages and Literatures); M. Best (Economics); R. A. Potash, Chairman (History); D. Proulx (Anthropology); H. Wiarda (Political Science); R. Wilkie (Geography).

380 (I, II). FIELD STUDY.
Independent study in a Latin American country in accordance with a field experience project drawn up with the advice and approval of a faculty adviser and the Committee on Latin American Studies. Written report required. A

scholar in the Latin American country will normally be appointed to provide guidance and assistance. Orientation prior to departure is included.
Credit, 3-12.

390 (II). INTERDISCIPLINARY SEMINAR ON LATIN AMERICA.
Topics in modern and contemporary Latin America. For Certificate Program seniors and others who have completed at least three courses representing at least two different disciplines on Latin America and have a reading knowledge of either Spanish or Portuguese.

392 (I). BIBLIOGRAPHY OF LATIN AMERICAN STUDIES.
A survey and evaluation of sources of information about Latin America. Interdisciplinary approach. For Certificate Program students and others with strong interest in Latin America. Reading knowledge of either Spanish or Portuguese required.

Linguistics

Head of Department: Professor Samuel Jay Keyser; Professors Freeman, Partee; Assistant Professors Akmajian, Demers, Heny, Roeper.

Although there is no undergraduate major in Linguistics, courses are offered for those wishing to prepare for graduate work in this field or in anthropology, computer science, English, the foreign languages, philosophy, or speech. In addition to the courses listed below, many other departments offer related courses.

201 (I), (II). GENERAL LINGUISTICS (C).
A comprehensive treatment of the field of linguistics. The nature of language. Some language universals. Phonology, syntax, and other aspects of modern language theory. By permission may be counted for major credit in English, German, Romance Languages, Speech, and Psychology.

202 (I), (II). PHONOLOGICAL THEORY (C).
Introduction to the theoretical and psychological bases of contemporary phonological analysis; the concepts of the distinctive feature analysis. Prerequisite, Ling 201 or permission of instructor.

203 (I), (II). SYNTAX (C).
Methods of word and sentence formation; the notions of grammatically and well-formed utterances. Prerequisite, Ling 201 or permission of instructor.

204 (II). FIELD METHODS.
The methodology of linguistic work in the field; preparing questionnaires; analysis of data; use of the tape recorder. Prerequisite, permission of instructor.

323 (II). THE STUDY OF THE NATIVE LANGUAGE.
Historical backgrounds for the teaching of the English language; comparative analysis of modern theories of grammar; the uses of English; dialect and register; the language of literature.

385 (I), 386 (II). SPECIAL PROBLEMS.

398 (I). DEPARTMENTAL HONORS.
Credit, 1-9.

399 (II). DEPARTMENTAL HONORS.
Credit, 1-6.

RELATED COURSES:
ANTHROPOLOGY 105.
ENGLISH 312; 321.
GERMAN 284; 285.
PHILOSOPHY 125; 370; 371; 372; 373.
PSYCHOLOGY 221.
SLAVIC LANGUAGES 363; 365.
SPEECH 181; 284.

Mathematics and Statistics

Acting Head of Department: Associate Professor Murray Eisenberg. Professors Marshall H. Stone (George David Birkhoff Chair of Mathematics), Chen, Cohen, Cullen, Fischer, Foulis, Hayes, Holland, Jacob, Janowitz, Kundert, Mann, Martindale, Oakland, Schweizer, Skibinsky, Strother, Su, Wagner, Wang, Whaples; Associate Professors Allen, Bennett, Borrego, Catlin, Dickinson, Fogarty, Knightly, H.-T. Ku, Lavallee, Liu, Randall, Reed, Rosenkrantz, Schreiner, Sicks, Stockton; Assistant Professors Adams, Broshi, Bussel, Chang, Clark, Connors, Cook, Dahiya, Frank, Gauger, Geman, Gleit, Hedlund (Acting Assoc. Head), Hertz, Horowitz, Hurt, Joiner, R. Jones, S. Jones, Killam, King, Kleyle, M.-C. Ku, Lew, Mandelbaum, Manes, McGuigan, Meeks, Naylor, Norman, Ooms, Rudvalis, Shafer, St. Mary, Storey, Wattenberg; Instructor Maecher (Administrative Head).

MATHEMATICS
Beginning with the class of 1975, the requirements for a major in mathematics are the successful completion of: 1) Mathematics 165 (or 166) and 167; 2) a two-semester sequence in each of two of the groups Algebra, Analysis, Applied Mathematics, and Geometry and Topology listed below; 3) one course in a third of these four groups; 4) three additional 3-credit, upper-division (numbered above 199) courses in mathematics or certain related fields (a list of the specific mathematics-related courses which may be used to satisfy this requirement will be found in the Mathematics Information Leaflet); 5) two courses in engineering or in some one physical or biological science. In addition, a major is expected to have a cumulative quality point average of at least 2.0 in all mathematics courses numbered 167 or above taken at the University and used to satisfy these requirements.

The Algebra group is 211-212 and 311-312. The Analysis group is 225-226, 233, 325-326 and 331-332 (or 331-334). The Applied Mathematics group is 241-242, 251-252, 257 and 345-346. The Geometry-Topology group is 261-262, 363 and 365-366. The two-semester sequences in this list which may be used to satisfy requirement 2), above, are those pairs marked with a hyphen.

Students wishing to take upper level mathematics courses should note that Math 167 is a prerequisite for most of them. Mathematics 167 may be taken at any time after the student has finished one semester of calculus. Students desiring a strong preparation for upper division courses should consider taking Math 200. Math 200 can be taken at any time, though perhaps the sophomore year is preferable, and may be used in the completion of requirement 4) in the list above.

Mathematics majors in the class of 1974 may elect to satisfy either the requirements described above or else the prior requirements. The old requirements call for successful completion of: 1) Math 174 (or 165 or 184); 2) Mathematics 200, the old versions of Math 211-212 (offered for the last time during 1972-73), and 225 (or 325); 3) four additional upper-division courses in mathematics, exclusive of Math 285 and 286 (one or two of these may be replaced by math-related courses which would satisfy requirement 4) of the new requirements); 4) two courses in some one science.

Further information may be obtained from the Mathematics Information Leaflet, available from the department office, or from the departmental chief adviser.

011. ELEMENTARY COLLEGE ALGEBRA.
For those students who offer only one unit of algebra for entrance. A review of elementary algebra and a more thorough study of such topics as quadratic equations, exponents and radicals. No Credit.

100. MATHEMATICS IN THE MODERN WORLD (E).
A cultural presentation of some mathematical ideas to demonstrate both the scientific and the humanistic values. Open to Mathematics majors for nonmajor elective credit.

110. ELEMENTARY TECHNIQUES OF MATHEMATICS (E).
Including sets, logic, numbers, counting, functions, and graphs. Credit not allowed those who have taken the former course Math 111, Math 112, or any calculus course.

112. FINITE MATHEMATICS (E).
Finite mathematics with applications in probability. Topics chosen from logic, algebra of sets, and elementary combinatorial analysis. Topics include truth tables, implication, permutations and combinations, binomial theorem, conditional probability, Bayes' Theorem, expected value, stochastic processes and Markov chains. Prerequisites, Math 110 or equivalent.

115. ELEMENTARY LINEAR ALGEBRA (E).
Designed for and required of students in the School of Business Administration. Topics include systems of linear equations, vectors, matrices, determinants, Markov chains, linear programming, and application of these topics to business situations. Credit not given if taken after Math 167.

116. CALCULUS FOR BUSINESS I (E). Functions, limits, differentiation, and applications to business. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisite, high school algebra.

117. CALCULUS FOR BUSINESS II (E). Integration, functions of several variables, and applications to business. Credit given for only one of the courses 117, 119, 132, 136, 138. Prerequisite, Math 116.

118. MATHEMATICS 116 REMEDIAL (E). Calculus for business students (see description of 116) along with the necessary precalculus material. Intended for students not prepared for Math 116. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisite, high school algebra. 4 class hours.

119. MATHEMATICS 117 REMEDIAL (E). Continuation of Math 118. Credit given for only one of the courses 117, 119, 132, 136, 138. Prerequisite, Math 116/118. 4 class hours.

127. CALCULUS FOR THE LIFE AND SOCIAL SCIENCES I (E). Introduction to differential and integral calculus. Applications to the life and social sciences stressed. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra, analytic geometry (and trigonometry when taught in the spring semester).

128. CALCULUS FOR THE LIFE AND SOCIAL SCIENCES II (E). Continuation of Math 127. Credit given for only one of the courses 117, 119, 128, 132. Prerequisites, trigonometry and Math 127.

130. PRECALCULUS MATHEMATICS (E) Functions and graphs; analytic geometry of lines and conic sections; polynomial, exponential, logarithmic, and trigonometric functions. Primarily for students intending to study calculus but needing extensive preparation in the requisite algebra, trigonometry, and analytic geometry.

131. CALCULUS WITH PRECALCULUS I (E). Introduction to differential and integral calculus of functions of a single variable with requisite analytic geometry and trigonometry: analytic geometry of lines and conic sections, trigonometric functions, continuity, derivatives, extrema, curve sketching, the integral. Intended for students not prepared for Math 135 but who need less preparation than Math 130. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra and plane geometry. 4 class hours. Credit, 4.

132. CALCULUS WITH PRECALCULUS II (E). Continuation of Math 131. Integration techniques, limits, partial derivatives, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 128, 132, 136, 138. Prerequisite, Math 131/135. 4 class hours. Credit, 4

135. CALCULUS I (E). Introduction to differential and integral calculus of functions of a single variable: continuity, derivatives, extrema, curve sketching, the integral, elementary integration techniques. Primarily for students in the sciences. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra, plane geometry, trigonometry, and analytic geometry of lines and conic sections, or Math 130.

136. CALCULUS II (E). Continuation of Math 135. Limits, partial derivatives, integration techniques, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 132, 136, 138. Prerequisite, Math 135/137.

137. HONORS CALCULUS I (E). An enriched version of Math 135 for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 135. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, some demonstrated mathematical aptitude and permission of department.

138. HONORS CALCULUS II (E). An enriched version of Math 136 for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 136. Credit given for only one of the courses 117, 119, 128, 132, 136, 138. Prerequisites, some demonstrated mathematical aptitude, Math 135/137, and permission of department.

141. MATHEMATICS OF FINANCE (E). The mathematical principles of simple and compound interest, annuities, depreciation, valuation of bonds, and insurance.

143, 144. SPECIAL OR EXPERIMENTAL LOWER DIVISION COURSE. (E). Courses taught under these numbers will include one-time-only courses offered upon the availability of faculty with special interests or upon petition of twelve or more students; experimental courses; or interdisciplinary studies.

146. IDEAS OF THE CALCULUS (E). Origins and development of the major concepts of the calculus: analytic geometry, continuity, the derivative, the integral, differential equations. Intended for students not needing a working knowledge of calculus. Credit given for only one of the courses 116, 118, 127, 131, 135, 137, 146. Prerequisites, high school algebra and geometry.

151. BASIC CONCEPTS OF ALGEBRA (E). The real numbers as a field. Linear and quadratic equations and inequalities. Systems of linear equations and inequalities. Congruence. Complex numbers. Polynomials. Algebraic structures. Functions. Highly recommended for prospective elementary school teachers. Credit not allowed for Math 151 after Math 211. Prerequisite, Math 110 or equivalent.

165. MULTIVARIABLE CALCULUS (E). Functions of several variables, partial derivatives, multiple integrals, theorems of Green, Stokes, and Gauss. Prerequisite, Math 173/183 or Math 132/136/138.

166. HONORS MULTIVARIABLE CALCULUS (E). An enriched version of Math 165, for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 165. Prerequisites, Math 138 or Math 183, and permission of department.

167. INTRODUCTION TO LINEAR ALGEBRA (E). Vector spaces over the real field, linear independence, linear equations, bases and dimension, inner product spaces, linear transformations and matrices, determinants, eigenvalues, applications to geometry. Not for credit after Math 212. Corequisite, 2nd semester of calculus.

187. ORDINARY DIFFERENTIAL EQUATIONS FOR SCIENTISTS AND ENGINEERS (E). First and second order equations, elementary theory of Laplace transforms, systems with constant coefficients. Not for credit after Math 331 or 343. Prerequisite, Math 173/183 or Math 132/136/138. Math 165/166 recommended as a corequisite.

191, 192. FRESHMAN SEMINAR (E). A development of one or more topics in mathematics with extensive student participation. Intended for freshmen with mathematical interests and abilities. 191, Fall; 192, Spring. Prerequisite, permission of instructor. 1 to 3 class hours. Credit, 1-3.

200. FUNDAMENTAL CONCEPTS OF MATHEMATICS (E). Non-axiomatic propositional calculus (with truth tables), basic quantification theory and set algebra. Binary relations, equivalence relations, partitions, functions. Development of basic algebraic and topological features of real numbers from the axioms for a complete ordered field. Prerequisite, permission of instructor.

211. INTRODUCTION TO MODERN ALGEBRA I (E). Introduction to groups, rings, and fields. Prerequisite, Math 167. Math 200 may be helpful but is not necessary.

212. INTRODUCTION TO MODERN ALGEBRA II (E). Continuation of Math 211. Algebraic field extensions and solution by radicals,

canonical forms of matrices, quadratic forms, theory of groups, or other topics in algebra. Prerequisite, Math 211.

225. ADVANCED CALCULUS I (E).
Elementary topology of the line and Euclidean n-space, continuous functions, Riemann integration, infinite series and power series. Not for credit after Math 325. Prerequisites, Math 165/166 or Math 174/184 and Math 167. Math 200 may be very helpful but is not necessary.

226. ADVANCED CALCULUS II (E).
Continuation of Math 225. Multivariate analysis and the theorems of Green, Gauss, and Stokes. Not for credit after Math 326. Prerequisite, Math 225.

233. PROBABILITY.
A postulational study of probability, including counting methods, random variables; additional topics chosen from Bayes' theorem, statistical independence, laws of large numbers, and Markov processes. Prerequisites, Math 165/166 or Math 174/184, and Math 167. Math 200 and/or Math 211 strongly recommended.

241. APPLIED ANALYSIS I.
Complex analysis including analytic functions, residues, and conformal mappings; superposition of solutions of linear differential equations; orthogonal functions and Fourier series. Prerequisite, Math 174/184 or Math 165/166.

242. APPLIED ANALYSIS II.
Continuation of Math 241. Properties of Fourier series; boundary value problems; orthogonal functions; Laplace and Fourier transforms; applications to physical and engineering sciences. Prerequisite, Math 241; differential equations and a year of physics desirable.

251. NUMERICAL ANALYSIS I.
A first course in techniques of numerical approximation in analysis and algebra. Not for credit after Computer Science 251. Prerequisites, Math 174/184 or 165/166, and Comp Sci 121 or 131 or knowledge of basic FORTRAN.

252. NUMERICAL ANALYSIS II.
Continuation of Math 251, including numerical solution of partial differential equations. Prerequisite, Math 251.

255. MATHEMATICS FOR THE LIFE AND SOCIAL SCIENCES.
Infinite series, finite difference equations, and differential equations with applications from the life and social sciences. Cannot be taken for credit after Math 187 nor for upper division Math major credit. Prerequisite, one year of calculus.

257. LINEAR PROGRAMMING AND THEORY OF GAMES.
The Simplex Method and extensions, duality theorems, transportation problems and other applications. Finite two-person zero-sum games and the fundamental theorem. Prerequisite, Math 167 or permission of instructor.

261. AFFINE AND PROJECTIVE GEOMETRY I.
Coordinatization of the Desarguesian affine plane, the projective plane as an extension of the affine plane. Highly recommended for prospective secondary school mathematics teachers. Prerequisite, Math 167 or permission of instructor.

262. AFFINE AND PROJECTIVE GEOMETRY II.
Continuation of Math 261. Topics from affine, projective, Euclidean, and non-Euclidean geometry. Prerequisite, Math 261.

271. THEORY OF NUMBERS.
Euclidean algorithm, prime numbers, congruences, quadratic reciprocity, further topics in number theory. Recommended for prospective high school mathematics teachers. Prerequisite, Math 167 or Math 200, or permission of instructor.

275. TOPICS IN THE HISTORY OF MATHEMATICS.
A detailed examination of the work of a single great mathematician, the mathematics of a single historical period, or the historical development of a single mathematical idea. Prerequisite, Math 174/184 or Math 165/166.

299. PROBLEM SEMINAR.
For students with strong interest and ability in mathematics. Meets weekly in small sections to present and discuss solutions to challenging problems taken from a variety of sources. May be repeated for credit. Prerequisite, permission of instructor. One class hour. Credit, 1.

311. THEORY OF GROUP REPRESENTATIONS (E).
Abstract groups, subgroups, quotient groups, homomorphisms, representations, irreducible representations, characters, orthogonality relations. For students qualified to study algebra at a significantly higher level of abstraction than Math 211. Prerequisites, Math 167 and permission of department.

312. ADVANCED TOPICS IN ALGEBRA (E).
Topics to be chosen from: rings, integral domains, modules over principal ideal domains, field extensions, and Galois theory. Prerequisite, Math 311, or Math 211 and permission of instructor.

325. INTRODUCTORY MODERN ANALYSIS I (E).
Basic topology of Euclidean n-space and metric spaces, convergence of sequences and series, continuous functions and their local and global properties. Prerequisites, Math 174/184 or Math 165/166, and Math 167. Math 200 strongly recommended.

326. INTRODUCTORY MODERN ANALYSIS II (E).
Continuation of Math 325. Differentiation, Riemann integration, sequences and series of functions, functions of several variables. Prerequisite, Math 325.

331. ORDINARY DIFFERENTIAL EQUATIONS.
First and second order equations, existence and uniqueness theorems, systems of equations. Prerequisites, Math 174/184 or Math 165/166, and Math 167.

332. TOPICS IN ORDINARY DIFFERENTIAL EQUATIONS.
Topics chosen from: Sturm-Liouville theory, series solutions, stability theory and singular points, numerical methods, transform methods. Prerequisite, Math 331.

334. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.
Classification of second order partial differential equations, wave equation, Laplace's equation, heat equation, separation of variables. Prerequisites, Math 174/184 or Math 165/166, Math 167, and Math 331 or Math 343.

345. LINEAR ALGEBRA FOR APPLIED MATHEMATICS.
Introduction to vector spaces, inner products, and matrices followed by study of linear transformations, tensors, determinants, orientation, the spectral theorem for normal operators, complexification, real normal operators, and exterior algebra. Prerequisites, Math 167. Math 200 recommended but not required.

346. VECTOR AND TENSOR ANALYSIS WITH APPLICATIONS.
Continuation of Math 345. Fréchet derivatives, the inverse and implicit function theorems, vector and tensor fields, exterior differentiation, differential forms, differentiable manifolds. Prerequisites, Math 345, and Math 165/166 or Math 174/184.

363. DIFFERENTIAL GEOMETRY.
Differential geometry of curves and surfaces in Euclidean 3-space using vector methods. Prerequisites, Math 174/184 or Math 165/166, and Math 167, or permission of instructor.

365. TOPOLOGY I.
Introduction to the topology of metric spaces and topological spaces: metrics, topologies, continuity, connectedness, compactness. Prerequisite, Math 225, or Math 325, or permission of instructor.

366. TOPOLOGY II.
Introduction to the geometric ideas behind algebraic topology. Polyhedra, manifolds, Jordan curve theorem, homology mod 2, classification of surfaces, Brouwer fixed-point theorem. Prerequisites, Math 211 or 311, and Math 365.

371. SET THEORY.
Basic properties of sets. Ordered sets. Complete ordered sets. Well-ordered sets. Cardinal and ordinal numbers. Axiom of choice, well-ordering theorem, and Zorn's lemma. Cardinal arithmetic. Highly recommended for continuing mathematics majors. Prerequisite, Math 167 or permission of instructor.

385, 386, 387, 388. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

399. SENIOR HONORS.

STATISTICS

There is no undergraduate major in statistics. The curriculum is intended for those who wish to prepare themselves for graduate work in statistics and for those who require statistics as a basic preparation for their own subject-matter discipline. Cognate courses are needed to supply a basis for mature thinking. The statistical specialist should choose, according to his interests, cognate courses from such fields as: animal and plant breeding, biology, computer science, econometrics, engineering, genetics, mathematics, market research, psychology, and sociology. Students who expect to do graduate work in statistics should take Statistics 315 and 316.

Statistics leans heavily on mathematics and most of the prerequisites for the advanced statistics courses will come from Math 174/184, or Math 165/166 (calculus), Math 331 (differential equations), and a course in matrix algebra such as Math 167 or Math 212.

121 (I), (II). ELEMENTARY STATISTICS (E).
Selected topics in elementary probability and statistics: discrete models for chance experiments, conditional probabilities; "odds" and betting schemes, combinatorics, averages and standard deviation, random sampling, binomial and normal distributions, regression, statistical inference, chi square test. Students who intend to use statistics as a research tool, but who do not have a calculus background, should elect Stat 231, 232. Students with calculus background should elect Stat 315, 316.

231. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE I (E).
Random experiments and probability models; independence; conditional probability; sampling; random variables; data representations; special distributions, deduction and inference.

232. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE II (E).
Point, interval and model estimation; hypothesis testing; optimality concepts; power; least squares techniques; decision theoretic notions. Prerequisite, Stat 231.

251 (II). ELEMENTARY LEAST SQUARES, REGRESSION AND ANALYSIS OF VARIANCE (E).
Theory of least squares, analysis of variance, simple linear and multiple regression, and application of these techniques to the real data. Prerequisite, Stat 121 or 232.

261 (I). DESIGN OF EXPERIMENTS (Methods).
Purpose of experimental designs and their basic assumptions; individual comparisons, components of error, confounding; applications from various fields. Prerequisite, Stat 121, 232, or 316.

262 (II). ADVANCED STATISTICAL ANALYSIS OF EXPERIMENTAL DATA.
Analysis of data with disproportionate subclass numbers. Includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses. Prerequisite, Stat 261.

271 (I). SURVEY SAMPLING.
Theory and practice of sampling; optimum allocation of resources, estimation of sample size, various sampling methods, ratio and regression estimates, problem of non-response. Prerequisite, Stat 121, 232, or 316.

272 (II). SAMPLING THEORY AND METHODS.
Problems and methods of samplings; production and quality control, acceptance sampling, OC and ASN curves, types and properties of estimators. Prerequisite, Stat 121, 232, or 316.

281 (II). MULTIVARIATE ANALYSIS (Methods).
Applications of the theory in Statistics 282 to actual problems; research studies by the students, critiques of published research, or analysis of other bodies of data. Prerequisite, Stat 251 or 316.

282 (II). MULTIVARIATE ANALYSIS (Theory).
Correlation and regression, principal components, canonical analysis, analysis of dispersion and covariance, tests of homogeneity, discriminant functions. Prerequisite, Stat 316.

315 (I). INTRODUCTION TO THE THEORY OF STATISTICS I (E).
Probability, random variables, probability distribution (with emphasis on the binomial and normal distributions), mathematical expectation, bivariate and multivariate distributions, sampling distributions, the central limit theorem, point estimation, maximum likelihood estimators, interval estimation. Prerequisite, Math 124/125/134 or 117/119 or 132/136/138 or 154.

316 (II). INTRODUCTION TO THE THEORY OF STATISTICS II (E).
Interval estimation, hypothesis testing, analysis of variance, regression, correlation, decision theory. Prerequisite, Stat 315.

Microbiology

Acting Head of the Department: Professor Robert P. Mortlock. Professors Canale-Parola, Cox, Thorne; Associate Professors Dowell, Holt, Lessie, Zimmerman; Assistant Professors Czarnecki, Norkin, Reiner, Wilder; Instructor Boggs.

Microbiology majors are required to have broad training in collateral sciences, and minimum requirements include chemistry through quantitative analysis and organic, one year each of introductory biological science and physics, and mathematics through calculus. Those students contemplating graduate study will be advised to emphasize stronger training in these collateral sciences, especially physical chemistry and biochemistry. Courses in microbiology are designed to offer fundamental training in the basic core areas and disciplines of this field. Microbiology majors are required to take 17 credits of upper division departmental courses including Microbiology 250, 280, 340, 391 and 392.

140 (I), (II). BIOLOGY OF MICROORGANISMS (E).
The microbial world, including history, structure, growth, ecology, physiology, pathogenesis, and microbial genetics. Lectures supplemented with visual aid material.

141 (I), (II). BIOLOGY OF MICROORGANISMS.
Open only to students concurrently registered for Microbiol 140. 1 3-hour laboratory period. Credit, 1. Mr. Czarnecki.

250 (I), (II). GENERAL MICROBIOLOGY (E).
Microbial structure, growth and physiology, and the reactions of microorganisms to their physical, chemical and biological environments. Designed for students intending to take more advanced courses in microbiology and for other science majors. Prerequisites, Chem 262 and 264, 166 and 168, or 160 and one semester of biological science. 2 class hours, 2 3-hour laboratory periods. Credit, 4.

260 (I). MICROBIAL DIVERSITY (E).
Principles of selective enrichment and isolation; morphological, physiological and ecological characteristics of a number of microbial groups isolated from nature. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods.
Credit, 4. Mr. Canale-Parola.

280 (II). PATHOGENIC BACTERIOLOGY.
Correlation of physiologic, metabolic, and immunologic properties of bacteria with pathogenesis of disease. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods. Credit, 4. Mr. Wilder.

310 (I). IMMUNOLOGY.
Fundamental study of nature of antigens and antibodies, their interactions and significance in resistance and hypersensitivity. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods.
Credit, 4. Mr. Cox.

320 (II). MAMMALIAN VIROLOGY AND TISSUE CULTURE.
Properties of animal cells in tissue culture. Mechanisms by which viruses pene-

trate, replicate in, and produce morphological and functional changes in animal cells. Laboratory exercises on cell and virus propagation in tissue culture, virus assay techniques, and neoplastic transformation. Prerequisite, Microbiol 250, or permission of instructor. 2 class hours, 2 3-hour laboratory periods. Credit, 4.

340 (II). MICROBIAL PHYSIOLOGY. Fundamental studies of microbial chemistry and growth. Composition of bacterial cells, energy metabolism, biosynthesis of macromolecules and macromolecule precursor materials, and regulatory mechanisms governing these events. Prerequisite, Microbiol 250 or permission of instructor. Mr. Lessie, Mr. Mortlock.

385, 386. SENIOR RESEARCH. Prerequisites, 8 credits of Microbiology and departmental permission. Credit, 2-4.

391, 392 (I), (II). SEMINAR. Prerequisite, Microbiol 250. Credit, 1.

Music

Head of Department: Professor Philip Bezanson. Professors Alviani, Contino, du Bois (Associate Head), King, Teraspulsky, Tillis; Associate Professors Chesnut, Jenkins, Kaeser, J. Olevsky, Ornest, Steele, Stern, P. Tanner, Whaples; Assistant Professors Coxe, Fussell, d'Armand, Gaver, Harler, Humphrey, Lehrer, E. Olevsky, J. Tanner; Instructors Duchi, Smith; Lecturers Harry, Stencel.

The Bachelor of Music degree and the Bachelor of Arts degree are offered. A student must apply to the Music Department for admission. An audition is required of all applicants. Professor Joseph Contino is the Chief Adviser for undergraduate music.

The Bachelor of Music degree may be earned with a concentration in 1) Performance, or 2) Theory-Composition, or 3) Music Education (Vocal or Instrumental).

The Bachelor of Arts degree with a major in music may be earned with a concentration in 1) Performance, or 2) Theory-Composition, or 3) Music History. The Bachelor of Arts programs are preprofessional, serving to broaden cultural background.

All music majors take music theory (a three-year sequence), music literature and history (three semesters), work in large ensembles (all four years) and small ensembles, and electives. The general education requirements for the Bachelor of Arts are the core requirements of the College of Arts and Sciences; those for the Bachelor of Music are the University core requirements.

Additional music courses required for each specific major program include the following and other courses: extra applied music credits and a senior solo recital in Performance; teacher certification work in Music Education; advanced specialized courses in the particular field for majors in theory-composition or music history. Up-to-date outlines for the eight semesters in each of the majors may be obtained by applying to the Department. The final selection of courses is made by counselling each individual student.

Majors in other departments may elect a minor in music to include 111, 112, 201, 202, and 4 credits as advised in individual applied music and/or ensemble work. Education majors upon completing 111-112 should elect 242 (in lieu of 201).

The large and small ensemble organizations listed below, and other small ensembles specially arranged under 187, are open to all University students depending on any applicable audition requirements, space available, or permission of the instructor, who should in any case be consulted beforehand.

The Music Department is an associate member of the National Association of Schools of Music.

HISTORY AND APPRECIATION

101 (I), (II). INTRODUCTION TO MUSIC (C). Open to all students not majoring in music. Previous musical training not required. Basic music materials, principles of design, and cultural significance of representative works from the ninth century to the present.

102 (I). LITERATURE OF MUSIC (C). Review of music materials and principles of design. Emphasis on important examples of vocal music, keyboard music, chamber music, symphonies, concertos and operas from the Renaissance through the present time. Brief reference to Pre-Renaissance music. Listening and analysis. For music majors or by permission of instructor.

108 (II). AFRO-AMERICAN MUSIC AND MUSICIANS (C). Spirituals, blues, songs, jazz and classical music of Afro-Americans.

201 (I), 202 (II). HISTORICAL SURVEY OF MUSIC. History and literature of music: Music 201, from early religious chant through Bach and Handel; Music 202, from 1750 through vocal and instrumental music of the twentieth century. Prerequisite, permission of instructor, or Music 112.

203 (I). MUSIC FROM MONTEVERDI TO BACH. Baroque and Rococo periods, including music of such composers as Monteverdi, Schutz, Lully, Purcell, Corelli, Couperin, Rameau, the Scarlattis, Bach, Handel. Prerequisite, Music 201 and permission of instructor.

205 (I). GOTHIC AND RENAISSANCE MUSIC. Chant and organum through Renaissance motet and madrigal. Reading, listening, score study, analysis. Prerequisite, Music 201 and permission of instructor.

209 (I), (II). MUSIC OF THE 20TH CENTURY. European and American music written since 1900, including Stravinsky, Bartok, Hindemith, Copland, jazz, electronic music. Prerequisite, Music 202 and permission of instructor.

301 (II). HAYDN, MOZART AND BEETHOVEN. Reading, listening, score study. Prerequisite, Music 202 and permission of instructor.

302 (II). MUSIC FROM SCHUBERT TO DEBUSSY. History of nineteenth century romantic music in small and large forms, and various media including lieder, chamber music, symphony, opera. Reading, listening, score study. Prerequisite, Music 202.

303. HISTORY OF OPERA. History of Opera from the late sixteenth to the present century. Prerequisite, permission of instructor.

THEORY

111 (I), 112 (II). ELEMENTARY MUSIC THEORY (111:C). Notation, ear-training, solmization, sight-reading, harmony, counterpoint, analysis by score and sound of music literature from all periods, orchestration, improvisation and original composition. Kodaly materials and methods: in special class sections. Prerequisite, ability to read music. 111 prerequisite to 112. 2 class hours, 2 laboratory hours.

113 (I), 114 (II). INTERMEDIATE MUSIC THEORY. Continuation of 111, 112. Prerequisite, Music 112. Kodaly materials and methods: in special class sections. 113 prerequisite to 114. 2 class hours, 2 laboratory hours.

211 (I), 212 (II). ADVANCED MUSIC THEORY. Continuation of 113, 114. Prerequisite, Music 114. Kodaly materials and methods: in special class sections. 211 prerequisite to 212. 3 class hours, 1-2 laboratory hours as arranged.

213 (I), 214 (II). SENIOR MUSIC THEORY. Continuation of 211, 212. Prerequisite, Music 212. Kodaly materials and methods: in special class sections. 213 prerequisite to 214. 3 class hours, 1-2 laboratory hours as arranged.

215 (I). COUNTERPOINT. The techniques of sixteenth century modal counterpoint. Analysis, listening, and written assignments. Prerequisite, Music 114.

216 (II). ORCHESTRATION. Problems in scoring for various ensembles including full orchestra. Prerequisite, Music 114 or permission of instructor. 2 class hours. Credit, 2.

217 (I). CONTEMPORARY TECHNIQUES. Examination of melody, rhythm, harmony,

and form in twentieth century music. Analysis, listening, and written assignments. Prerequisite, Music 114. 2 class hours. *Credit, 2.*

218 (I). JAZZ ARRANGING AND COMPOSITION.
Writing arrangements and composing for jazz ensembles and the school stage band. Analysis, listening and instrumental scoring. Prerequisite, Music 114 or permission of instructor. 2 class hours, 1 2-hour laboratory period.

311 (I), 312 (II). COMPOSITION.
Free composition in various forms and media. Individual lessons. Weekly Seminar. Prerequisite, permission of instructor, Music 114.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1.*

MUSIC EDUCATION

118 (I), 119 (II). VOICE CLASS.
Vocal techniques. Open to instrumental music majors only. 1 class hour. *Credit, 1.*

151 (I), 152 (II). KODALY METHODOLOGY AND PRACTICE TEACHING.
Vocal music in public school grades 1 through 3. Kodaly Curriculum: complete analysis and usage of the curricular sequence, development of children's musical concepts and skills, theory of teaching. Preparation and evaluation of lessons and teaching experiences. Practical experience and teaching in a cooperating school. Co-requisite: Music 113, 114 (including Kodaly-solfege section). 151 prerequisite to 152. 1 class hour, 4 laboratory hours.

221-229* (I), (II). INSTRUMENTAL TECHNIQUES.
Class in one instrument. Materials and methods of teaching. Open to music majors only. 3 class hours, 2 laboratory hours. *Credit, 2.*

221—Violin
222—Cello
223—Flute
224—Oboe (Bassoon)
225—Clarinet
226—Horn
227—Trumpet
228—Trombone
229—Percussion

240. PRACTICUM IN MUSIC EDUCATION.
A laboratory experience in the observation, discussion and critical analysis of rehearsal techniques in the large music ensemble through the medium of the student's own performing group. Current and future trends in music education investigated and evaluated.

241. INSTRUMENTAL MUSIC IN THE PUBLIC SCHOOLS.
Philosophy, methods, and materials of instrumental music teaching in secondary education coupled with implications for elementary school instrumental music teaching.

242. MUSIC IN ELEMENTARY EDUCATION.
Techniques and classroom strategies that develop a sensitivity to music. Examination of movement, children's literature, vocal media, and emerging trends in curriculum design.

243. CHORAL MUSIC IN SECONDARY EDUCATION.
Problems of the changing voice, choral repertoire for junior and senior high school, rehearsal techniques, organization and structure of secondary school choral program.

244 (II). CLASSROOM MUSIC IN SECONDARY EDUCATION.
Investigation, evaluation, and organization of materials that contribute to the development of an aurally sensitive, intelligent and perceptive student in grades 7-12. Study and development of units of instruction for use in general music classes. Structure of non-performance oriented curricula.

245 (II). VOCAL PEDAGOGY.
Methods of teaching voice production. Prerequisite, 3 years of voice study. 1 class hour. *Credit, 1.*

247. MARCHING BAND TECHNIQUES.
Organization, training and repertoire for the high school and college marching band. Charting of drills, formations and continuity. 2 class hours. Prerequisite, two years of marching band experience. *Credit, 2.*

250 (II). INTERNSHIP IN THE TEACHING OF PUBLIC SCHOOL MUSIC.
This internship is designed as a semester-long supervised experience for students who wish to be certified to teach music in the public school. It offers the student the opportunity to integrate the theory of teaching with the practical experience. *Variable Credit, 6-12 hours.*

251 (I), 252 (II). KODALY METHODOLOGY AND PRACTICE TEACHING.
Continuation of Music 151, 152 applied to grades 4 through 6. Co-requisite, Music 211, 212 (including Kodaly-solfege section). 251 prerequisite to 252. 2 class hours, 4 laboratory hours. *Credit, 4.*

351 (I), 352 (II). KODALY METHODOLOGY AND PRACTICE TEACHING.
A continuation of Music 251, 252 applied to grades 7 through 12. Co-requisite, Music 213, 214 (including Kodaly-solfege section). 351 prerequisite to 352. 2 class hours, 4 laboratory hours. *Credit, 4.*

363 (II). BASIC CONDUCTING.
Introduction to conducting. Prerequisite, Music 211. *Credit, 2.*

364 (I). INSTRUMENTAL CONDUCTING.
Rehearsal techniques and conducting of instrumental ensembles. Prerequisite, Music 363. 2 class hours. *Credit, 2.*

365 (I). CHORAL CONDUCTING.
Rehearsal techniques and conducting of vocal ensembles. Prerequisite, Music 363. 2 class hours. *Credit, 2.*

APPLIED MUSIC

Registration in Applied Music courses requires prior permission of the department. Music majors are not charged additional fees for applied lessons or practice rooms.

120 (I), (II). PIANO CLASS.
Piano proficiency. Required of all music majors. Not open to non-majors. By examination, or no more than four hours credit allowed. 1 class hour. *Credit, 1.*

121-138* (I), (II). INDIVIDUAL INSTRUCTION.
Piano, voice, organ, strings, woodwinds, brasses, or percussion. Attention to development of performance skills and study of appropriate literature. Student recitals provide an opportunity for frequent public performance. *Credit, 1-4.*

121 Piano
122 Organ
123 Voice

Woodwinds
128 Flute
129 Oboe
130 Clarinet
131 Bassoon
132 Saxophone

Strings
124 Violin
125 Viola
126 Cello
127 Bass

Brasses
133 Trumpet
134 French Horn
135 Trombone
136 Baritone Horn
137 Tuba

138 Percussion

161* (I), (II). UNIVERSITY CHORALE.
A cappella choir selected by audition. Preparation and performance of choral literature ranging from the Renaissance to Contemporary. Concerts on campus and on tour. Three rehearsals a week. Chamber Singers selected from this group. May be repeated for credit. *Credit, 1.* Mr. du Bois

162* (I), (II). UNIVERSITY CHORUS.
Open to all students. Preparation and concert performance of oratorios and other large choral works. Two rehearsals a week. Madrigal Singers selected from this organization. *Credit, 1.* Mr. Harler.

165* (I), (II). WOMEN'S CHOIR.
A select choir specializing in choral literature for women's voices. Audition required. *Credit, 1.* Mr. Harler.

167 (I), (II). CHAMBER SINGERS.
Vocal ensembles specializing in performance of chamber music from Renaissance to Contemporary. Audition required. *Credit, 1.*

168 (I), (II). MADRIGAL SINGERS.
Vocal ensemble specializing in music of the Renaissance. Audition required. *Credit, 1.*

171* (I), (II). UNIVERSITY ORCHESTRA.
Preparation and performance of orchestral literature of various styles and periods. *Credit, 1.* Mr. Steele.

181* (I). MARCHING BAND.
Preparation and performance of pre-game and half-time shows during football season. Prerequisite, attendance at pre-season band camp and permission of conductor. Freshmen and sophomores may elect Marching Band in lieu of required Physical Education during the marching season. Credit, 1. Mr. Jenkins.

182* (I), (II). SYMPHONY BAND.
Preparation and performance of band and wind ensemble literature of various styles and periods. Credit, 1. Mr. Jenkins.

183* (I), (II). CONCERT BAND.
Preparation and limited performance of selected band literature.
Credit, 1. Mr. Duchi.

187* (I), (II). ENSEMBLE.
Preparation and performance of appropriate literature for small instrumental and vocal ensembles. Open to music majors and with permission of instructor.
Credit, 1.

188 (I), (II). JAZZ WORKSHOP.
Preparation and performance of literature for jazz ensembles and the school stage band. Prerequisite, permission of instructor. Credit, 1.

*May be repeated for credit.

Near Eastern Studies

The University of Massachusetts does not have a department of Near Eastern Studies, but an inderdepartmental major is available. The major is administered by the following members of the Near Eastern Studies Committee, under the chairmanship of Professor Gilbert Lawall of the Department of Classics:

Vartan Artinian, Department of Classics
Leora Baron, Department of Classics
Lois Beck, Department of Classics
Jack Benson, Department of Art
David Biddle, Department of History
Walter Denny, Department of Art
Charles Isbell, Department of Classics
George Kirk, Department of History
Leila Meo, Department of Political Science
Edward Phinney, Department of Classics

Students majoring in Near Eastern Studies may choose any of the above professors as a faculty adviser, with whom to arrange their programs of study. The major consists of a minimum of 24 upper level credits in courses chosen from the list below. Normally the major will include some courses at the neighboring colleges. Near Eastern Studies 100, 101 is prerequisite to the major, and students must take at least 3 years or the equivalent of courses in Arabic or Hebrew. Special problems courses may be arranged in the area of the student's particular interests with any of the professors listed above.

NEAR EASTERN STUDIES
100 (I), 101 (II). NEAR EASTERN CIVILIZATIONS (C).
Survey of Near Eastern civilizations from earliest times to the present. Either semester may be elected independently.
Mr. Biddle.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the Near Eastern Studies Committee. Credit, 1-3.

Related Course:
ENGLISH 203 (I), (II). THE BIBLE: MYTH, LITERATURE AND SOCIETY.

ARABIC
110 (I), 120 (II). ELEMENTARY ARABIC.
Introduction to modern standard Arabic. 3 class hours, 1 laboratory period.

130 (I), 140 (II). INTERMEDIATE ARABIC (140:C).
Readings in modern standard and classical Arabic.

200 (I), 201 (II). MODERN ARABIC LITERATURE (C).
Readings in modern Arabic writers.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement.
Credit, 1-3.

ARMENIAN
110 (I), 120 (II). ELEMENTARY ARMENIAN.
Introduction to the Armenian language. 3 class hours, 1 laboratory period.
Mr. Artinian.

130 (I), 140 (II). INTERMEDIATE ARMENIAN (140:C).
Readings in modern and classical Armenian literature. Mr. Artinian.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement.
Credit, 1-3.

HEBREW
See listings under JUDAIC STUDIES.

PERSIAN
110 (I), 120 (II). ELEMENTARY PERSIAN.
Introduction to modern Persian. 3 class hours, 1 laboratory period. Mrs. Beck.

130 (I), 140 (II). INTERMEDIATE PERSIAN (140:C).
Readings in modern and medieval Persian.
Mrs. Beck.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement.
Credit, 1-3.

TURKISH
110 (I), 120 (II). ELEMENTARY TURKISH.
Introduction to modern Turkish. By arrangement. Mr. Denny.

130 (I), 140 (II). INTERMEDIATE TURKISH (140:C).
Readings in modern and Ottoman Turkish. By arrangement. Mr. Denny.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement.
Credit, 1-3.

Related Courses:
The following courses in other departments may be taken for major credit in Near Eastern Studies:

Art 233, 235. Islamic Art and Architecture I and II. Mr. Denny.
Art 305. Art of Early Mediterranean Cultures. Mr. Benson.
Classics 225, 226. Mythology in the Ancient World I and II. Mr. Phinney.
History 200 The Ancient World to 500 B.C. Mr. Kirk.
History 340. Civilization of Islam. Mr. Biddle.
History 341. The Modern Middle East. Mr. Biddle.
History 342. The Ottoman Empire.
Political Science 233. Governments and Politics of the Middle East. Miss Meo.

The following courses at Amherst, Mount Holyoke, and Smith Colleges may be taken for major credit in Near Eastern Studies:

AC History 40. Modern Greece.
AC History 51, 52. The Middle East.
AC History 53. The History of Israel.
AC History 54. Topics on the Middle East.
MHC Anthropology 202s. Ethnology: Peoples and Cultures of the Middle East.
MHC Anthropology 352s. Seminar on Nomadic Pastoralism.
MHC Art 234s. Art in the Ancient Near East.
MHC Geography 214f. Geography of the Middle East.
MHC Greek 213f, 214s. Biblical and Early Christian Literature.
MHC History 292s. Introduction to Islamic History.
MHC History 310s. The Middle Ages: Byzantium and the West.
MHC Religion 223f. History of the Christian Church I.
MHC Religion 304s. The Beginning of Christianity.
SC Art 209a. Egyptian Art.
SC Art 210b. The Art of the Ancient Near East.
SC Art 220a. Early Christian and Byzantine Architecture.
SC Government 223a. Governments and Politics of the Middle East and North Africa.
SC History 201a. The Ancient Near East.
SC History 215a. The Byzantine Empire, 300-1453.
SC History 216a. The Islamic Middle East to the Fifteenth Century.
SC History 251b. The Islamic Middle East since the Fifteenth Century.
SC History 351b. Problems in the History of the Middle East.
SC Religion 230a. History of Christian Thought, I.
SC Religion 231b. Eastern Christianity.
SC Religion 275a. Islam.

Philosophy

Head of Department: Professor Vere Chappell. Professors Ackermann, Aune, Gettier,

Heidelberger, Matthews, Sleigh, Wolff; Associate Professors A. Brentlinger, J. Brentlinger, Ehrlich, Foster, Parsons, Robison; Assistant Professors Feldman, Jubien, Sirridge.

The standard major in Philosophy consists of 10 courses (30 credits), including one in logic, one in ethics, and four in the history of philosophy. 100-level course may be counted in meeting this requirement, as may individual study courses, which can be arranged by students with special interests.

Two variations on the standard major are offered: (1) an Honors major, in which students take special seminars and write a senior honors thesis; and (2) a teacher preparation program, designed to enable students to meet secondary school certification requirements, in which work in Education and opportunities for student teaching at local high schools are provided.

Plans are also underway for a series of joint major programs, in which philosophy is combined with work in other disciplines. Some of these programs should be available in 1973-74; information about them can be obtained from Professor Matthews, Director of Undergraduate Studies, or from the Departmental Office.

105 (I), (II). INTRODUCTION TO PHILOSOPHY (C).
Some of the most important general questions, ideas, theories, and methods of inquiry which have given direction to Western thought.

110 (I), (II). ETHICS (C).
Classical and contemporary theories concerning policy formation and the justification of personal decisions and ways of life.

111 (I). PROBLEMS IN SOCIAL THOUGHT (C).
A critical examination of a number of major problems in social policy and philosophy.

112 (II). MAN AND THE STATE (C).
An exploration of the historical, moral, legal, and political relationships between the individual and the state.

125 (I), (II). INTRODUCTION TO LOGIC (E).
The nature of critical thinking, including the functions of language, the structure of deductive arguments, and a glimpse at inductive methods.

161 (I). HISTORY OF PHILOSOPHY—ANCIENT AND MEDIEVAL (C).
Development of Western thought from its earliest beginnings to the flowering of medieval scholasticism. Emphasis on the contribution of important movements and great thinkers.

162 (II). HISTORY OF PHILOSOPHY—MODERN (C).
Continuation of Philos 161 from the Renaissance and the rise of modern science to nineteenth century idealism, positivism, and voluntarism.

201. PLATO AND ARISTOTLE (C).
The major works of Plato and Aristotle in ethics, logic, and metaphysics; the systematic character of their thought and its contemporary relevance. Prerequisite, one semester course in philosophy.

202. MEDIEVAL PHILOSOPHY (C).
The writings of major philosophers of the period, including Augustine, Aquinas, Duns Scotus, and Ockham; their historical setting and relevance to modern thought. Prerequisite, one semester course in philosophy.

203. CONTINENTAL RATIONALISM (C).
Representative philosophical texts, with concentration on authors of major historical influence such as Descartes, Spinoza, Leibniz, and Pascal. Prerequisite, one semester course in philosophy.

204. BRITISH EMPIRICISM (C).
Representative philosophical texts. Emphasis on Locke, Berkeley, Hume and their historical influence, especially on contemporary empiricism. Prerequisite, one semester course in philosophy.

205. KANT AND 19TH CENTURY PHILOSOPHY (C).
Readings of original texts, with emphasis on Kant and selected nineteenth century thinkers. Prerequisite, one semester course in philosophy.

218. AMERICAN PHILOSOPHY (C).
Examination, by means of a study of selected original texts by the outstanding American philosophers, of their contribution to western thought and American civilization.

225. INDIAN PHILOSOPHIES (C).
Theories of reality, of knowledge, of art, and of human destiny in the leading schools of Indian Asia; traditional and contemporary political theory.

226. EAST ASIAN PHILOSOPHIES (C).
Theories of human nature, society, and the state in philosophies of Chinese and Japanese origin; the modification of Buddhism under the influence of Chinese thought.

230. INTERMEDIATE LOGIC.
First order quantification theory with relations, identity, and definite descriptions; an introduction to one or more of the following: modal logic, epistemic logic, deontic logic, tense logic, and many-valued logics. Prerequisite, Philos 125.

240. PHILOSOPHICAL APPROACHES TO SCIENCE (E).
An introduction to the results of philosophical analysis of scientific practice, and the bearing of these results on a general description of scientific methodology.

241. PHILOSOPHICAL APPROACHES TO RELIGION (C).
Readings in contrasting religious philosophies, followed by analysis of concepts involved in understanding religion as related to other aspects of experience.

243. PHILOSOPHY OF ART (C).
The nature and function of artistic creation and expression, the analysis of aesthetic experience, the distinctive function of art in culture and personality, and the principles of criticism.

261. CONTEMPORARY ANALYTIC PHILOSOPHY (C).
Russell, Carnap, Wisdom, the later Wittgenstein, Austin, Strawson, Quine. Prerequisite, one semester course in philosophy.

263. MARXISM.
The moral, social, and political philosophy of Marx and Engels. Prerequisite, one semester course in philosophy or permission of instructor.

264. EXISTENTIAL PHILOSOPHIES (C).
Examination by a study of selected original texts of the main problems peculiar to this movement as a whole and to its main exponents individually. Prerequisite, one semester course in philosophy other than 125.

340. PHILOSOPHY OF SCIENCE.
A critical analysis of the structure of scientific method and the language of science, the respective roles of induction and deduction in science, and the status of theoretical terms. Prerequisites, three semester courses in philosophy, including 125.

341. PHILOSOPHY OF RELIGION.
Analytic study of the meaning and justifiability of beliefs concerning the existence and nature of God. Prerequisites, three semester courses in philosophy, including 125.

342. POLITICAL PHILOSOPHY.
A systematic approach to major controversies in philosophy of political science and political ethics; e.g., rationalism vs. empiricism, natural law *vs.* legal positivism. Prerequisite, one semester course in philosophy or permission of instructor.

343. AESTHETICS.
Analytic study of selected problems in aesthetic theory. Prerequisites, three semester courses in philosophy, including 125.

344. EPISTEMOLOGY.
Examination of various accounts of the nature of knowledge; attention to basic principles of epistemic logic, probability, and certainty. Prerequisites, three semester courses in philosophy, including 125.

345. METAPHYSICS.
The basic problems of metaphysics. Problems include the nature of necessity, the relation between universals and particulars, the concept of causality, and the relative merits of competing metaphysical views, such as materialism, idealism, and dualism. Prerequisites, three semester courses in philosophy, including 125.

350. HISTORY OF ETHICS.
Theories of important figures in the history of ethics, presented chronologically. Works in the following traditions will be represented: ancient Greek ethics; natural law and natural right theorists; the British moral sense, sympathy, and sentiment theorists; Kant; utilitarianism; self realization; pragmatism; and contemporary intuitionists. Prerequisites, two semester courses in philosophy above 200.

351. ETHICAL THEORY.
Some major problems of ethical theory. Emphasis on definition, the status of ethical statements, and reasoning and justification in ethics. Prerequisites, two semester courses in philosophy, including 125.

365. PHILOSOPHICAL THEOLOGY.
Systematic and historical inquiry into the methods, problems, and directions of theological thought. Prerequisites, two semester courses in philosophy above 200.

371. PHILOSOPHY AND LOGIC.
Informal exposition of results of modern logic that are of philosophical significance. Topics chosen from: semantics for first-order theories; Lowenheim-Skolem theorem; Herbrand-Gentzen theorem; Gödel's incompleteness theorem for first-order elementary number theory; Church's undecidability theorem for quantification theory; Tarski's semantic conception of truth; paradoxes of abstract set theory. Prerequisite, Philos 230.

372. MATHEMATICAL LOGIC I (E).
Axiomatization of sentential logic and the lower functional calculus; the syntax and semantics of first-order theories including results concerning consistency, adequacy, completeness, and elementary model theory. Prerequisite, Philos 230 or major in mathematics.

373. MATHEMATICAL LOGIC II (E).
Formalization of elementary number theory as a first-order theory; Gödel's theorem concerning incompleteness of number theory; introduction to the theory of recursive functions. Prerequisite, Philos 372 or major in mathematics.

381. SELECTED ANCIENT OR MEDIEVAL PHILOSOPHER.
Intensive study in the works of a single ancient or medieval philosopher, such as Plato, Aristotle, or Aquinas. Prerequisites, Philos 125, 161 or 201, and one additional semester course in philosophy.

382. SELECTED MODERN CONTINENTAL PHILOSOPHER.
Intensive study in the works of a single modern continental philosopher, such as Descartes, Spinoza, Leibniz, Kant, or Hegel. Prerequisites, Philos 125, 162 or 203, and one additional semester course in philosophy.

383. SELECTED MODERN BRITISH PHILOSOPHER.
Intensive study in the works of a single modern British philosopher, such as Locke, Berkeley, Hume, or Mill. Prerequisites, Philos 125, 162 or 204, and one additional semester course in philosophy.

(381, 382, and 383 may be repeated for an additional 3 credits provided the topic is different on each occasion.)

384. CONTEMPORARY PROBLEMS.
Selected persistent philosophical problems—e.g., induction, relation of mind and body, perception, certainty of statements, knowledge of other minds. Prerequisites, Philos 125 and two additional semester courses in philosophy.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391, 392. SEMINAR.
One major philosopher, major philosophical tradition, or restricted subject in a special field of philosophical inquiry. Prerequisites, two semester courses in philosophy numbered above 200, or permission of department.

396, 397. HONORS SEMINARS, I, II.

399. HONORS THESIS.
Restricted to senior Honors Majors. To be taken both semesters of the senior year. *Credit, 6 (second semester on completion of thesis).*

Physics and Astronomy

Head of Department: Professor L. F. Cook. Professors Brehm, Engelsberg, Gluckstern, Harrison, Huguenin, Inglis, Irvine, Jones, Krotkov, Peterson, Quinton, Rosen, Ross, Shafer, Soltysik, Sternheim, Strong; Associate Professors Arny, Byron, Dent, Ford, Freytag, Gerace, Goldenberg, Golowich, Guyer, Hertzbach, Kofler, Kreisler, Langley, Manchester, Mullin, Penchina, Pichanick, Rabin, Sastry, Schultz, Swift, Taylor; Assistant Professors Chang, Crooker, Dworzecka, Hallock, Hoffman, Holstein, Kane, Mathieson, Tademaru, Van Blerkom, Walker, Whitney; Staff Associate Gray; Research Associates and Lecturers Griffiths, Jacobs, Johnson, Webb.

PHYSICS

Many introductory courses are offered by the Department of Physics and Astronomy: Physics 115, 116, 117, 118 describe special topics in physics and are primarily of cultural value; Physics 121-122 is a broader survey of physics designed for non-science majors; Physics 141-142 is a broad survey of physics which caters to the needs of science majors in general, including those who plan to go to medical school. None of the above courses is normally available for major credit in Physics. Physics 100, providing the highlights in Physics in one semester, offers an excellent opportunity for a student to test his interest in Physics as a possible major area.

Physics 161-162-163 provide the necessary background in physics for Engineering, Chemistry and other Physical Science majors.

Students planning to major in Physics may consider one of two kinds of programs: the R-program, aimed at those who wish to pursue research and university careers and plan to go on to graduate study in physics, and the T-program, designed for those who plan to go into inter-disciplinary work, physics teaching at the high school level or science-oriented administrative technical and business careers. Considerable flexibility is available in this latter program to suit needs and goals on an individual basis. Although it is possible to switch between the two programs until fairly late stages, students are strongly urged to plan their courses early in consultation with faculty advisers in the Department. Either the series Physics 181-182-183-184 or Physics 161-162-163 is appropriate for majors in the Freshman and Sophomore years, although Physics 181-184 is the preferred start for students interested in the R-program. This series is also available for non-physics majors who may wish to learn physics at a relatively sophisticated level. The mathematics requirement is satisfied by the sequence Mathematics 131-132-165 or Mathematics 135-136-165. Additional mathematics courses such as 167, 187 or 331, 241 and 242 are recommended.

In addition to the above, the following are minimum requirements for a B.S. or B.A. in Physics: 18 credits in upper division courses in the Department of Physics and Astronomy (must include at least 4 credits in electricity and magnetism with a laboratory), 3 credits in modern physics and 3 credits in advanced experimental work (or an experimental honors project). Normal preparation for graduate study in Physics (R-program) consists of several Physics and Mathematics courses in addition to the minimum requirements (see the following typical program). The distinction between the B.S. and B.A. degrees is made on the basis of distribution requirements set by the College of Arts and Sciences.

Typical Program for R-Program Physics Major:

Freshman Year:	Physics 181 Math 135 Science elective	Physics 182 Math 136 Science elective
Sophomore Year:	Physics 183 Math 165	Physics 184 Math 187

Junior Year:	Physics 251 Physics 255 Physics 387 or	Physics 252 Physics 256 Physics 319
Senior Year:	Physics 271 Physics 285 Physics 385	Physics 272 Physics 286 Physics 386

Typical Program for a T-Program Major:

Freshman Year:	Physics 100 Math 130 Science elective	Physics 161 Math 135 Science elective
Sophomore Year:	Physics 162 Math 136	Physics 163 Math 165
Junior Year:	Physics 200	Physics 301 Physics 385 Physics 390
Senior Year:	Physics 302 Physics 386 Physics 390	Education Block or other electives

100 (I). INTRODUCTION TO PHYSICS: THE WORLD BEYOND OUR SENSES (E).
The universe in terms of its basic building blocks—atoms, nuclei, and "elementary particles." New views of nature derived from our ability to see and measure the world of the very small.

114. THEORY OF SOUND WITH APPLICATIONS IN SPEECH AND HEARING SCIENCE (E).
Fundamentals of wave motion; vibration of strings and membranes; sound waves; free and forced vibrations; transmission, reflection and absorption of sound. Applications to speech and hearing mechanisms. Designed as a prerequisite to Speech 287/587.

115 (II). PHYSICS OF MUSIC (E).
Elementary concepts of physics of sound in the production and reception of music. No previous physics training required; largely non-mathematical presentation. Emphasis on basic principles. Some historical perspective developed. Individual instruments discussed with demonstrations.

116 (I). RELATIVITY (E).
As much general physics material as is required for an understanding of the fundamental principles of relativity, and of their consequences in other fields. Intended for the general student. No background in physics or science required. Prerequisites, high school algebra and trigonometry.

117 (II). NUCLEAR ENERGY, ITS PHYSICS AND ITS SOCIAL CHALLENGE (E).
Basic physical concepts clarifying the nature of atoms and nuclei; the workings, capabilities and possible perils of nuclear reactors and explosives; associated social, political and diplomatic problems and challenges. Prerequisite, high school algebra. Students with more background in separate section.

118 (I). ELEMENTS OF QUANTUM PHYSICS (E).
Atoms and their structure, matter waves, duality, Pauli principle, spin, uncertainty principle, role of models in physics, application of concepts of quantum physics to solid state, nuclear and elementary particle physics, philosophical implications. Necessary background of classical physics. Prerequisites, high school algebra and trigonometry.

121 (I), 122 (II). CONCEPTS OF PHYSICS (E).
Mechanics, sound, heat, electricity, light, atomic and nuclear concepts. Conventional topics may be replaced to suit specific undergraduate majors, to emphasize historical, biographical and conceptual rather than mathematical approaches. Physics 121 prerequisite for Physics 122. 2 class hours, 1 2-hour laboratory period. *Credit, 3 each semester.*

130 (I), (II). PHYSICS FOR ELEMENTARY EDUCATION MAJORS (E).
Physical phenomena and the schemes for their representation. Topics from mechanics, electricity and magnetism, waves, optics and properties of matter. Mathematics at the level of algebra, trigonometry and simple geometry developed as required. For elementary education majors only. 2 class hours, 1 2-hour laboratory.

141 (I), 142 (II). INTRODUCTORY PHYSICS I, II (E).
Mechanics, sound, heat; electricity, magnetism, light and modern physics, using trigonometry and algebra, but not calculus. Intended for pre-medical, pre-dental, pre-veterinary, and some science major students. Prerequisites, Math 130 previously or concurrently for Physics 141; Physics 141 for Physics 142. 3 class hours, 1 2-hour laboratory period. *Credit, 4 each semester.*

161 (I), (II). GENERAL PHYSICS I (E).
Mechanics. For students primarily interested in engineering, chemistry, or mathematics. Prerequisite, Math 135 or equivalent previously, or concurrently with special permission. 2 lectures, 2 recitations, 1 2-hour laboratory in alternate weeks. *Credit, 4.*

162 (I), (II). GENERAL PHYSICS II (E).
Heat, electricity, and magnetism. Prerequisites, Math 135 or equivalent, Physics 161; Math 136 previously or concurrently. 2 lectures, 2 recitations, 1 2-hour laboratory in alternate weeks. *Credit, 4.*

163 (I), (II). GENERAL PHYSICS III (E).
Electromagnetic radiation, optics, atomic and nuclear physics. Prerequisites, Math 136; Physics 162. 2 lectures, 1 recitation, 1 2-hour laboratory period. *Credit, 4.*

171 (II). HONORS GENERAL PHYSICS I (E).
For students of science, engineering and mathematics with good mathematical preparation. 3 class hours of informal lecture and discussion, 1 2-hour laboratory in alternate weeks. Permission of adviser or instructor. Topics and prerequisites, see 161 (II). *Credit, 4.*

172 (I). HONORS GENERAL PHYSICS II (E).
For students of science, engineering and mathematics with good mathematical preparation. 3 class hours, 1 2-hour laboratory in alternate weeks. Permission of adviser or instructor. Topics and prerequisites, see 162 (I). *Credit, 4.*

181 (I), 182 (II). INTRODUCTORY PHYSICS I, II FOR PHYSICS MAJORS (E).
Limited-enrollment course for Physics majors or others interested in an introductory course at an advanced level. Subjects include: vector analysis, laws of mechanics, application to rigid body motion, conservation laws, complex numbers, wave motion, thermodynamics, kinetic theory. Corequisite, Math 135, 136 or equivalent. Permission of department required. 3 class hours, 1 2-hour laboratory period. *Credit, 4 each semester.*

183 (I), 184 (II). INTRODUCTORY PHYSICS III, IV FOR PHYSICS MAJORS (E).
Continuation of 181, 182. Subjects covered include: laws of electricity and magnetism, radiation, light, geometrical and physical optics, relativity, modern physics. Prerequisites, Physics 181, 182; corequisite, Math 165 or equivalent. 3 class hours, 1 2-hour laboratory period. *Credit, 4 each semester.*

200 (I). ELECTRICITY AND ELECTRONICS.
Basic ideas of electricity and magnetism. Emphasis on conceptual development. Topics include D.C. and A.C. circuits, electromagnetic field theory and Maxwell's equations, electron ballistics, vacuum tubes and transistors. Laboratory deals with electrical measurements and electronic devices such as power supplies, amplifiers, etc. Prerequisites, Physics 162 or 183 or equivalent, and Math 165. 3 class hours, 1 2-hour laboratory period. *Credit, 4.*

251 (I). ELECTRICITY AND MAGNETISM I.
Classical field theory, static electric fields and magnetic fields of steady currents. Scalar and vector potentials. Laplace's equation and its solutions. Prerequisites, Physics 142, 162, or 183; Math 165.

252 (II). ELECTRICITY AND MAGNETISM II.
Continuation of 251. Time-varying fields. Maxwell's equations and applications to radiation. Prerequisites, Physics 251 and Math 187 or 331.

254 (II). METEOROLOGY.
Theoretical treatment of various atmospheric phenomena, with correlation of

observation and theory. Weather observations, preparation of weather charts, and weather forecasting. Prerequisites, Physics 142, or 162 or 184; Math 165.

255 (I), 256 (II). MECHANICS I, II.
Development of the fundamental concepts of dynamics with applications to particles and rigid bodies in translation and rotation. At the level of Becker's Theoretical Mechanics. Prerequisites, Physics 142, or 162 or 184; Math 165.

264 (II). WAVE MOTION.
Physical optics, acoustics and other wave phenomena discussed in a unified way. Prerequisite, Physics 252.

271 (I), 272 (II). STATISTICAL PHYSICS I, II.
Presentation of thermodynamics, kinetic theory and statistical mechanics in a unified structure. Prerequisites, Physics 142 or 162 or 184, and Math 165.

285. MODERN PHYSICS I.
Review of classical mechanics, theory of relativity, black body radiation, photoelectric effect. Compton effect, background for development of quantum mechanics, Bohr atom. Prerequisites, Physics 252, 256.

286 (II). MODERN PHYSICS II AND QUANTUM MECHANICS.
Quantum mechanics, application to atomic and nuclear physics, such as atomic spectra, Zeeman effect, angular momentum, barrier penetration. Prerequisite, Physics 285. 4 class hours. *Credit, 4.*

288 (I). SOLID STATE PHYSICS.
Introduction to theoretical and experimental physics of the solid state. Prerequisite, permission of instructor.

301 (II). CONCEPTS OF MODERN PHYSICS I.
Fundamental concepts of twentieth century physics. Topics include kinetic theory, transport phenomena, shell structure of atoms, basic principles of quantum mechanics. Prerequisite, Physics 163 or 184 or equivalent, Math 165.

302 (I). CONCEPTS OF MODERN PHYSICS II.
Continuation of Physics 301. Topics include relativity, properties and structure of nuclei, nuclear reactions, new quantum numbers and families of elementary particles; aspects of space physics such as Van Allen radiation belts; properties of matter in the solid state. Prerequisite, Physics 301 or equivalent, permission of instructor.

319 (II). ELECTRONICS INSTRUMENTATION.
A laboratory-oriented course designed expressly for physicists and chemists. Basic electronics principles, servo systems, operational amplifiers, digital circuits, other modern devices. Prerequisite, permission of instructor. 1 class hour, 1 4-hour laboratory period.

375, 376. ADVANCED EXPERIMENTAL WORK I, II.
Selected experiments and projects are investigated, according to the needs of the individual student. Prerequisite, Physics 200 or Physics 251. Two 3-hour laboratory periods. *Credit, 1-3.*

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

387 (I), (II). SPECIAL TOPICS IN ELECTRICAL MEASUREMENTS.
Selected experiments performed by students to gain experience in methods of electrical measurements. Normally open to junior majors. 1 to 3 2-hour laboratory meetings a week.
Credit, 1-3 each semester.

391. SEMINAR.
An aspect of physics not usually covered in regular course offerings. Normally open to upper division Physics majors. Prerequisite, permission of instructor.
Credit, 1-3.

ASTRONOMY (A Five College Department)
Chairman: Professor William M. Irvine. Professors Harrison, Huguenin, Seitter, Strong; Associate Professors Arny, Dent, Taylor; Assistant Professors Dennis, C. Gordon, K. Gordon, Greenstein, Tademaru, Van Blerkom.

100 (I), (II). EXPLORING THE UNIVERSE (E).
Not open to Physical Science or Engineering majors. The earth, its structure and age, the moon, the sun, other planets and the origin of the solar system. Stars and galaxies, their birth and death. The universe, its structure and evolution. Supplemented by occasional hours of evening observation.

101 (I). THE SOLAR SYSTEM (E).
Earth, moon, tides, laws of motion, planets and satellites, the sun. Origin of the solar system and current theories of the origin of life. Astron 103 is an optional laboratory.

102 (II). STARS AND GALAXIES (E).
The astronomical universe. Astronomical instruments. Stellar distances and motions, star clusters, nebulae, pulsars, quasars. Evolution of stars and galaxies, cosmology. Astron 103 is an optional laboratory.

103 (I), (II). ASTRONOMICAL OBSERVATIONS.
A laboratory and field course for students who are not majoring in physics and astronomy and preferably those who are taking or have taken either Astronomy 100, 101, or 102. Telescopic observations, evening field trips, daytime field trips to the Five College Radio Observatory and Planetarium, and examination of astronomical photographs. *Credit, 1.*

105 (II). WEATHER AND OUR ATMOSPHERE (E).
An introduction to the earth's atmosphere, including weather forecasting, the origins of rainbows, sundogs, fog, inversions, halos, thunderstorms, and other common phenomena.

122 (I), (II). INTRODUCTION TO ASTRONOMY AND ASTROPHYSICS (ASTFC 22) (E).
For astronomy majors or others interested in a quantitative introductory course. A description of our present knowledge of the universe and the means by which this knowledge has been obtained. The properties of the solar system, individual and multiple stars, interstellar matter, our galactic system, external galaxies, and the possibility of extraterrestrial life. Prerequisites, Physics 181 (or 161 or 141), Math 124 (or 136) or permission of instructor. *Credit, 4.*

231 (I). SPACE SCIENCE: TOPICS OF CURRENT ASTRONOMICAL RESEARCH (ASTFC 31) (E).
Intended primarily for students in major program I. A discussion of selected topics from current astronomical research. Choice of topics depends upon the instructor and may include the aims and results of space research and exploration, recent developments in stellar evolution, cosmology, and current research in radio astronomy. The discussion is in depth, but does not require advanced mathematics. Prerequisites, Astron 101-102 or 122 and Math 111 or 123.

234 (II). DEVELOPMENT OF ASTRONOMY (ASTFC 34).
The progress of astronomy, traced from prehistoric petroglyphs to the space age. Emphasis on the development of important ideas in the field and the relation of astronomy to other cultural trends. Supplemented by occasional use of the planetarium and the departmental telescopes. Prerequisite, Astron 101-102 or 122.

237 (I). ASTRONOMICAL OBSERVATION (ASTFC 37) (E).
An introduction to the techniques of gathering and analyzing astronomical data. Subjects to be covered depend somewhat on individual interests: fundamental astronomical catalogues and their uses, photography, photometry, spectroscopy and classification of spectra, techniques of planetarium use, basic radio astronomy, introduction to telescope design and use, the astronomical distance scale. Three hours of classroom work per week, some of which will be observing sessions to be arranged. Prerequisite, Astron 101-102, or 122, or permission of instructor.

238 (II). TECHNIQUES OF MODERN ASTRONOMY (ASTFC 38).
An introduction to modern methods of astronomical observation and data reduction. Specific techniques of optical astronomy, radio astronomy, and space astronomy are discussed and analyzed.

Laboratory experiments and field observations performed by students during the semester. Prerequisite, Physics 184 or permission of instructor.

343 (I). ASTROPHYSICS I (ASTFC 43). Basic topics in astrophysics. Equilibrium configurations and the physical state of stellar interiors. Polytrope models. Interaction of radiation and matter, and radiative transfer. Radiative and convective equilibrium. Study of opacity. Prerequisite, concurrent enrollment in Physics 251 or permission of the department. 4 class hours. Credit, 4.

344 (II). ASTROPHYSICS II (ASTFC 44). Interaction of matter and radiation. Radiative transfer. Introduction to the physics of stellar and planetary atmospheres. Interplanetary and interstellar particles. Extraterrestrial radio emission. Prerequisite, Astron 343, or permission of the department. 4 class hours. Credit, 4.

385 (I) or (II), 386 (I) or (II). SPECIAL PROBLEMS.
An individual research project approved by the department. Prerequisite, permission of the department.

Political Science

Chairman of Department: Professor Glen Gordon. Professors Allen, Beth, Booth, Braunthal, Feit, Fenton, Fliess, Houn, Howards, Lederle, Lewy, Mainzer, Maki, Oppenheim, Syed, Vali, Wiarda; Associate Professors Alfange, Connolly, Coulter, Friedman, Gere, Goldman, King, Meo, Ryavec, Shanley, Sulzner; Assistant Professors Bach, Eagan, Einhorn, Kline, Kramer, Mileur; Lecturer Reid.

Information concerning a Political Science Major may be obtained from Prof. Jerome M. Mileur, Chief Adviser or from any of the department's undergraduate advisers.

100 (I), (II). AMERICAN POLITICS (D). Introduction to constitutional principles and public policy making in American national government. Democratic theory, major national political institutions, electoral behavior, and selected public policy questions.

150 (I), (II). COMPARATIVE POLITICS (D).
Introduction to political structures, processes and comparative national development in parliamentary, one-party, and other political systems. The relationship of cultural values to institutions; emphasis on such forces of change as democracy, industrialization, and revolution.

161 (I), (II). WORLD POLITICS (D). Introduction to the nature, dynamics, and problems of world politics. Nationalism, ideology, and other forces underlying the foreign policies of the United States, the Soviet Union, and other states, as illustrated by selected contemporary issues.

201 (I), (II). ANCIENT AND MEDIEVAL POLITICAL THOUGHT (D).
Development of political thought and its relation to cultural and institutional growth from the time of the Greeks to the end of the Middle Ages.
Mr. Eagan, Mr. King, Mr. Lewy, Mr. Oppenheim.

202 (I), (II). MODERN POLITICAL THOUGHT (D).
Development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present.
Mr. Connolly, Mr. King, Mr. Lewy, Mr. Oppenheim, Mr. Syed.

203 (I), (II). PROBLEMS IN POLITICAL THOUGHT (D).
An analysis of central concepts and themes in political theory. Major orientations in both classical and contemporary thought.
Mr. Connolly, Mr. King, Mr. Mileur, Mr. Oppenheim.

218 (I), (II). POLITICAL PARTIES AND ELECTIONS (D).
American political processes. Emphasis on parties, pressure groups, and public opinion.
Mr. Coulter, Mr. Fenton, Mr. Gordon, Mr. Mileur, Mr. Shanley, Mr. Sulzner.

219 (I), (II). STATE GOVERNMENT (D). American state politics, organization, and functions. The role of the state in our federal system. Prerequisite, Pol Sci 100 or permission of instructor.
Mr. Booth, Mr. Gere, Mr. Howards, Mr. Shanley.

220 (I), (II). MUNICIPAL GOVERNMENT (D).
Survey of the structure and function of government in American municipalities.
Mr. Booth, Mr. Gere, Mr. Grady, Mr. Howards, Mr. Shanley.

221 (II). THE PRACTICE OF AMERICAN POLITICS.
Practical American politics, taught by a prominent political leader under the University Distinguished Professorship in Public Affairs. Prerequisite, Pol Sci 100. 2 class hours. Credit, 2.

222 (I). MASSACHUSETTS POLITICS (D). Analysis of the significant characteristics of Massachusetts politics as applied to political problems from an historical perspective with both a theoretical and a practical base. Field work supplements readings, lectures, and discussions.
Mr. Friedman.

233 (I), (II). GOVERNMENT AND POLITICS OF THE MIDDLE EAST (D).
Review of the dynamics of the traditional Islamic political system and of the transformation of that system under the impact of Western penetration of the Middle East. Contemporary Middle East politics with special reference to Israel, Syria, Lebanon, and the UAR. Miss Meo.

234 (II). GOVERNMENT AND POLITICS OF JAPAN (D).
Government and politics of modern Japan; emphasis on post-1945 period. Descriptive analysis of structure and function of governmental and political processes. Mr. Maki.

235 (I), (II). GOVERNMENTS OF EAST CENTRAL EUROPE (D).
Survey of the major governments in the East Central European area; emphasis on the nature of Communist Party control. Governments include those of Czechoslovakia, East Germany, Hungary, Poland, Rumania, Yugoslavia, and others. Prerequisite, Pol Sci 150 or permission of instructor. Mr. Ryavec, Mr. Vali.

236 (I), (II). GOVERNMENT AND POLITICS OF THE SOVIET UNION (D).
Historical and ideological influences on Soviet politics; the interconnection of social and political institutions and processes; membership, organization, and operation of the Communist Party; the state structure and law; and contemporary Soviet foreign policy. Prerequisite, Pol Sci 150 or 161, or History 100-101, or permission of instructor.
Mr. Fliess, Mr. Ryavec, Mr. Vali.

237 (I), (II). GOVERNMENT AND POLITICS OF CHINA (D).
Analysis of the political ideologies, party movements, governmental institutions, and major domestic and foreign policies of contemporary China. Prerequisite, Pol Sci 150 or 161 or permission of instructor.
Mr. Houn.

238 (I), (II). GOVERNMENT AND POLITICS OF SOUTH AND SOUTHEAST ASIA (D).
Comparative study of the institutions and dynamics of government and politics in South and Southeast Asia, especially in India, Pakistan, Indonesia, and Malaysia. The issues of political stability, economic development, and relations with the United States and other great powers. Prerequisite, Pol Sci 150 or 161 or permission of instructor. Mr. Allen, Mr. Syed.

239 (I), (II). WEST EUROPEAN COMPARATIVE POLITICS (D).
Analysis of the political cultures, institutions, systems and processes of selected West European countries. Emphasis on social and economic factors relating to contemporary political issues.
Mr. Braunthal, Mr. Einhorn, Mr. King.

240 (I). GOVERNMENT AND POLITICS OF SOUTH AMERICA (D).
Comparative analysis of the interest groups, political parties, and governmental institutions of the South American countries. Emphasis on the background and political culture in which Latin American politics and government take place. Prerequisite, Pol Sci 150 or previous courses in Latin America, or permission of instructor. Mr. Kline, Mr. Wiarda.

241 (II). GOVERNMENT AND POLITICS OF CENTRAL AMERICA AND THE CARIBBEAN (D).
Comparative analysis of the interest groups, political parties, and governmental institutions of the Central American and Caribbean countries. Emphasis on

communism and the role of the U.S. Prerequisite, Pol Sci 150, or previous courses in Latin America, or permission of instructor. Mr. Kline, Mr. Wiarda.

242 (I). THE POLITICS OF SUB-SAHARAN AFRICA (D).
Organization and processes of African politics, centering on the general political problems facing contemporary African governments. Prerequisite, permission of instructor. Mr. Feit.

243 (I), (II). COMPARATIVE AFRICAN GOVERNMENTS (D).
Comparative study of the political processes of five African states. Prerequisite, Pol Sci 242 or permission of instructor. Mr. Feit.

244 (II). POLITICAL DEVELOPMENT AND MODERNIZATION (D).
Comparative analysis of political change and development in the emerging nations. Mr. Coulter, Mr. Maki, Mr. Wiarda.

245 (II). GOVERNMENT AND POLITICS OF SPAIN AND PORTUGAL (D).
An examination of the unique aspects of the process of political development (and/or decay) in Spain and Portugal, with emphasis on the heritage of these two nations as reflected in their New World colonies in the Americas and on the present-day pattern of politics in the Iberian peninsula. Mr. Wiarda.

248 (I), (II). GREAT BRITAIN AND THE COMMONWEALTH (D).
The practice of parliamentary government in Great Britian and the Commonwealth countries. Emphasis on the development of the conception of the Commonwealth, the institutions through which it operates, and its role in contemporary world politics. Prerequisite, Pol Sci 150 or 161 or permission of instructor.

254 (I), (II). INTERNATIONAL RELATIONS (D).
The nation-state system and conceptions of national interest in modern world politics. Emphasis on forms and distribution of power, making of foreign policy, and adjusting of international conflict. Prerequisite, Pol Sci 150 or 161, or History 101, or permission of instructor. Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Vali.

272 (I), (II). PUBLIC ADMINISTRATION (D).
Organization of bureaucracy, bureaucratic life, constitutional position and political role of governmental bureaucracy. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Kramer, Mr. Lederle, Mr. Mainzer, Mr. Reid.

273 (II). PUBLIC PERSONNEL ADMINISTRATION.
The personnel function in bureaucracy; patronage and merit; career service and political executive; authority and informal organization; employee rights and collective action. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Kramer, Mr. Lederle, Mr. Mainzer.

275 (I). COMPARATIVE PUBLIC POLICY (D).
Comparative analysis of policy formation. Emphasis on the process of social and economic policy decision-making in selected industrial societies; the interaction of institutions, ideas, and power in decisions concerning social welfare, economic planning, and related policy areas. Prerequisite, Pol Sci 150 or Econ 125. Mr. Einhorn.

276 (II). POLITICAL THEORY AND PUBLIC POLICY (D).
Evaluation of social policy in the United States. Emphasis on normative issues raised in controversies over selected cases of social and economic policy in the light of the main traditions of Western political thought and of recent work on the logical and ethical aspects of social choice. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Eagan.

277 (I). ARMED FORCES AND POLITICAL POLICY (D).
Comparative study of civilian-military relations in Western and non-Western nations. Emphasis on both regular and irregular armed forces. Mr. Feit.

290 (I), (II). CONSTITUTIONAL LAW (D).
Historical study of the United States Constitution as interpreted by decisions of the Supreme Court. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Alfange, Mr. Beth, Mr. Goldman.

291 (I), (II). THE LAW AND PRACTICE OF CIVIL LIBERTIES (D).
Development in American Constitutional Law of the concept of civil liberty, including free speech and religion, fair trial, and race discrimination. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Alfange, Mr. Beth, Mr. Goldman.

292 (I), (II). POLITICS, THE LAW AND JUDICIAL BEHAVIOR (D).
Law as the political and social means of adjusting needs and desires to governmental policy. Emphasis on judicial behavior in lawmaking and law enforcing. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Alfange, Mr. Beth, Mr. Goldman.

303 (I), (II). AMERICAN POLITICAL THOUGHT (D).
Development of American political thought from colonial times to the present. Mr. Gere, Mr. Mileur, Mr. Syed.

306 (II). COMMUNIST POLITICAL THOUGHT.
Philosophical and religious origins of communism in Western and Eastern Europe; analysis of the classics from Marx to Khrushchev. Emphasis on causes, nature, and effect of communism as the ideology of a national and international movement; communist theory of state, law, and democracy; and socialist ethics. Mr. Fliess.

321 (I), (II). THE PRESIDENCY IN AMERICAN GOVERNMENT (D).
Constitutional and political aspects of the presidency in legislation, administration and conduct of foreign and military affairs. The President as party leader. Prerequisite, Pol Sci 100 or permission of instructor. Mr. Bach, Mr. Gordon, Mr. Kramer, Mr. Reid, Mr. Sulzner.

322 (II). THE LEGISLATIVE PROCESS (D).
Analysis of American legislative systems and processes. The role of the executive in legislative decision-making. Prerequisite, Pol Sci 218 or permission of instructor. Mr. Bach, Mr. Gordon, Mr. Sulzner.

323 (II). PUBLIC OPINION IN POLITICS (D).
Analysis of opinion and communication as aspects of the political process. Emphasis on communication through the mass media. Mr. Fenton.

324 (I), (II). METROPOLITAN POLITICS (D).
Problems of metropolitan areas; actual and possible political approaches to their solution. Emphasis on the role of parties, the development of political leadership, existing political institutions, and pressure group activity. Prerequisite, Pol Sci 218 or permission of instructor. Mr. Booth, Mr. Howards, Mr. Shanley.

325 (II). BLACK POLITICS (D).
Theoretical and historical analysis of the relationship of Black people to the American political system. Emphasis on the development of Black ideologies, political organizations and strategies, and on alternative forms of participation in the American political system. Mr. Booth, Mr. Sulzner.

355 (II). AMERICAN FOREIGN POLICY (D).
Principles of American foreign policy. Emphasis on constitutional, political, and administrative considerations that influence the formation and execution of foreign policy. Prerequisite, introductory sequence in Political Science or permission of instructor. Mr. Allen, Mr. Braunthal.

356 (II). INTERNATIONAL LAW (D).
The origin, character, and function of international law. Prerequisite, Pol Sci 254 or History 211 or permission of instructor. Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Vali.

357 (II). INTERNATIONAL ORGANIZATION (D).
International organization in the twentieth century. Emphasis on the United Nations and regional organizations. Prerequisite, Pol Sci 254 or History 211 or permission of instructor. Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Vali.

358 (I). INTERNATIONAL RELATIONS: ASIA (D).
Introduction to general problems of Asian international relations since 1859, with detailed examination of problems since World War I. Emphasis on China, Japan, and the new nations. Mr. Houn, Mr. Maki.

359 (I). WESTERN EUROPE AND THE ATLANTIC COMMUNITY (D).
Analysis of the emerging institutional patterns of the West European and Atlantic communities. Emphasis on the major political, military, and economic regional organizations.
Mr. Braunthal, Mr. Einhorn.

360 (II). SOVIET FOREIGN POLICY (D).
Analysis of continuity and change in Soviet perceptions, goals, methods, and priorities in foreign policy. Emphasis on the period since World War II.
Mr. Ryavec.

361 (II). CHINESE FOREIGN POLICY (D).
Examination of the geographical, historical, ideological, economic, military, and other factors in Peking's foreign policy since 1949. Emphasis on mainland China's relations with various countries and her positions on major international issues.
Mr. Houn.

374 (II). ADMINISTRATIVE LAW (D).
Governmental activities in the regulation of industry, agriculture, and labor. Emphasis on the legal framework within which these activities operate.
Mr. Lederle.

380 (I), (II). TUTORIAL IN AMERICAN POLITICS AND LAW.
Directed readings on announced topics in American national government, politics, and public law.

381 (I). (II). TUTORIAL IN STATE-LOCAL POLITICS AND PUBLIC ADMINISTRATION.
Directed readings on announced topics in state and local government and politics and public administration.

382 (I), (II). TUTORIAL IN COMPARATIVE POLITICS.
Directed readings on announced topics in comparative government and politics and area studies.

383 (I), (II). TUTORIAL IN INTERNATIONAL RELATIONS.
Directed readings on announced topics in international relations and foreign affairs.

384 (I), (II). TUTORIAL IN POLITICAL THEORY.
Directed readings on announced topics in political theory, analysis, and methodology.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391, 392. SEMINAR.
Special problems in the study of politics.

393 (I). SENIOR HONORS SEMINAR.
Seminar for senior honors students on the study of politics. Prerequisite, invitation from the Departmental Honors Committee and concurrent enrollment in Pol Sci 399.

399. DEPARTMENTAL HONORS.
Enrollment by invitation of departmental Honors Committee. Credit, 1-6.

Pre-Dental, Pre-Medical, Pre-Veterinary Program

Chief Adviser: Assistant Professor Benjamin C. Crooker, Department of Physics.

A pre-professional student should select a major department in the field of most interest to him. Requirements for professional schools can be completed within the four-year curriculum of most departments in the University. At the end of the first semester of his sophomore year, the interested student should apply to the pre-medical Advisory Committee for admission to the program as either an affiliate or a pre-professional major. Minimum preparation for pre-dental and pre-medical students is one year of inorganic, one year of organic, and one semester of analytical chemistry; one semester of botany and one year of zoology; one year of college mathematics and one year of physics. Minimum requirements for pre-veterinary students are similar but they should include in their curriculum the specific courses Zoology 221, Zoology 240, Animal Science 121, Animal Science 330, Biochemistry 220, and Microbiology 250. Certain additional courses in biology, chemistry, or mathematics, as well as a foreign language may be required by some dental, medical, and veterinary schools. Students should consult their advisers as well as professional school catalogs in regard to specific requirements of particular schools. Persons interested in further information should contact the Pre-Med Office in Room 217, Hasbrouck Laboratory.

Psychology

Head of Department: Professor Richard T. Louttit. Professors D. Appley, M. Appley, Berger, Bogartz, Donahoe, Dzendolet, Epstein, Feldman, Golann, Kates, Levinger, Moore, N. Meyers, J. Myers, Raush, Southworth, Steiner, Watt; Associate Professors Averill, Ayres, Balagura, Cashdan, C. Clifton (Associate Department Head), R. Clifton, Eagly, Harmatz, Jarmon, Moss, Schumer, Staub; Assistant Professors Ajzen, Anderson, Bean, Carlson, Chumbley, Daehler, Danielson, Dorris, Eichelman, Fite, Gadlin, Kamil, Kaplan, Lieberman, Olley, Pollatsek, Reisman, Royer, Simonson, Todd, Turner, Wade, Well, Willoughby, Wisocki.

Psychology 101 is the prerequisite entrance course for all psychology students. Both psychology majors and non-majors may then elect any of the following additional courses without further prerequisite: 141, 145, 201, 210, 220, 230, 260, 262, 263, 270, 280, 290, 301, 305, 311, 325.

Students interested in majoring in psychology should elect Psychology 141 following completion of Psychology 101 and may then pursue a general psychology major or one designed for those preparing for graduate study and professional careers in the field.

The *general psychology major* must take Psychology 101, 141 and 305. In addition, he must elect at least two courses from each of the following two groups: *A)* 210, 220, 230, and 250; *B)* 260, 270 and 280. "Enriched" sections of some of the above core courses will be offered for those students who desire more in-depth study of the material.

The Department requires a minimum of 24 credits and a maximum of 30 credits in courses numbered above 200. The maximum of 30 credits may be increased to 40 credits (including senior honors) with consent of adviser. Students completing this major will fulfill the *Departmental* requirements for the Bachelor of Arts degree.

(Note: Students who have entered the B.A. program may elect the additional courses indicated below to complete a "career" major *without* shifting to a B.S. program, or they may elect to become B.S. degree candidates if in the balance of their program they choose and are able to meet the *additional* science requirements of the College. Depending on their backgrounds, certain transfer students may have difficulty fulfilling these requirements in the time they have available. Students who are in doubt as to which major or degree programs to follow should discuss the available options with their Faculty Advisers.)

The *career psychology major* must elect the same program as the general psychology major as a minimum. In addition, such students should plan to elect Psychology 145 and at least one laboratory course from each of the following two groupings: *A)* 211, 221, 222, 231, and 251; and *B)* 261, 271, 281, and 282. (Psychology 145 (Statistics) is prerequisite for all of the laboratory courses except 222, 231, and 251.)

These laboratory electives must be taken in proper sequence with their associated non-laboratory prerequisites or corequisites. Students completing this major will fulfill the *Departmental* requirements for either the Bachelor of Arts or the Bachelor of Science degree.

Students in the "career" program (either B.A. or B.S.) who are otherwise eligible will be encouraged to participate in the Honors Program in their junior and senior years.

Selected majors in either program may from time to time be invited to participate in Special Problem programs, the Department's cooperative teaching program or both.

101 (I), (II). ELEMENTARY PSYCHOLOGY (D).
An introduction to the basic approaches and concepts of modern psychology. Examples from the areas of perception, conditioning, cognitive processes, social behavior, tests and measurements, and personality. Mr. Gadlin.

141 (I), (II). PSYCHOLOGICAL METHODS (D).
Introduction to the ways questions about behavior are formulated and then tested through experiments. Lectures and laboratory experiences involving concepts from many areas of psychology used to expose psychology majors to the procedures

utilized in designing, conducting and reporting experiments. Prerequisite, Psych 101. 2 class hours, 1 3-hour laboratory period.

145 (I), (II). STATISTICS IN PSYCHOLOGY.
Introduction to statistical principles and techniques as applied to psychological data. 3 class hours, 1 1-hour laboratory.

201 (II). PSYCHOLOGY OF ADJUSTMENT (D).
Problems of personality development and adjustment emphasized. Psychological nature of man, conflict, and thinking and adjustment. Prerequisite, Psych 101.
Mr. Kates.

210 (I), (II). SENSATION AND PERCEPTION (D).
Methods, data and theories of the functioning of various sensory systems. Topics include a survey of basic sensory processes in the cutaneous senses, audition, vision, gustation, and olfaction; and higher perceptual processes in selected senses. Prerequisite, Psych 101.

211 (II). LABORATORY IN SENSATION AND PERCEPTION.
Selected laboratory exercises in audition and vision and a semester project chosen by the student, with the aid of the instructor, in some area of sensation or perception. Prerequisites, Psych 141, 145 and 210. 2 2-hour laboratory periods.
Credit, 2.

220 (I), (II). LEARNING AND THINKING (D).
A general survey of animal and human learning and performance. Topics include: factors affecting acquisition, generalization, discrimination, extinction, and transfer in animals and humans; memory; and higher cognitive processes in humans. Prerequisite, Psych 101.

221 (I). LABORATORY IN HUMAN LEARNING.
Introduction to methods used in investigating rote verbal learning, concept formation, short-term retention, verbal conditioning, artificial language learning, motor-skills, and other phenomena in human learning and retention. Prerequisites, Psych 141, 145 and 220. 2 2-hour laboratory periods.
Credit, 2. Mr. Chumbley, Mr. Clifton.

222 (II). LABORATORY IN ANIMAL LEARNING.
Introduction to methods used in investigating classical conditioning and operant behavior primarily using laboratory animals as subjects. Topics studied in the laboratory include: acquisition, generalization, discrimination, extinction, and transfer phenomena. Prerequisites, Psych 141 and 220. 2 2-hour laboratory periods.
Credit, 2.

230 (I), (II). MOTIVATION (D).
Introduction to theories and research on the nature and determinants of motivation. Topics include instinct, behavior energization concepts, biological and acquired bases of emotions and motives, frustration, conflict and stress. Prerequisite, Psych 101.

231 (II). LABORATORY IN MOTIVATION.
Methods of investigating motivation, including both laboratory and field studies using human and animal subjects. Includes selected projects conducted individually and in small groups by members of the class. Prerequisites, Psych 141, 230. 2 2-hour laboratory periods.
Credit, 2.

242 (I), (II). ADVANCED EXPERIMENTAL PSYCHOLOGY.
Instrumentation, methods and techniques of experimental psychology. Prerequisite, Psych 141. May be repeated for maximum of 6 credits.

245 (I). STATISTICAL INFERENCE IN PSYCHOLOGY.
Application of statistical procedures to analysis of psychological data and to problems of measurement in psychology and related fields. Prerequisites, Psych 101, Psych 145, or Stat 121 and permission of instructor. 2 class hours, 1 2-hour laboratory period.

250 (I), (II). PHYSIOLOGICAL PSYCHOLOGY (D).
Neural bases of behavior, current issues in physiological psychology; psychobiological investigations of learning, sensory processes, motivation, and instinctive behavior. Prerequisites, Psych 101 and Zool 101 or permission of instructor.
Mr. Carlson, Mr. Feldman.

251 (I). LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY.
Development of skills in laboratory techniques used in physiological psychology, including animal neurosurgery, electrophysiological stimulation and recording, and assessment of drug-behavior interactions. Prerequisites, Psych 141 and 250. 2 2-hour laboratory periods.
Credit, 2. Mr. Carlson, Mr. Feldman.

252 (II). DRUGS AND BEHAVIOR.
The psychobiological foundations of drug-behavior interactions. The neural and neurochemical basis of behavior, basic pharmacology, drugs that affect mood and their mode of action, the psychological and physical bases of drug dependence and addiction, experimental approaches to psycho-pharmacology. Prerequisites, completion of four courses in each of the "E" and "D" categories, including Psych 101 and Zool 101. Mr. Feldman.

260 (I). CHILD BEHAVIOR AND DEVELOPMENT (D).
Psychological development of the child, including theories, methods, and data of child behavior studies. Open to psychology majors only. Prerequisite, Psych 101.

261 (II). LABORATORY IN CHILD BEHAVIOR AND DEVELOPMENT.
Selected experiments investigating perceptual, conceptual, learning, and social processes in children. Prerequisites, Psych 141, 145, and 260. 2 2-hour laboratory periods.
Credit, 2.

262 (I). CHILD PSYCHOLOGY (D).
Psychological development of the child, including language, emotions, intelligence, social behavior, motivation, and personality. Not open to psychology majors. Prerequisite, Psych 101.

263 (II). PSYCHOLOGY OF ADOLESCENCE (D).
The development and emotional, social and intellectual adjustment of the individual during adolescence. Prerequisite, Psych 101. Mr. Schumer, Mr. Willoughby.

265 (I). INTRODUCTION TO THE STUDY OF EXCEPTIONAL CHILDREN (D).
Emphasis on the etiology, diagnosis, characteristics, education, and prognosis of deviations in mental, physical, and socio-emotional development. Prerequisites, Psych 101, 262, or permission of instructor. Mr. Kates.

270 (I), (II). PERSONALITY (D).
Introduction to the scientific study of personality. Personality development, structure and dynamics from major theoretical orientations. Prerequisite, Psych 101.

271 (II). EXPERIMENTAL STUDY OF PERSONALITY.
Selected research projects in personality carried out by class members. Each student conducts one major project of his own in addition to the group projects. Prerequisites, Psych 141, 145 and 270, which may be taken concurrently. 2 2-hour laboratory periods.
Credit, 2. Mr. Epstein.

280 (I). SOCIAL PSYCHOLOGY (D).
Introduction to the principles and study of social behavior. The psychological factors involved in attitude formation and change, communication and persuasion, and small group processes. Prerequisite, Psych 101.

281 (I). LABORATORY IN ATTITUDES AND OPINIONS.
Methods and research concerning attitude formation and change, attitude and opinion measurement, communication and persuasion. Prerequisites, Psych 141, 145 and 280 or permission of instructor. 2 2-hour laboratory periods. *Credit, 2.*

282 (II). LABORATORY IN GROUP BEHAVIOR.
Methods and research concerning the behavior of individuals in groups. Interpersonal attraction, social interaction and influence, power and conflict, communication, group structure, leadership, and productivity. Prerequisites, Psych 141, 145 and 280, or permission of instructor. 2 2-hour laboratory periods. *Credit, 2.*

288 (I). INDUSTRIAL PSYCHOLOGY (D).
Psychological principles underlying personnel selection and training, communi-

cation and decision-making in industry. Prerequisite, Psych 101. Mr. Moss.

289 (II). ORGANIZATIONAL PSYCHOLOGY (D).
Introductory conceptions of schools, hospitals, prisons, industries, and other organizations as complex social systems; individual adaptation in organizational settings; organizational development and personal change. Prerequisite Psych 101. Mr. Todd.

301 (I), (II). EDUCATIONAL PSYCHOLOGY (D).
Psychological facts and principles of development, learning, and measurement as applied to educational situations. Prerequisite, Psych 101. 2 class hours, 1 2-hour laboratory period. Ms. Bean, Mr. Royer.

305 (II). HISTORICAL AND CONTEMPORARY SYSTEMS (D).
General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems. Prerequisite, Psych 101. Mr. Averill, Mr. Gadlin.

306 (I). COMPARATIVE PSYCHOLOGY.
Emphasis on experimental investigations in a wide range of species. Topics include sensory and physiological systems, learning and early experience. Prerequisite, completion of four courses in each of the "D" and "E" categories, including Psych 101 and Zool 101. Ms. Fite, Mr. Kamil.

311 (I). PSYCHOLOGICAL TESTS.
Survey of tests of intelligence, aptitude, interest, personality, and adjustment. Test rationale, construction, characteristics, uses and evaluation emphasized. Prerequisite, Psych 101. 2 class hours, 1 2-hour laboratory period. Mr. Olley.

325 (I). ABNORMAL PSYCHOLOGY (D).
Etiology, symptoms and therapy of behavior abnormalities including neuroses, psychoses, epilepsies, speech disorders, and mental deficiency. Prerequisite, Psych 101. Mr. Harmatz, Mr. Cashdan.

331 (I), (II). CLINICAL PSYCHOLOGY.
Introduction to theoretical approaches and methods used in understanding and treating psychologically-disturbed individuals. Prerequisite, Psych 325 or permission of instructor. Mr. Epstein (I), Mr. Cashdan (II).

345 (II). INTRODUCTION TO QUANTITATIVE THEORIES OF BEHAVIOR (D).
Introduction to quantification of theories of learning, retention, choice, perception and the interaction of individuals in group situations. Prerequisites, Psych 145, 305 or permission of instructor. Mr. Myers, Mr. Chumbley, Mr. Pollatsek.

365 (II). THEORIES AND PRACTICE IN COUNSELING.
Theories, techniques and tests necessary in counseling and guidance. Practice in organization and evaluating relevant data in the analysis of illustrative cases. Prerequisite, Psych 270, or 311, or permission of instructor. 2 class hours, 1 2-hour laboratory period. Mr. Kates, Mr. Turner.

385 (I), 386 (II). SPECIAL PROBLEMS.
For qualified students. Independent work on special problems or in certain fields of psychological interest. By arrangement with members of the department. *Credit*, 1-3.

387 (I), (II). READINGS IN PSYCHOLOGY.
Survey of relevant research literature under guidance of a staff member who will direct the student's research problem. Open only to qualified juniors. By arrangement with members of the department. *Credit*, 1-3.

391 (I), 392 (II). SEMINAR IN PSYCHOLOGY.
For qualified juniors and seniors. A survey and critical evaluation of the literature pertaining to selected topics in psychology. By permission of the department. *Credit*, 1-3.

395 (I). HONORS SEMINAR.
For qualified junior psychology majors. Will survey the research areas of psychology represented in the department. Intended for juniors who will work on an honors thesis during their senior year. *Credit*, 1.

399 (I), (II). SENIOR HONORS THESIS.
For seniors selected to do individualized research with faculty. Students are nominated to honors program during spring semester of their junior year. Students selected must take this course for two consecutive semesters. No credit given until completion of second semester of work. *Credit*, 6.

Rhetoric

Director of Program: Professor Walker Gibson (English). Associate Director: Malcolm Sillars (Speech). Professors Frank, Haven, Koehler (English); and Bevilacqua, Reid, Wallace (Speech). Associate Professors Bagg, Clayton (English); and Blankenship, Brown, Savereid, Shelby, H. Stelzner (Speech). Assistant Professors P. Hicks, B. Hunt, Jayne, Jorgans, Leheny, Lyons, Moran, Shadoian, Sitter, C. K. Smith, Wolff (English); Bohn, Conville, Cronen, Matlon, W. Price, Stromgren (Speech); and Stewart (Theatre). Instructors Adams, DiMarco, E. Smith (English); and Mihevic, R. Price, S. Stelzner (Speech). Lecturers Kenseth (English); and Rottenberg (Speech).

With certain exceptions for advanced placement, the University Core in Rhetoric requires the completion of one course in Group I, and one other course in Rhetoric. The requirement is expected to be completed by the end of the sophomore year.

Within the standard two-semester sequence in composition and speech, the Program in General Rhetoric offers flexibility and choice, as well as a systematic theory of language. It asks two questions: How do we use words and styles to express ourselves and communicate with our world? How can we improve this expression and communication, and what do we mean by "improvement?" The Program confronts at a basic or unspecialized level, many of the "languages" through which people share their experience—oral and written, kinesics, film, electronics. Fuller details on the courses in the Program are available at the Rhetoric Office, 308C Bartlett Hall.

GROUP I

100 (I), (II). LANGUAGE AND WRITING (B).
How words and styles are chosen to express ourselves and our world, with particular attention to the written language. Varied opportunities for written expression, on different subjects for different purposes and audiences. Emphasizes responsible choice in the language used in both academic and everyday life. Mr. Gibson.

102. READING, COMPOSITION AND GRAMMAR (B).
Enrollment only by special permission of department.

110 (I), (II). LANGUAGE AND SPEAKING (B).
The process and act of communication, emphasizing meaning and the principles of and the choices available in the use of language. The rhetorical nature of our world, and the means and ends of effective and ethical communication. The concepts of communication, meaning, and language; and the principles and problems of informative and persuasive speaking. Required: three to four prepared speeches, and three to four written assignments. Mr. Price.

GROUP II

140 (I), (II). VOICES OF IMAGINATIVE WRITING (B).
Various kinds of verbal imaginative expressions in our culture—rock lyrics and modern poems, short fiction, drama—to enable more articulate and critical reading and more resourceful and daring writing. Exercises in critical reading or analysis balanced by frequent "creative" writing activities in various genres; "playing" at self-expression and self-definition. Mr. Gibson.

145 (I), (II). CRITICISM AND THE THEATRICAL ARTS (B).
An opportunity to sharpen critical judgment about theatre. Aims at development of informal criticism into well-reasoned judgments of theatrical art, using as subject matter current local offerings in theatre, film and dance, and participation in laboratory projects. Mr. Stewart.

150. COMPARATIVE MEDIA (B).
A team-taught exposition of the stylistic range of four media—novel, television, drama, and film—through analysis of a single "work of art" to determine why a specific medium was chosen, how a theme was modified for compatibility with a medium, how the range of aesthetic ap-

proaches affects content and form. Emphasis on written evaluation of the capabilities of media to reveal and interpret aspects of reality. Mr. Mitchell.

160 (I), (II). THE ART OF RHETORICAL DISCOURSE (B).
Explores the key concepts and problems in public communication. Problems and concepts traced from classical times through contemporary events. Such topics as: How are the ethics of communication influenced by political theory? What is acceptable as proof? What is the function of speaker "image" in communication? At least three papers, a mid-term and a final exam. Mr. Bevilacqua.

165 (I), (II). MODERN PUBLIC DISCOURSE (B).
The analysis of contemporary rhetorical discourse; how it works and why it sometimes fails. Emphasis on oral political discourse, but a wide variety of communication situations are studied to discover the relationship of source, message and receiver. The interrelation of language and thought with the environment in which they occur examined through lectures, discussion, films, tapes, and multimedia presentations. Miss Blankenship.

170 (I), (II). THE PROCESS OF COMMUNICATION (B).
The basic processes and elements involved in communication. Communicative purposes, settings, and forms; approaches to the study of communication. Units on the process of communication, language, and speech behavior, interpersonal communication, and public communication. Lectures, discussion, papers. Mr. Price.

175 (I), (II). THE RHETORIC OF MODERN MEDIA (B).
With attention to comparison and contrast, examines television, film, print, and various aural media forms. Analysis of specific case examples. Classical skills expanded to consideration of "McLuhanesque" thought. Mr. Bohn.

180 (I), (II). THE RHETORIC OF FILM (B).
The process of communication focusing on the languages of film. Emphasis on relationships between techniques and meaning in film and the ways film uses the rhetorical methods of oral and written language. Each student views a significant number of films, reads related essays, writes frequent papers, and has an opportunity to write a brief scenario or (in some cases) make a short film. Mr. Harrington.

GROUP III
Courses not open to native speakers of English:

105. ENGLISH AS A SECOND LANGUAGE: PREPARATORY.
Preparation for Levels 1 and 2. Credit, 2.

106. ENGLISH AS A SECOND LANGUAGE: LEVEL I.
Concentration upon developing fluency in verbal English.

107. ENGLISH AS A SECOND LANGUAGE: LEVEL II.
Reading and writing in conjunction with improvement of verbal skills.

Related Course:
AFRO-AM 152. BLACK RHETORIC (B).

Slavic Languages and Literatures

Head of Department: Professor Maurice I. Levin. Professors Ivask, Tikos; Associate Professor Rothstein; Assistant Professors Lake, Ostrorog, Stawiecki; Lecturer Cade.

The Russian major aims at proficiency in reading, writing, speaking and understanding the language, as well as a knowledge of Russian literature. Russian majors are encouraged to acquire a background in the history, government, economy and sociology of Russia, in order to understand the culture and literature of the Russian people. Successful completion of the program should prepare the student for graduate study or enable him to become a teacher or translator of Russian.

Prerequisite for a major in Russian is the successful completion of Russian 110, 120, 130, 140 or the equivalent.

Departmental requirements for a major are:

1. the third-year language sequence:
   261, 262—Advanced Grammar
   271, 272—Russian Conversation
2. the fourth-year language sequence:
   281, 282—Russian Stylistics
   291, 292—Introduction to Russian Literature
3. Two additional courses within the department to be selected in consultation with an adviser.
4. History 214, 215—The History of Russia

It is strongly recommended that students make every effort to initiate or continue the study of another foreign language, preferably French or German. This is particularly urgent for anyone planning graduate study, but is important for others as well. Since students have a limited number of electives, it is essential for majors and prospective majors to consult early and often with their academic advisers in selecting their courses.

RUSSIAN

110 (I), 120 (II). ELEMENTARY RUSSIAN.
Grammar, exercises in composition and conversation, selected readings. No previous language training required. 3 class hours, 1 laboratory hour.

119, 129, 139. RUSSIAN READING COURSE.
Intensive study of Russian grammar. Emphasis on developing reading ability only. No previous language training required.

130 (I), 140 (II). INTERMEDIATE RUSSIAN (140:C).
Review of fundamentals of grammar followed by more advanced study of grammatical structure and idiom. Composition, conversation and readings in Russian fiction. Prerequisite, Russ 120 or equivalent.

149 (II). RUSSIAN EXPOSITORY PROSE.
Readings in non-literary Russian texts from a wide variety of scientific and technical fields. Emphasis on developing reading skill in the student's field of specialization. Prerequisite, three semesters of Russian or equivalent.

201 (I). RUSSIAN CULTURE.
Russian geographical, historical, literary, religious, philosophic and artistic life as a means to assess Russian cultural progress. Conducted in English.

253 (I). DOSTOEVSKY (C).
Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Prerequisite, junior standing.

254 (II). TOLSTOY (C).
Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Prerequisite, junior standing.

255 (I). MASTERPIECES OF RUSSIAN LITERATURE IN TRANSLATION (C).
Selection from classics of Russian romanticism and realism culminating in the novels of Dostoevsky and Tolstoy. Prerequisite, junior standing.

256 (II). RUSSIAN DRAMA (C).
Russian drama in the originals from the beginnings to the establishment of a national repertoire and theatre. Plays from Fonvizin to Gorky. Prerequisite, Russ 262 or equivalent.

257 (II). SOVIET LITERATURE (C).
Beginnings and development of Soviet prose, drama and criticism from Gorky to the present. Conducted in English. Majors required to do research in Russian. Prerequisite, junior standing.

258 (II). RUSSIAN POETRY.
Russian poetry in the originals. Nineteenth century to the present. Prerequisite, Russ 262 or equivalent.

259 (I). THE SLAVIC PEOPLES, THEIR LANGUAGES AND CIVILIZATIONS.
A survey of the historical, social, intellectual and cultural evolution of the Slavic peoples from the earliest times to the present. Emphasis on the non-Russian Slavs. Conducted in English.

261 (I), 262 (II). ADVANCED RUSSIAN.
Advanced grammar, building vocabulary and improving reading ability through selections from the Classical and Soviet

Periods. Composition and classroom discussions in Russian on reading materials. Prerequisite, Russ 140 or equivalent. Departmental requirement for Russian majors.

264 (II). SCIENTIFIC RUSSIAN.
Intensive experience in translating scientific, technical, academic and journalistic articles. Prerequisite, Russ 140 or equivalent.

266 (II). RUSSIAN PHONETICS.
Detailed analysis of the Russian sound system. Articulation and intonation treated largely in comparison with the sound system of English. Recommended for those preparing to teach Russian. Prerequisite, Russ 262 or equivalent.

271 (I), 272 (II). RUSSIAN CONVERSATION.
Devoted to acquiring a conversational vocabulary and to developing fluency in speaking Russian. Prerequisite, Russ 140 or equivalent. Departmental requirement for Russian majors.

281 (I), 282 (II). RUSSIAN STYLISTICS.
The style of Russian literary works. Practical application of grammatical principles and intensive study of idiomatic expressions. Prerequisite, Russ 262 or equivalent. Departmental requirement for Russian majors.

291 (I), 292 (II). INTRODUCTION TO RUSSIAN LITERATURE.
Survey course conducted in Russian. Readings in Russian, written reports. Prerequisite, Russ 262 or equivalent. Departmental requirement for Russian majors.

310 (II). THE TEACHING OF RUSSIAN.
Analysis of the major linguistic problems facing the teacher of Russian and the methods used in solving them. Prerequisite, Russ 365 or permission of instructor.

319 (I). PUSHKIN.
The most important works of Pushkin, prose and poetry: Eugene Onegin, Boris Godunov, The Captoin's Doughter, The Bronze Horsemon, Poltovo, and others. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

320 (II). GOGOL.
The most important works of Gogol: The Inspector-General, Deod Souls, The Overcoot and selected passages from his Correspondence with Friends, and other works. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

331 (I). NINETEENTH CENTURY RUSSIAN CRITICISM.
Criticism of the nineteenth century: Belinsky, Chernyshevsky, Dobrolyubov, Pisarev and others. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

363 (II). HISTORY OF THE RUSSIAN LANGUAGE.
Historical phonology and morphology of Russian; emphasis on the development of the Russian literary language. Prerequisite, proficiency in Russian.

365 (I). STRUCTURE OF RUSSIAN.
Descriptive analysis of the morphology of contemporary standard Russian with additional emphasis on selected problems of derivation. Prerequisite, proficiency in Russian.

366 (II). CONTRASTIVE STRUCTURES OF RUSSIAN AND ENGLISH.
Contrastive analysis of Russian and English. Emphasis on those elements of Russian structure that differ significantly from English. Prerequisite, Russ 365.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

398. DEPARTMENTAL HONORS.
Credit, 1-9.

399. DEPARTMENTAL HONORS.
Credit, 1-6.

POLISH

110 (I), 120 (II). ELEMENTARY POLISH.
Oral and written exercises, pronunciation and grammar, reading of selected works. No previous language training required. 3 class hours, 1 laboratory hour.

130 (I), 140 (II). INTERMEDIATE POLISH (140:C).
Review of grammar, composition and selected readings. Prerequisite, Polish 120 or equivalent and permission of instructor.

Sociology

Choirmon of Deportment: Professor N. J. Demerath III. Professors Driver, Gordon, Killian, Korson, Page, Park, Speier, Wilkinson, Yaukey; Associate Professors Chilton, Golden, Hewitt, Hollander, Lewis, Manfredi, Mehta, Piedmont, Platt, Simpson, Sutton, Tausky; Assistant Professors Chevan, Faulkner, Harris, O'Rourke, Roof, Stokes; Instructors Kaplan, Reilly, Westkott.

Sociology majors are required to take Sociology 101 (Introductory) and a minimum of eight to a maximum of ten 200-level or above courses selected from among the offerings of the Sociology Department. Introductory Sociology is recommended for all students who anticipate taking Sociology courses at the 200-level or above. Sociology majors, especially those who are considering graduate studies, are strongly advised to take a statistics course, Sociology 282 (Sociological Theory), and Sociology 295 (Research Methods).

101. INTRODUCTION TO SOCIOLOGY (D).
The fundamental terminology of sociology. Intensive discussion of selected topics from a sociological point of view.

222. SOCIOLOGY OF EDUCATION (D).
Social and economic interrelationships of education, stressing social class and social change. Attention to developing countries and minority people.

224. HIGHER EDUCATION IN AMERICA (D).
The organizational context within which college and post-graduate education takes place. Historical and international comparison, with review of the relevant discussions of individual development; higher education in its broader relationship to other human activities.

231. SOCIOLOGY OF AGING (D).
Aging as a social phenomenon in the United States and Massachusetts with emphasis on the elderly population. Topics include biological, psychological and social factors in the aging process, the demographic and ecological conditions of aging, the problem of retirement, and public policy and politics as they relate to old age.

233. POLITICAL SOCIOLOGY (D).
The relationships between the political and non-political institutions and values of society. The formal and informal aspects of the exercise of power, its social and cultural setting. Social movements: their appeal, ideology and social base. Extremism, pluralism and totalitarianism. Participation and pseudo-participation. The cults of personality, charisma and propaganda. The culmination of social conflict: coercion, its processes and techniques.

247. SOCIAL STATISTICS.
An introduction to principles and techniques with reference to application in sociology.

251. URBAN SOCIOLOGY (D).
A comparative analysis of cities and of urbanization with reference to demographic characteristics of urban populations, urban ecology, and urban social structure.

252. URBANIZATION AND THE CITY (D).
A comparative analysis of world urbanization, its trends, causes and consequences. Regional variations in the nature of urbanization and trends in major countries analyzed and related to major aspects of the spatial and social structure of cities. Prerequisite, Sociol 101.

253. SOCIOLOGY OF LAW (D).
The institution of law in society, with reference to variations among societies in systems of law, the development of English and American law, the structure of

the legal profession, and the relationships between the legal system and other aspects of society.

254. INDUSTRIAL SOCIOLOGY (D).
The role, status and function of the worker in the industrial community. A consideration of changing technology and the adjustment made in the industrial community.

255. SOCIOLOGY OF RELIGION (D).
The relationship of religious beliefs and institutions to cultures and societies.

256. RACE RELATIONS (D).
The social, economic and political aspects of racial and ethnic problems in the United States; briefer consideration of similar problems in Africa and Asia.

257. THE FAMILY (D).
The development of the customs of courtship and marriage and the contemporary family. The basic causes of changes and trends of the family.

258. SOCIAL INTERACTION (D).
Social interaction in the context of groups, especially small groups. The dynamics of interaction process as the basis for group development. Attention to the emergence of normative and affective subsystems and to role differentiation.

259. SOCIAL STRATIFICATION (D).
The factors associated with institutionalized inequality in social life. A consideration of class, status, and power in American society.

260. SOCIETY AND THE INDIVIDUAL (D).
A course in sociological social psychology examining individual and group behavior in the context of structured social arrangements. Topics include socialization, motivation, the social control of behavior, attitudes and behavior, the self-concept, and some aspects of collective behavior. Materials are drawn from a variety of perspectives, ranging from behavioral social psychology and field theory to symbolic interaction and ethnomethodology. Prerequisite, Sociol 101.

261. POPULATION PROBLEMS (D).
An analytical study of population composition; the causes and consequences of changes in the basic demographic variables: fertility, mortality, and migration.

262. THE DEMOGRAPHY OF MINORITY GROUPS (D).
Demographic and ecological factors affecting relationships between ethnic, racial, and religious groups. The demography of minorities from a comparative perspective, drawing upon materials from various nations. Prerequisite, Sociol 256.

265. POPULATION OF JAPAN.
A demographic survey of the history and development of modern Japan. Emphasis on (1) the similarities and contrasts between Japan's demographic transition and that of the West, and (2) the relevance of Japanese experience for contemporary underdeveloped nations. Prerequisite, Sociol 261 or equivalent.

266. COMMUNITY AND HUMAN ECOLOGY (D).
The origin, development, location, junctions, and systems of communities. Ecological process of change, invasion and succession, centralization and decentralization, concentration, suburbanization, and patterns of residence and segregation of racial, ethnic, and religious groups are comparatively analyzed.

270. SOCIAL STRUCTURE OF INDIA (D).
The origins, distributions, and cultural traits of the major groups in India. Attention to marriage, family, caste patterns, and positions in the economic and political system.

272. SOCIAL CHANGE (D).
Changes arising from culture contact, social reform, and technical inventions. Planned and unplanned change, particularly in underdeveloped countries.

275. SOCIAL PROBLEMS (D).
The distribution and interrelationships among some types of deviance and disorganization; crime, mental disorders, addiction, suicide, family tension. Theories of causation; research projects.

276. DRUGS AND SOCIETY (D).
The sociological implications of drug usage, including alcohol as well as "mind altering" drugs. Effects of drugs, prevalence of usage, social correlates, anthropological and historical perspectives, problems and management of addiction, social control of use and abuse, social implications of drugs, especially with respect to the counter-culture movement.

278. CRIMINOLOGY (D).
The nature of crimes and the factors underlying criminal behavior. The machinery of justice; the law, courts, police systems, and correctional institutions.

280. SOVIET SOCIETY (D).
Survey of the major social institutions, process and problems of Soviet Society; official and popular values and norms, stratifications, social controls, the family, types of socialization and social problems (i.e., crime, delinquency, the misuse of leisure, rural migration, etc.). The nature and usefulness of various theoretical models of Soviet Society.

282. SOCIOLOGICAL THEORY (D).
Contributions of European and American writers who have concerned themselves with theories of the origin, growth, and development of human social organization.

285. COMPLEX ORGANIZATIONS (D).
An analysis of the processes leading to the formation, stability and instability of complex organization. Theoretical and empirical work related to these processes.

286. SOCIOLOGY OF MEDICINE (D).
Survey of the field of medical sociology, and examination of the medical institution using sociological concepts. Organization and utilization of medical care, social epidemiology, interaction between the community and the medical institution, patient-practitioner interaction.

287. SOCIOLOGY OF MENTAL DISORDERS (D).
Influence of social factors on diagnosis, treatment, and possible etiology of mental disorders. Application of sociological concepts and methods in considering: nature and extent of mental illness, mental hospitals, and the community in rehabilitation.

292. BACKGROUND TO THE STUDY OF SOCIAL WELFARE (D).
The historical development and current status of British and American concerns about poverty in the context of the Industrial Revolution; sociological perspectives concerning differentials in access to economic security and social rewards, and problems of measurement and planning as related to social policies.

293. ISSUES IN SOCIAL POLICY PLANNING (D).
Primarily for upper division students. Focuses upon (1) systematic policy planning, the role of research and development and the role of the scientific community in domestic policy programming; and (2) selected substantive issues which draw heavily from social and geographical distributions of relative access to the valued goods, services and rewards in the society and consideration of mobility processes upon the redistribution of such access. Prerequisite, permission of instructor.

295. RESEARCH METHODS.
Research methods and techniques employed in sociology. Each student is required to design a research project of limited scope.

296. SEMINAR IN RESEARCH.
Guided research on problems of sociological interest. Research projects using the tools and logic of sociological research. Prerequisite, Sociol 295.

360. TECHNIQUES OF DEMOGRAPHIC ANALYSIS (SEMINAR).
The methods for gathering population data and the uses of these data to measure mortality, fertility, migration and population composition. The theoretical interrelations among these factors. Methods for making population estimates and projections. Prerequisite, Sociol 261 or a course in statistics, and permission of instructor.

363. FERTILITY AND SOCIETY (SEMINAR).
A review of past and present trends in fertility on a worldwide basis, an analysis of the social determinants and consequences of these trends, and an assessment of the likely future trends. Prerequisites, Sociol 261 and permission of instructor.

367. POPULATION THEORIES AND POLICIES (SEMINAR).
The major theories concerning population growth, distribution, internal and international migration, and population quality. Theorists include the pre-Malthusians, Malthus, Marx, Keynes, Stouffer, Petersen, Myrdal, Clark, Coale, Keyfitz, Spengler, and Davis and others. Population policies include the direct ones as well as social policies with demographic consequences. Attention to a cross-cultural analysis of the relations among sex status, social status, and human reproduction. Prerequisites, Sociol 261 and permission of instructor.

375. SOCIOLOGY OF LITERATURE (SEMINAR).
Literature as a source of information about society, in particular social values and norms, social change and conflict and the various relationships between society and the individual. The seminar also examines the conditions under which literature reflects or distorts social realities and the interaction between literary products and their social environment. Permission of instructor required.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-6

391. SEMINAR IN SOCIOLOGY.
A survey and critical evaluation of the literature pertaining to selected topics in sociology. For juniors and seniors. Permission of instructor required.

399. DEPARTMENTAL HONORS.
Credit, 1-6

Soviet and East European Studies Program

Chairman of Program: Associate Professor Karl Ryavec. Members of the Committee on Soviet and East European Studies: Joel Halpern (Anthropology), Vaclav Holesovsky (Economics), Paul Hollander (Sociology), Robert Jones (History), Maurice Levin (Slavic), Stanley Radosh (Slavic Bibliographer, Library), and Karl Ryavec (Political Science).

The Soviet and East European area is viewed in this Program from the perspective of several disciplines. Requirements for a major are:

1) Proficiency in a relevant language (usually Russian) at a level adequate to enable the student to conduct research in that language;
2) successful completion of ten courses (including the third year of the language) dealing with the area in a minimum of three disciplines to be chosen from Anthropology, Economics, History, Political Science, Slavic Languages and Literatures, and Sociology;
3) two courses in modern European history.

The faculty above and approximately ten other faculty members in various departments teach courses on the area. The approximate total of courses is presently 34, 15 of which are language courses.

Questions regarding the program may be directed to Professor Ryavec in 210 Thompson Hall or Professor Levin, Head of the Department of Slavic Languages and Literatures in 438 Herter Hall.

Speech

Chairman of Department: Professor James E. Lynch. Professors Bevilacqua, Melrose, Nober, Reid, Sillars, H. Stelzner, Tolhurst, Wallace; Associate Professors Blankenship, Boothroyd, Brown, Matlon, Nerbonne, Savereid, Shelby, Thomas; Assistant Professors Bohn, Conville, Cronen, Harper, Meyer, Nielsen, Peirce, W. Price, Rood, C. Seymour, H. Seymour, Stromgren, Tokay, Weaver; Instructors Bacal, Gillispie, Mihevc, R. Price, S. Stelzner; Lecturer Rottenberg; Adjunct Professor Goldberg.

THEATRE

Chairman of Program: Professor David M. Knauf. Professor Niedeck; Associate Professors Abramson, Korty, Stewart, Young; Assistant Professors Bednerik, Brann, Fiala, Gaeke, Mahnken.

See Rhetoric for other courses sponsored by the Department of Speech.

Students wishing to major in Speech are encouraged to visit the main office of the department in Bartlett Hall to secure specific information concerning concentrations in (1) Communication and Rhetorical Theory, (2) Communication Disorders, and (3) Mass Communication. Students who wish to major in Theatre should come to the main office of Theatre in Machmer Hall.

NOTE: As this publication went to press, the name of the Department of Speech was changed to Department of Communication Studies, and Theatre was elevated from Program to Department status.

GENERAL

250. SPEECH AND LANGUAGE THEORY (D).
The nature of speech and language and the process involved in acquiring, understanding and producing speech and language.

350. BEHAVIORAL RESEARCH IN COMMUNICATION.
Introduction to research design and the practical problems in carrying out experimental and descriptive research in speech communication. Students will pursue research projects either individually or in groups.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.

399. SENIOR HONORS.

COMMUNICATION AND RHETORICAL THEORY

201. ADVANCED PUBLIC SPEAKING.
Practical communication. For students who want to go beyond the General Rhetoric Program in developing their ability to communicate ideas. Emphasis on one-to-group communication.

202. SMALL GROUP COMMUNICATION.
The theory and process of small group communication. Practical application to group discussion; leadership; and problem solving.

203. ARGUMENTATION.
Reasoning and evidence as used in public deliberation. Application to the building and refuting of arguments.

204. PERSUASION THEORY.
How attitudes are formed and changed through speech communication. An appropriate ethic of persuasion in today's society.

205. CLASSICAL RHETORICAL THEORY (C).
Major rhetorical theories from the emergence in ancient Greece to the late Roman Empire. Special emphasis is given to the Sophists, Plato, Aristotle, Hermagoras, Cicero, Quintilian, and St. Augustine. Prerequisite, permission of instructor.

207. RHETORIC AND SOCIAL CHANGE IN AMERICA (D).
A survey of the rhetorical strategies of various American social movements such as the American Revolution, the populist movement, and the civil rights movement.

211. CONTEMPORARY RHETORICAL THEORY (D).
Contemporary philosophical approaches to rhetorical theory. Selected major contemporary theorists such as Weaver, Richards, Burke, Duncan, McLuhan, and Perelman.

212. PARLIAMENTARY PROCEDURE.
The basic principles upon which a group operates using parliamentary law and practical drill as the class organizes itself into an operating parliamentary body. 2 class hours. *Credit, 2.*

COMMUNICATION DISORDERS

181. PHONETICS.
The physiological and acoustic processes involved in producing sounds and the use of the International Phonetic Alphabet in describing these processes.

182. INTRODUCTION TO COMMUNICATION DISORDERS.
The types and causes of communication disorders with emphasis on speech disorders.

281. CLINICAL PROCEDURES.
Introduction to the clinical process in a Communication Disorders Clinic including personnel responsibilities, professional ethics, techniques of differential diagnosis, study of clinic forms and referrals. Supervised observations of diagnostic and therapy sessions. Laboratory training in clinical equipment. 2 class hours, 2 2-hour laboratories.

283. ARTICULATION DISORDERS.
Basic principles and methods involved in the rehabilitation of articulation disorders. Emphasis on types of disorders, diagnosis and evaluation of disorders, and therapeutic procedures. Laboratory observation. Prerequisites, Speech 181 and 182. 3 class hours, 1 1-hour laboratory.

284. ANATOMY AND PHYSIOLOGY OF THE SPEECH AND HEARING MECHANISM.
The anatomy and physiology of the speech and hearing mechanism; consideration of respiration, phonation, resonance, articulation, and audition.

285. BASIC CLINICAL AUDIOLOGY.
The acoustics and physiology of hearing. The etiology and symptomatology of hearing loss. Selected diagnostic procedures. Supervised practice in audiometric testing. Prerequisite, Speech 182.

286. REHABILITATION OF THE ACOUSTICALLY HANDICAPPED.
Techniques of speech therapy, auditory-training, and speech reading for hard of hearing children and adults; multi-sensory approach to language development. Laboratory practice under supervision. Prerequisite, Speech 285. 2 class hours, 1 3-hour laboratory period.

287. FUNDAMENTALS OF HEARING AND SPEECH SCIENCE.
Investigation of physiological, acoustic and psychological correlates of speech production, transmission and reception. Exercises in the application of laboratory methods. Prerequisites, Speech 181 and 284. 2 class hours, 1 2-hour laboratory.

288. CLINICAL PRACTICE.
Supervised experience in therapy with individuals having articulatory type disorders. May be repeated once. Prerequisites, Speech 181 and 182.
Credit, 1-3 per semester.

289. COMMUNICATION PROBLEMS OF THE DEAF AND HARD OF HEARING.
Physical, psychological, social, and education problems and needs of the hearing handicapped. Prerequisite, Speech 250.

291. PEDIATRIC AUDIOLOGY.
Assessment and clinical management of infants and children with auditory disorders. Problems of differential diagnosis, screening techniques, conditioning procedures, and electrophysiologic methods. Parental guidance and employment of amplification with children. Prerequisites, Speech 285 and 286.

292. LEARNING AND LANGUAGE DISABILITIES IN CHILDREN.
Learning disabilities associated with physical, psychological and social etiologies. Problems of language development and cognitive disorders, remedial practices in reading and writing problems, and learning patterns of the culturally disadvantaged. Diagnostic assessment and educational processes are outlined.

295. STUTTERING.
Major theories of the etiology, diagnosis, and clinical management of stuttering. Prerequisite, Speech 289.

392. SEMINAR IN COMMUNICATION DISORDERS.
Special problems; include a choice of a) communication disorders and the teacher, b) communication disorders in geriatrics, c) communication disorders and medicine, d) the non-verbal child, e) electrophysiologic audiometry, and f) speech audiometry. Prerequisite, permission of instructor. 3 class hours, 1 3-hour laboratory period. May be repeated.

MASS COMMUNICATIONS

121. INTRODUCTION TO MASS COMMUNICATIONS (D).
Including history and development, structure, roles, and functions. Standards for evaluation of the mass media.

222. THE PROGRAM PROCESS IN RADIO.
The program processes in radio from original idea to finished program. Basic experience in creating, producing, and directing radio programs. 2 class hours, 1 2-hour laboratory period.

223. THE PROGRAM PROCESS IN TELEVISION.
The basic program process in television from original idea to finished program. Training and procedures involved in the technique of television production. Experience in creating and producing television programs. Evaluation of program forms. 2 class hours, 1 2-hour laboratory period.

224. CREATIVE TELEVISION PRODUCTION/DIRECTION.
Advanced theories of television production and direction; creation and production-direction of experimental program. Prerequisite, Speech 223. 2 class hours, 1 2-hour laboratory period.

225. HISTORY AND DEVELOPMENT OF THE MOTION PICTURE.
Evolution of the motion picture as an international art form and social force. Analysis of form, technique and impact of film. Selected screening of representative film styles and content.

226. PRINCIPLES AND TECHNIQUES OF FILM MAKING.
The theory and principles of film making for the motion picture theatre and television. Experience in writing, directing, editing and sound recording of films. Evaluation of film techniques, form and content. 1 class hour, 1 4-hour laboratory period per week.

227. FILM THEORY AND CRITICISM (C).
Basic theories of film communication; various film modes and structures. Development of bases for evaluation of films according to communicative and aesthetic values. Prerequisite, Speech 225.

228. MASS MEDIA IN SOCIETY (D).
Mass media as a major force in the American society. Emphasis on cultural, economic, political and social effects. Prerequisite, Speech 121.

229. BROADCAST NEWS AND PUBLIC AFFAIRS.
Legal, ethical and practical considerations involved in selecting, preparing and presenting news broadcasts, news documentaries and other public affairs programming. Prerequisites, Speech 121 and 222 or 223. 3 class hours, field trips.

230. WRITING FOR THE MASS MEDIA.
The role and function of the writer and the message in the mass media. Communication significance of content and style elements in television, radio and film. Comparison with print media. Writing experience in all media. Prerequisites, Speech 121 and 222 or 223. 2 class hours, 1 2-hour laboratory per week.

231. PRACTICUM IN MASS COMMUNICATIONS.
Individual and group projects designed to provide creative production and research experience in radio, television or film. Prerequisites, Speech 121 and 222. 5 laboratory hours per week. This course may be repeated to a total of 3 credits.
Credit, 1.

232. BROADCASTING AND THE GOVERNMENT (D).
The role, function and effect of regulation on broadcasting. Prerequisite, Speech 121.

391. PRO SEMINAR IN MASS COMMUNICATIONS.
Analysis and discussion of major problems in the field of mass communications. Examination of current research. Prerequisites, 9 hours of courses in mass communications. May be repeated up to a total of 6 credits.

THEATRE

115. INTRODUCTION TO THE THEATRE (C).
Introduction to the art of the theatre: a survey of its aesthetics, elements, forms,

and contributing artists; its influences and place in our culture.

135. FUNDAMENTALS OF PLAY PRODUCTION.
Methodology and techniques of play production; lectures, demonstrations, and practical laboratory work. The responsibilities and contributions of all participating artists examined in detail through intensive study of every aspect of production from script to stage. 2 class hours, 1 2-hour laboratory period.

140. INTRODUCTION TO STAGECRAFT AND DESIGN.
A survey of the nature and function of spectacle in the theatre. Attention to scenery, lighting, costume, and make-up. 3 class hours, 1 hour laboratory period.

152. ORAL INTERPRETATION.
Principles and techniques of reading aloud, using a variety of literary forms: verse, prose, and dialogue. Specific vocal needs relevant to the communication of meaning.

240. TECHNICAL PRODUCTION.
The materials and methods in construction for the stage. Prerequisites, Speech 115 and 140. 3 class hours, 1 2-hour laboratory period.

241. PRINCIPLES OF SCENE DESIGN.
An intensive study of the principles of scene design and the application of these principles to a series of design projects. Practical experience gained through laboratory work in scene painting and decoration. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

242. DESIGN AND CONSTRUCTION OF COSTUME.
Silhouette, draping, color, texture, drafting of patterns, construction, and the application of these basic principles to a series of design projects. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

243. ACTING I.
An orientation to the basic physiological and mental tools of the actor. Prerequisite, Speech 115. 2 class hours, 1 2-hour laboratory period.

244. ACTING II.
Character analysis and development with attention to the interrelationship of characters. Prerequisites, Speech 115, 243. 2 class hours, 1 2-hour laboratory period.

245. DIRECTING I.
An introduction to the theory and practice of stage direction. Emphasis on comprehension and mastery of the basic theatrical elements necessary to the creation of the stage picture. Prerequisite, Speech 115. 2 class hours, 3 laboratory hours.

246. DIRECTING II.
Problems in the interpretation and staging of various types of contemporary drama. Attention to rehearsal and performance procedures. Prerequisite, Speech 245. 2 class hours, 3 laboratory hours.

247. THEATRE HISTORY I (C).
The history of theatre in western civilization from its beginnings to 1642; the Classical, Medieval, and Renaissance theatres; the origins and development of drama, spectacle, theatre production, and theatre architecture.

248. THEATRE HISTORY II (C).
History of the theatre in western civilization. Emphasis on the eighteenth and nineteenth centuries, the Continental, English, American, and Modern Theatres.

251. ORAL INTERPRETATION OF CHILDREN'S LITERATURE.
Selection and interpretation of literary materials for children.

252. ADVANCED ORAL INTERPRETATION OF LITERATURE.
Theory and techniques of group performance of verse and prose of various types; preparation, rehearsal, and performance of the readers theatre and chamber theatre script. Prerequisite, Speech 152.

253. CHILDREN'S DRAMA I.
Informal dramatics, without an audience, in classroom and recreation programs, serving children's need for creative outlets and furthering awareness, self-expression, self concepts, and social growth through imagination, pantomime, and improvised story dramatization. 3 class hours, observation of demonstration classes.

254. CHILDREN'S DRAMA II.
Formal aspects of children's theatre, the selection and presentation, by adults or older young people, of suitable plays for the child audience.

257. STAGE AND TELEVISION LIGHTING.
Principles, practices and equipment involved in stage and television lighting. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

260. DRAMATIC FORM (C).
Possible critical approaches to a play with focus on the play script both as a formal unit and as a potential vehicle for dramatic production.

261. HISTORY OF DRAMATIC THEORY (C).
A survey of important trends and documents in the history of dramatic theory from Plato to 1900. Prerequisite, Speech 260.

262. THE BLACK PRESENCE IN AMERICAN DRAMA (C).
Selected works by American white and black playwrights, from mid-nineteenth century to the present, with emphasis on the image of the Afro-American.

264. HISTORY OF THE AMERICAN THEATRE AND DRAMA.
From its beginnings in the eighteenth century to the present day. The drama itself, the building in which it is performed, scenic effects, and the contributions of actor and director.

360. PLAYWRITING.
The problems of translating idea into dramatic action. Prerequisite, permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

Zoology

Chairman of Department: Professor Harold Rauch. Professors Bartlett, Edds, Fairbairn, Honigberg, Moner, Nutting, J. L. Roberts, H. D. Rollason, Snedecor, Stuart; Associate Professors Andrews, Edwards, Kaulenas, Klingener, Levin, Ludlam, Mange, O'Connor, Potswald, L. S. Roberts, G. S. Rollason, Sargent, Scudo, Snyder, Wyse; Assistant Professors Dersham, Kunkel, Noden, Searcy, White, Woodcock, Ziegler.

Each student majoring in Zoology must complete the following Zoology courses: 240 (Principles of Genetics); 360 (Cell Physiology); 221 or 223 or 227 (Comparative Anatomy or Histology or Embryology); 281 or 282 or 283 (Biology of the Lower Invertebrates or Biology of the Higher Invertebrates or General Parasitology); 243 or 335 or 337 or 350 (Introductory Population Biology or Limnology or Ecology or Animal Behavior); and 366 or 370 or 380 (Vertebrate Physiology or Comparative Physiology or Developmental Biology).

The student must attain proficiency in French, German, or Russian by completing a university language course at the 140 level or by achieving a score of 600 or better on a College Entrance Examination Board test or on an equivalent test. Study of French, German, or Russian in high school, by itself, is not sufficient.

Students must also complete satisfactorily the following collateral courses: Botany 100 (Introductory Botany); Chemistry 111, 112 (General Chemistry); Chemistry 261, 262, 263, 264 (Organic Chemistry); Biochemistry 222 or 223 (General Biochemistry); Physics 141, 142 (Introductory Physics); and Statistics 231, 232 (Fundamentals of Statistical Inference) or Computer Science 131, 132 (Introduction to Computers and Programming, Survey of Computer Applications) or Mathematics 127, 128 (Calculus for Life and Social Sciences). Students with a special interest in chemistry or chemical biology may, with the approval of the Chemistry Department, substitute Chemistry 113, 114 (General Inorganic Chemistry) for 111, 112; those with a special interest in physics may wish to substitute Physics 161, 162, 163 (General Physics) for 141, 142; alternatively, students may wish to enroll in special Introductory Physics sections for life science students.

All students should enroll in a chemistry sequence in their freshman year, because subsequent courses in Organic Chemistry and Biochemistry are prerequisite to Zoology 360 which in turn is prerequisite to all of the courses in the 366-370-380 group.

Botany 100 should be elected in the fall of the freshman year, as it will serve to review major biological concepts prior to the Zoology major's first Zoology course (genetics) in the spring of the freshman year.

Zoology 101 (Introductory Zoology) is not required of Zoology majors. Students who have not studied biology in high school or who feel that their knowledge of introductory zoology is inadequate may enroll in the course or audit the lectures prior to or concurrently with their enrollment in Zoology 240.

The curriculum for those who plan to become certified secondary school biology teachers requires, in addition to the departmental requirements outlined above, Botany 125 (The Plant Kingdom) and 126 (New England Flora); Psychology 101 (Elementary Psychology), and either 263 (Psychology of Adolescence) or 301 (Educational Psychology); Education 251 (Foundations of Education). In addition, students must register in the undergraduate teacher preparation program (TPPC), through a coordinating director, Center for Teacher Education, School of Education, in order to complete the following requirements for teacher certification: Educ 285 (Student Teaching); Educ 386 (prepracticum and supervised seminar) concurrently or after practice teaching. Students in the Secondary Education curriculum may, with the permission of their adviser, substitute Zoology 135 (Introductory Physiology) for the requirement of one of the 366-370-380 group provided that the substitution is not made before the student's junior or senior year, when his plans for secondary teaching have become firm.

101 (I), (II). INTRODUCTORY ZOOLOGY (E).
Principles of zoology including cell structure and metabolism, heredity, development, behavior, evolution, ecology, and the anatomy and psychology of the major groups in the animal kingdom. Background for understanding current biological problems. 2 class hours, 1 3-hour laboratory.

135 (I), (II). INTRODUCTORY PHYSIOLOGY (E).
Circulation, respiration, digestion, metabolism, excretion, chemical and nervous coordination, muscular activity, and reproduction. Prerequisite, Zool 101. 2 class hours, 1 3-hour laboratory.
Mr. Dersham, Mr. Wyse.

137 (I), 138 (II). ANATOMY AND PHYSIOLOGY.
A systematic approach to the study of the human body with integration of function and structure. Designed for students in nursing; not open to other majors. Prerequisite, Chem 110 or equivalent; credit only for full-year course. 3 class hours, 1 3-hour laboratory.
Credit, 4 per semester. Mrs. White.

145 (II). HUMAN GENETICS (E).
Introduction to human genetics emphasizing principles applicable to all species, specific knowledge of man, and scientific methodology. Topics include chromosomal and biochemical variations, blood groups, linkage, hypothesis testing, and gene frequency changes in populations. Not open to students majoring in biological sciences. Prerequisite, Zool 101.
Mr. Mange.

150 (I). BIOLOGY OF BEHAVIOR (E).
The biological approach to the study of animal behavior. Historical, descriptive, physiological, and evolutionary aspects; the relationships of animal behavior studies to the understanding of human behavior. Not for major credit. Prerequisite, one semester of biological science.
Mr. Sargent, Mr. Stuart.

161 (I). BIOLOGY OF BIRDS (E).
Selected topics in avian biology: birds' migrations and navigational capabilities; breeding behavior; structural and functional specializations; origin and evolution; ecology, economics, and aesthetic relations to man. For non-biologists only. Prerequisite, one semester of biological science. Mr. Bartlett.

176 (I), (II). ECOLOGY OF MAN (E).
Man's interaction with the physical, chemical, and biological environment. Problems of population, food supply, pollution, resources, and human behavior, in relation to ecological theory. Not open to students majoring in biological sciences. Prerequisite, 1 laboratory course in biological science.
Mr. Ludlam, Mr. J. L. Roberts.

200 (I), (II). NATURAL HISTORY (E).
Features of sky, climate, terrain, and organisms important in understanding the natural world and in teaching natural science. Laboratory includes methods of identification, collecting data, etc. Open to majors other than Elementary Education only as space permits. Prerequisite, Botany 100 or Zool 101. 1 class hour, 1 4-hour laboratory. (Also listed under Botany 200.) Mr. Nutting.

221 (I), (II). COMPARATIVE VERTEBRATE ANATOMY.
Structure and phylogeny of vertebrates. Laboratory work illustrates evolutionary trends and specializations and provides experience in dissection. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Klingener, Mr. Snyder.

223 (I), (II). HISTOLOGY.
Structure of cells, tissues, and organs as related to function; emphasis on the mammal; introduction to microtechnique. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory.
Mr. Potswald, Ms. Rollason.

227 (II). EMBRYOLOGY.
A survey of embryonic development from a combined descriptive, comparative, and analytical point of view. Laboratories deal with descriptive and comparative phases of ontogeny, especially of amphibia, birds, and mammals. 2 class hours, 1 3-hour laboratory. Prerequisite, Zool 101 or 240. Mr. Noden.

230 (I). SYSTEMS OF THE HUMAN BODY.
Lectures present a detailed and integrated study of human anatomy and physiology. Laboratories deal with functional properties of the human organism and are supplemented by exercises in gross anatomy of the cat and rat. Designed for students in Medical Technology and Public Health; others must have instructor's permission. Prerequisites, Chem 112, Zool 101. 3 class hours, 1 3-hour laboratory. Credit, 4. Mr. O'Connor.

240 (I), (II). PRINCIPLES OF GENETICS.
Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution. Not open to students who have passed Zool 145. Prerequisites, Chem 111, one semester of biological science.
Mr. Levin, Mr. Mange, Mr. Rauch, Mr. Scudo.

243 (II). INTRODUCTORY POPULATION BIOLOGY.
An evolutionary and integrated introduction to the demographic, ecological, genetic, and geographic aspects of the biology of populations. Consideration of social implications and utility. Background in probability theory, statistics, and mathematical and numerical modelling. Prerequisites, Zool 145 or 240 or equivalent, and 1 semester of mathematics. 2 class hours and 1 2-hour period for discussion and problem solving.
Mr. Levin, Mr. Scudo.

246 (I). POPULATION GENETICS.
Distribution of genes and genotypes within species, emphasizing theoretical models of static and evolving natural populations. Observational and experimental data considered, where available. Prerequisites, Zool 240, Math 127.
Mr. Mange, Mr. Scudo.

250 (II). MATHEMATICAL IDEAS IN BIOLOGY.
An introduction to some biological problems using mathematical concepts and techniques as tools. The emphasis is on biology. Topics, introduced at an elementary level, include "thinking" machines and artifical intelligence, energetics and locomotion of animals, and elementary models for populations. Intended for biologists, pre-meds, biophysicists, and mathematicians. More advanced aspects of such topics are covered concurrently as Zool 385. Prerequisites, Zool 251 and 252 concurrently or equivalent background.

251 (II). BIOLOGY REVIEW FOR ZOOLOGY 250.
A survey of basic aspects of cytology, life cycles, anatomy, genetics, behavior, and populations. Concurrent registration

in Zool 250 is required. Intended for students with an adequate mathematical background but weak in biology.
Credit, 1.

252 (II). MATHEMATICS REVIEW FOR ZOOLOGY 250.
A survey of basic aspects of sets, functions, derivation and integration, qualitative study of difference and differential equations. Concurrent registration in Zoology 250 is required. Intended for students with an adequate biological background but weak in mathematics.
Credit, 1.

275 (II). BIOLOGY OF PROTOZOA.
Morphology and physiology of protozoa, with emphasis on contributions made to basic problems of biology through study of these organisms. Prerequisites, Zool 101 or 240, 2 additional laboratory courses in biological sciences, Chem 262. 1 class hour, 1 2-hour and 1 3-hour laboratory. Mr. Honigberg.

281 (I). BIOLOGY OF LOWER INVERTEBRATES.
Survey of invertebrate animals based upon evolutionary and phylogenetic considerations. Includes the Protozoa, Porifera, Cnidaria, Platyhelminthes, Nematoda, Mollusca, etc. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Nutting, Mr. L. S. Roberts.

282 (II). BIOLOGY OF HIGHER INVERTEBRATES.
Survey of invertebrate animals based upon evolutionary and phylogenetic considerations. Includes the Annelida, Arthropoda, Ectoprocta, Echinodermata, etc. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory.
Mr. Nutting, Mr. L. S. Roberts.

283 (I). GENERAL PARASITOLOGY.
Morphology, life cycles, and physiology of protozoan and helminth parasites, with emphasis on broad aspects of parasitism. Prerequisites, Zool 101 or 240, Chem 112 or 114. 2 class hours, 1 3-hour laboratory.
Mr. Honigberg.

285, 286 (I), (II). TOPICS IN ZOOLOGY.
Occasional offerings on a variety of zoological topics. Consult the department for current offerings. Credit, 1-6.

300 (I). VERTEBRATE ZOOLOGY.
History, relationships, patterns of distribution, classification of vertebrates, with emphasis on fishes. Laboratories include field trips. Prerequisite, Zool 101 or 240. 1 class hour, 2 2-hour laboratories.
Mr. Andrews.

302 (II). ICHTHYOLOGY.
Morphology, ecology, and relationships of fishes, and their distribution in space and time. Prerequisite, Zool 221 or 300. 2 class hours, 1 3-hour laboratory.
Mr. Andrews.

306 (II). ORNITHOLOGY.
An introduction to avian biology for majors in the biological sciences. Emphasis on structure, function, classification, and behavior. Laboratory includes some field trips. Prerequisite, Zool 221 (preferred) or 300. 2 class hours, 1 3-hour laboratory.
Mr. Bartlett.

308 (II). MAMMALOGY.
Evolution, distribution, classification and ecology of mammals. Laboratory includes field trips, preparation of study material, and identification of local fauna. Prerequisite, Zool 221 or 300. 2 class hours, 1 3-hour laboratory. Mr. Snyder.

335 (II). LIMNOLOGY.
Inland waters, including geological, physical, chemical and biological aspects. Prerequisites, Bot 100, Zool 101 or 240, Chem 112 or 114, Physics 141. 2 class hours, 1 3-hour laboratory or field trip.
Mr. Ludlam.

337 (I). ECOLOGY.
Introduction to descriptive and theoretical ecosystems, community, population, and behavioral ecology. The laboratory emphasizes ecologic principles and techniques. Prerequisites, Zool 101 or 240, Math 128, one semester of invertebrate zoology, preferably Zool 282. 2 class hours, 1 3-hour laboratory. Mr. Edwards, Mr. Ziegler.

350 (I). ANIMAL BEHAVIOR.
The biological bases of animal behavior. Analysis of the methods and objectives of current research. Prerequisite, Zool 101 or 240, and Psych 101 or 250.
Mr. Sargent, Mr. Stuart.

360 (I), (II). CELL PHYSIOLOGY.
Modern trends in physiology with emphasis on chemical and physical properties of cells including cell ultrastructure and metabolism, permeability, muscle contraction and molecular biology. Prerequisites, one year of biology, Biochem 222 or 223. 2 class hours, 1 3-hour laboratory.
Mr. Kaulenas, Mr. Kunkel, Mr. Moner, Mr. Searcy.

366 (I). VERTEBRATE PHYSIOLOGY.
Function of organs and organ systems in vertebrates. Not open to students who have passed Zool 135. Prerequisite, Zool 360 or Biochem 220 or 222 or 223. 2 class hours, 1 3-hour laboratory. Mr. Snedecor.

370 (II). COMPARATIVE PHYSIOLOGY.
Physiological principles involved in adaptations of animals to their environment; laboratory emphasis on experimental methods used to study adaptive mechanisms. Prerequisite, Zool 360. 2 class hours, 1 3-hour laboratory.
Mr. J. L. Roberts, Mr. Dersham.

380 (I), (II). DEVELOPMENTAL BIOLOGY.
Physiological and biochemical aspects of development. Laboratory includes seminars, discussions, and experimental work. Prerequisites, Biochem 222 or 223, Zool 360. 2 class hours, 1 3-hour laboratory.
Mr. Kaulenas, Mr. Kunkel.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-6.

399 (I), (II). SENIOR HONORS PROJECTS.
Individual study and research under the direction of a faculty member for highly qualified seniors. Students should consult with appropriate faculty during their Junior year. No credit given until completion of second semester of work.
Credit, 6.

Note: Summer courses such as Invertebrate Zoology, Invertebrate Embryology, and Marine Ecology taken at the Marine Biological Laboratory, Woods Hole, Massachusetts or study at the University's Nantucket Island Field Station or other biological field stations will be awarded 3 to 6 credits upon certification of satisfactory achievement in 6 to 12 weeks of study.

School of Business Administration

Wendell R. Smith, *Dean*
John T. Conlon, *Associate Dean*
Lawrence A. Johnson, *Assistant Dean*
Nelson E. Pion, *Assistant Dean*

The School offers a number of programs leading to the degree of Bachelor of Business Administration. Students in Business Administration follow a common curriculum during their Freshman and Sophomore years. This curriculum is composed of:

- Two courses in Rhetoric
- Two courses in History or Political Science
- One course in Psychology
- One course in Sociology
- One course in Science
- Mathematics 115, 116, 117
- Two courses in Physical Education
- Accounting 120 and 130
- Economics 103 and 104
- A two-course sequence in Statistics, either Statistics 315 and 316 or General Business 250 and 255
- Four elective courses

Courses and major programs are listed under the four departments in the School of Business Administration: Accounting, General Business and Finance, Management and Marketing. Irrespective of any major selected, a certain "core" of courses is required of all students.

This core is composed of:

- Accounting 110, or
- Management 110, Introduction to Computers for Business
- Finance 201, Corporation Finance or
- Finance 205, Analytical Financial Management
- General Business 260, Law I or
- Political Science 292, Politics, The Law and Judicial Behavior
- Management 201, Principles of Management
- Marketing 201, Fundamentals of Marketing
- Elective courses in major programs are selected with the aid and consent of the student's adviser.

Accounting

Chairman of Department: Professor Carl Dennler, Jr. Professors Anderson, Backer, Lentilhon, Singer; Associate Professors Krzystofik, Simpson, Stone; Assistant Professors Burch, Fitzgerald, Gosman, Motekat, O'Connell, Zeisel; Instructors Grudnitski, Pion.

	Credits
Required "core" courses	21
Required courses in the major:	
Accounting 220, Financial Reporting Theory I	3
Accounting 221, Financial Reporting Theory II	3

A course or courses in at least two of the following three areas:

1. Accounting 230, Cost Accounting, or Accounting 235, Managerial Cost Analysis
2. Accounting 210, Business Applications of Computer, or Accounting 211, Business Information Systems
3. Accounting 370, Federal Income Tax Procedures

Electives sufficient to reach a minimum of 24 hours in accounting courses (including Accounting 120 and 130).

A Business Law course in addition to the one required in the School core	3
Four elective courses outside the School	12

Additional electives to bring total to the 120 credits required for graduation. Note: Students planning to work in public accounting in New York state should elect a Finance course in addition to the one required in the School core.

110 (I), (II). INTRODUCTION TO COMPUTERS FOR BUSINESS.
The BASIC and FORTRAN computer programming languages with emphasis on the use of the computer for business data processing and problem solving. (Also listed as Mgt. 110.)

120 (I), (II). INTRODUCTION TO FINANCIAL ACCOUNTING.
Introduction to principles underlying the preparation of financial statements.

130 (I), (II). INTRODUCTION TO MANAGERIAL ACCOUNTING.
Continuation of Accounting 120 with major emphasis on the development and application of accounting data for planning and control.

210 (I), (II). BUSINESS APPLICATIONS OF COMPUTERS.
Basic business data processing methods with emphasis on general business problems and their application to the COBOL language. Prerequisites, Acctg. 120, 130 and Acctg./Mgt. 110. (Also listed as Mgt. 210.) Mr. Burch.

211 (I), (II). BUSINESS INFORMATION SYSTEMS.
Data processing methods and design of file structures as they relate to business information systems. Emphasis on the role of the accountant and manager in the design and operation of the systems. Complementary methods of providing information to management for purposes of control, planning, and decision-making. Prerequisites, Acctg. 120, 130 and Acctg./Mgt. 110 or equivalent. (Also listed as Mgt. 211.) Mr. Burch.

220 (I), (II). FINANCIAL REPORTING I.
Intensive examination of fundamental concepts underlying financial reporting. Current literature dealing with effects of alternative methods upon measurement of periodic income. Prerequisite, Acctg. 130. Mr. O'Connell, Miss Motekat.

221 (I), (II). FINANCIAL REPORTING II.
Continuation of Acctg. 220 and an introduction to consolidated financial statements of affiliated companies. Prerequisite, Acctg. 220. Miss Motekat, Mr. Simpson.

230 (I), (II). COST ACCOUNTING.
Methods of cost analysis for job order, process, and standard cost systems, with emphasis on cost control and interpretation. Prerequisite, Acctg. 130.
Mr. Dennler, Mr. Krzystofik, Mr. Lentilhon.

235 (I), (II). MANAGERIAL COST ANALYSIS.
Analysis of Cost-Volume-Profit relationships, cost behavior, budgeting and planning, responsibility accounting and control systems, behavioral aspects of budgets, divisional performance evaluation, inventory planning and accounting aspects of capital budgeting. Prerequisites, Acctg. 120, 130 and basic calculus. Mr. Gosman, Mr. Zeisel.

263 (II). LAW IV.
Legal problems most commonly encountered by certified public accountants. Special attention to subjects currently included in CPA examinations. Prerequisite, General Business 260. (Also listed as Gen. Bus. 263.) Mr. O'Connell.

320 (I), (II). FINANCIAL REPORTING III.
Consolidation problems of merged firms. Application of interest to accounting problems. Both general price-level and specific price change problems. Problems of foreign operations and of firms in financial difficulty. Prerequisite, Acctg. 221. Mr. Gosman, Mr. Simpson.

335 (I). INVENTORY CONTROL.
Mathematical modeling applied to control of inventory investments. Emphasis is also on the recognition of relevant costs for the development and solution of appropriate models. Prerequisites, proficiency with finite and infinitesimal calculus, probability theory, matrix algebra, computer programming, and operations research methodology, or permission of instructor.

340 (I), (II). AUDITING.
The basic concepts of auditing and control. Emphasizes internal control, audit programs, and professional responsibilities of the CPA. Attention to the auditing requirements for the CPA examination. Prerequisites, Acctg. 221, either Acctg. 230 or 235, Statistics, and a Computer course. Mr. Krzystofik.

360 (II). GOVERNMENTAL ACCOUNTING.
Special features of budgetary and fund accounting as applied to municipalities, other governmental units and institutions, such as hospitals and schools. Prerequisite, Accounting 120. Mr. Anderson.

370 (I), (II). FEDERAL INCOME TAX PROCEDURE.
Federal income tax laws and regulations as they affect individuals; preparation of tax returns. Prerequisite, Accounting 120. Mr. Anderson, Mr. Fitzgerald.

371 (I), (II). ADVANCED FEDERAL TAX PROCEDURES.
A continuation of Accounting 370 emphasizing corporations, partnerships, estates and trusts, gifts and estate taxes, tax planning and research. Prerequisite, Accounting 370. Mr. Anderson, Mr. Fitzgerald.

380 (II). CPA PROBLEMS.
Extensive practice in solution of problems for CPA examinations. Topics include: proper treatment of assets, liabilities and ownership equity; partnerships; consolidations; funds and cash flow; cost accounting and management uses of accounting information; and governmental accounting. Prerequisite, Accounting 320. Mr. Lentilhon.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

393 (I), (II). SENIOR HONORS SEMINAR.
Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

General Business and Finance

Chairman of Department: Associate Professor Alexander Barges. Professors Balintfy, Cheng, Hartzler, Kaczka, Ludtke, Osborn, Rivers; Associate Professors Belovicz, Bonsignore, Deets, Plattner, Whiston; Assistant Professors Abranovic, Arons, Burak, Choate, Cooper, d'Errico, Evans, Goldman, Katsh, Kumar, Moore, Pipkin, Potter, Puterman; Lecturer Flanders.

Curriculum in Financial Management

	Credits
Required "core" courses	15
Required courses in the major:	15
Finance 210, Financial Institutions, or	
Economics 211, Money, Banking and Credit	
Finance 202, Problems in Business Finance I	
Finance 203, Problems in Business Finance II, or	
Finance 204, Models of Financial Analysis & Management	
Finance 220, Investments	
Finance 230, Principles of Insurance	

Electives in area of concentration, with a minimum of 9 credits in Business Administration	18
Electives outside of Business Administration and Economics	12

Curriculum in General Business	Credits
Required "core" courses	15
Required courses in the major:	6
Finance 210, Financial Institutions, or	
Economics 211, Money, Banking and Credit	
General Business 265, Business and Its Environment	
Electives in Business Administration	12
Electives in Economics beyond introductory course level	9
Electives outside Business Administration and Economics with a minimum of 9 credits from a list of selected courses	18

Curriculum in Business Administration with an Area of Concentration in Urban and Regional Studies	Credits
Required "core" courses	15
Required courses in the major:	15
Finance 210, Financial Institutions, or	
Economics 211, Money, Banking and Credit	
General Business 245, Metropolitan Transportation	
General Business 270, Real Estate and Urban Development	
General Business 272, Seminar in Urban and Regional Studies	
Environmental Design 274, or	
Environmental Design 273, City Planning History, or	
Environmental Design 244, Broad Survey of the History of the Designed Human Environment	
Specialization Electives:	24
General Business 242, Public Service Corporations	
General Business 265, Business and Its Environment	
General Business 385 and 386, Independent Study and Research	
Economics 281, Regional Economics	
Economics 282, Urban Economics	
Economics 314, State and Local Public Finance	
Political Science 324, Metropolitan Politics	
Sociology 251, Urban Sociology	
History 331, Social History of the United States	
History 337, The City in the Modern United States	
Geography 260, Economic Geography	
Geography 270, Urban Spatial Organization	
Geography 280, Political Geography	
Electives outside of Business Administration and area of specialization	6

Curriculum in Business Administration and Quantitative Methods	Credits
Freshman Mathematics Requirements: Desirable but not required that persons considering this major elect the Mathematics 135, 136 sequence in place of Mathematics 116, 117.	
Required "core" courses	15
Required courses in the major:	9
General Business 253, Introduction to Management Science	
General Business 254, Topics in Management Science	
General Business 256, Management Science Application and Practicum	
Specialization Electives:	24
15 credit hours from a list of quantitative electives	
9 additional credit hours in Business Administration and Economics	
Electives outside of Business Administration and area of specialization	12

Curriculum in Business Administration and Economics	Credits
Required "core" courses	15
Required courses in the major:	9
Finance 210, Financial Institutions or	
Economics 211, Money, Banking and Credit	
Economics 203, Intermediate Microeconomic Theory	
Economics 204, Macroeconomic Theory and Business Cycles	
Electives in Business Administration and Economics, with a minimum of 12 credit hours in Economics	24
Electives outside of Business Administration and Economics	12

Curriculum in Business Administration and (Environmental field outside Business Administration and Economics)*	Credits
Required "core" courses	15
Other required courses in Business Administration and Economics (to be selected specifically by the student and his adviser for each individual program)	6
Electives in Business Administration and Economics	12
Other Electives (all may be elected from specialized field)	15
Electives outside of Business Administration, Economics and specialized field	12

*At least 48 hours must be taken in Business Administration and Economics courses.

FINANCE

201 (I), (II). CORPORATION FINANCE.
Corporate financial behavior; appraisal of factors affecting decision-making regarding sources and application of funds; introduction to capital budgeting and cost of capital problem. Prerequisite, Accounting 120 or permission of instructor.

202 (I). PROBLEMS IN BUSINESS FINANCE I.
Short- and intermediate-term financing; decision-making under uncertainty regarding needs and sources of funds. Prerequisite, Finance 201.

203 (II). PROBLEMS IN BUSINESS FINANCE II.
Long-term financing, capital budgeting, reserves and dividend policy, pensions, company expansion, merger and consolidation, reorganization. Prerequisite, Finance 201.

204 (I), (II). MODELS OF FINANCIAL ANALYSIS AND MANAGEMENT.
An analytical approach to the study of financial management. Emphasis on theoretical topics of financial decision-making. Through the use of mathematical, statistical and computer simulation methods, various financial decision-making models are made explicit in their assumptions, rigorous in their construction, and testable in their implications. Prerequisite, Finance 201 and the SBA required mathematics and computer courses.
Mr. Cheng, Mr. Kumar.

210 (I), (II). FINANCIAL INSTITUTIONS.
The American financial system and functional relationships between financial institutions and economic activities of households, business firms and governmental units. Prerequisites, Econ 103 and Accounting 120. Mr. Choate, Mr. Ludtke.

220 (I). INVESTMENTS.
Development of the general theory of investment with emphasis on the individual investor; practical application of the techniques to real world problems.
Mr. Deets.

221 (II). THEORY OF INVESTMENT ANALYSIS.
Detailed investigation into contemporary investment strategies; emphasis on the theoretical, with portfolio analysis and random walk being the chief topics. Prerequisite, Finance 220 or permission of instructor. Mr. Deets.

222 (II). THEORY OF INVESTMENT PROCESSES.
In-depth study of portfolio analysis and stochastic processes in security markets; emphasis on quantitative solution techniques and testing procedures. Prerequisites, Finance 220 and the required SBA quantitative courses. Mr. Deets.

230 (I), (II). PRINCIPLES OF INSURANCE.
Risks encountered by individuals and business firms and methods and institutions which have been established to insure against financial losses. Various forms of insurance, primarily from the buyers' point of view.
Mr. Cooper, Mr. Osborn.

231 (I). LIFE INSURANCE.
Application of life insurance to problems of family security, business security, investments, and estate protection.
Mr. Cooper, Mr. Osborn.

232 (I). EMPLOYEE BENEFIT PLANS.
Design and administration of pension; profit sharing, group life and health insurance plans and other miscellaneous insured fringe benefit programs.
Mr. Cooper, Mr. Osborn.

233 (II). PROPERTY RISKS AND INSURANCE.
Methods of protecting against direct and indirect losses from perils of fire, negligence, marine transportation and dishonesty. Analysis of insurer operational functions of underwriting, claim adjusting, investing and rate making. Mr. Cooper.

234 (I). ECONOMIC SECURITY.
Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes, and economic contingencies.
Mr. Cooper, Mr. Osborn.

GENERAL BUSINESS

240 (I). DOMESTIC TRANSPORTATION SYSTEMS.
A comprehensive survey of transport agencies. The differential rates of technological development for each mode and the consequential effects on land utilization, methods of rate making, and the formulation of public policy. Mr. Rivers.

241 (II). LOGISTICS AND THE TRANSPORT FUNCTION.
Alternative combinations of the production factors aiming at the least cost combination. Inventory control methods, plant location, plant layout, production scheduling, materials handling problems, use of transportation alternatives, warehouses, and customer service. Mr. Rivers.

242 (II). PUBLIC SERVICE CORPORATIONS.
The organization, operation, and social responsibilities of public utility corporations, and their impact on the economy and the environment. Mr. Rivers.

245 (I). METROPOLITAN TRANSPORTATION.
The analysis of economic, social, and technological developments on demand and supply factors for the movement of people and goods within urban areas. Determination of the optimal mix of modal facilities to maximize the total transport resources of the urban area. Coordination of internal and external transport systems. Prerequisite, G.B. 240 or permission of instructor. Mr. Rivers.

GENERAL BUSINESS AND FINANCE

250 (II). ADMINISTRATIVE STATISTICS.
Probability and statistical distributions applied to business management problems; application of Bayes' theorem to sampling for business decision-making under uncertainty. Mr. Whiston.

253 (I). INTRODUCTION TO MANAGEMENT SCIENCE.
Introductory but rigorous treatment of optimizing and behavioral models in business management involving the use of elementary techniques in finite mathematics, calculus, statistics, and computer programming. Prerequisites, Accounting 110 or Comp. Sci. 121, Linear Algebra, Calculus sequence and at least one semester of statistics. (Also listed as Management 253.)

254 (II). TOPICS IN MANAGEMENT SCIENCE.
Deterministic and stochastic models of business management planning and control involving subject matters in efficient allocation of resources, decision theory, organization theory, game theory, nonlinear programming, and simulation. Prerequisites, G.B. 253 or equivalent. (Also listed as Management 254.)

255 (I). DECISION MODELS IN BUSINESS.
Introduction to the theory of probabilistic processes in the formulation of decision models and their application to the field of business administration.

256 (I), (II). MANAGEMENT SCIENCE APPLICATION AND PRACTICUM.
Application of theoretical models in "real world" situations; current problems in cooperating firms are investigated by students.

258 (I). QUEUEING THEORY MODELS.
Development and application of models of waiting lines, including single and multiple channel and single and multiple stage queues for various priorities and queue disciplines. Prerequisites, G.B. 253 and G.B. 254, or permission of instructor.

259 (II). TIME SERIES ANALYSIS.
The analysis of time series and dynamic models for use in forecasting and control of business and economic systems.

260 (I), (II). INTRODUCTION TO LAW.
The nature, functions and limits of law. Various theoretical approaches to law as an important institution in society. Selected problems of law, power and stratification and the relationship of law and values in society. Analysis of the administration of law through legislation, administrative agencies and courts.

261 (I), (II). ADVANCED LEGAL STUDIES.
An extension and development in detail of topics surveyed in the introductory course. Prerequisite, G.B. 260.

262 (II). LAW III.
The economic functions and consequences of agency, partnerships and corporations. Prerequisite, G.B. 260.

263 (II). LAW IV.
Legal problems most commonly encountered by certified public accountants with attention to the subjects currently included in CPA examinations. (Limited to seniors majoring in accounting). Prerequisite, G.B. 260. (Also listed as Acctg. 263.)
Mr. O'Connell.

264 (I), (II). URBAN LAW.
The role of the legal process in shaping, controlling and defining urban social problems (i.e., slumlordism, welfare, crime, racial segregation, public school problems). The focus is on human problems and not property law problems. Prerequisite, G.B. 260 or equivalent.
Mr. Pipkin.

265 (I), (II). BUSINESS AND ITS ENVIRONMENT.
Theories and doctrines relating the firm to its environment. Aggregate legal, social, political, and economic factors are integrated in a rigorous examination of competing concepts of the role of business in society. Prerequisite, senior class standing or permission of instructor. (Also listed as Management 265.)
Mr. d'Errico, Mr. Katsh.

266 (II). LAW I — HONORS.
Nature of law and judicial process; the concept of contract; economic functions and consequences of contracts.

270 (I). REAL ESTATE AND URBAN DEVELOPMENT.
Introduction to principles of urban land use. Economic, legal, social, and political factors that affect real estate markets, valuation and land use.
Mr. Burak, Mr. Plattner.

272 (II). SEMINAR IN URBAN AND REGIONAL STUDIES.
Analysis of the dimensions of urban growth and change; discussion of the reasons behind, and the problems growing out of the economic growth and stagnation of urban areas. Prerequisite, G.B. 270, or Econ 181, or Econ 281, or permission of instructor. Mr. Moore.

273 (I), (II). INTRODUCTION TO SIMULATION.
The principles and methods of computer simulation. Each student is expected to construct, test, and run a complex simulation model. (Also listed as I.E. 273.)
Mr. Kaczka.

333. MANAGEMENT INTERNSHIP PROGRAM.
Summer service with a cooperating business firm or governmental agency. The student undertakes responsible duties and participates in managerial activities under supervision of experienced executive personnel. A written report is required. With permission of department chairman.

385 (I), 386 (II). INDEPENDENT STUDY AND RESEARCH.
For qualified seniors, independent study and research on selected problems in Business Administration. With permission of department chairman. Credit, 1-3.

391 (I), (II). CONTEMPORARY TOPICS IN LAW.
A series of seminars (probably two or three each semester) on some legal problem of special interest to faculty and students. Topics announced each semester in the Course Description Guide. Permission of instructor required.

392. SEMINAR IN URBAN PROBLEMS.
A discussion approach supplemented with occasional guest lecturers, films, and some field exposure to the operational aspects of urban problems. Managerial and public policy issues in urban communities, viewed in the context of the contemporary economic and social conditions of such areas. Mr. Evans.

393 (I), (II). SENIOR HONORS SEMINAR.
Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

399 (I), (II). SENIOR HONORS.

Management

Chairman of Department: Professor George B. Simmons. Professors Carlisle, Conlon, Hare, Litterer, McGarrah, Wortman, Young; Associate Professors Bornstein, Chen, Claunch, Elkins, Finch, Michael, Sahin; Assistant Professors Bartol, Bryant, Butterfield, Jones; Lecturer Brooke.

MANAGEMENT

	Credits
Required "core" courses	15
Required courses in the major:	12
Management 214, Personnel Management	
Management 231, Administrative Theory	
Management 247, Production Management I	
Management 371, Business Policy and Strategy	

Seven courses chosen with the concurrence of the adviser to include, typically, the following:

Curriculum in General Management
- Management 265, Business and Its Environment
- Management 341, Management Decision Simulation
- Management 342, Planning and Control Systems
- Management 391, Seminar in Administration

Curriculum in Personnel Management and Industrial Relations
- Management 344, Management-Union Relations I
- Management 345, Management-Union Relations II
- Management 392, Seminar in Personnel Management

Curriculum in Production Management
- Management 248, Production Management II
- Management 341, Management Decision Simulation
- Management 342, Planning and Control Systems
- Management 393, Seminar in Operations Management

Curriculum in Systems Management
- Management 341, Management Decision Simulation
- Management 342, Planning and Control Systems
- Management 393, Seminar in Operations Management and one of the following:
- Accounting 272, Administrative Costing and Control
- Industrial Engineering 256, Data Processing and Information Handling Systems
- Economics 301, Decision Theory
- Statistics 271, Sampling Theory and Methods

Curriculum in Business Administration and Quantitative Methods

Freshman Mathematics Requirements: Desirable but not required that persons considering this major elect the Mathematics 123, 124 sequence in place of Mathematics 116, 117.

	Credits
Required "core" courses	15
Required courses in the major:	12
General Business 250, Administrative Statistics	
Management 253, Introduction to Management Science	
Management 254, Topics in Management Science	
General Business 256, Management Science Application and Practicum	
Specialization Electives:	21
12 credit hours from a list of quantitative electives	
9 additional credit hours in Business Administration and Economics	
Electives outside of Business Administration and area of specialization	12

110 (I), (II). INTRODUCTION TO COMPUTERS FOR BUSINESS.
The BASIC and FORTRAN computer programming languages; use of the computer for business data processing and problem solving. (Also listed as Accounting 110.)

201 (I), (II). PRINCIPLES OF MANAGEMENT.
Fundamental principles and practices of the managerial process in business enterprises.

210 (I), (II). BUSINESS APPLICATIONS OF COMPUTERS.
Intermediate and advanced computer programming with emphasis on problems in accounting and management information systems. Prerequisites, Accounting 120 and 130, and Management 110. (Also listed as Accounting 210.)

211 (II). BUSINESS INFORMATION SYSTEMS.
Data processing methods and techniques as they relate to business information systems with emphasis on the role of the accountant and manager in the design and operation of the systems. Complementary methods of providing information to management for purposes of control, planning, and decision-making. Prerequisites, Accounting 120 and 130 and Management 110 or equivalent. (Also listed as Accounting 211.)

214 (I), (II). PERSONNEL MANAGEMENT.
Principle and policies followed by management in recruitment, development, direction, and control of personnel.

231 (II). ADMINISTRATIVE THEORY.
Principles of administration, modern organization theories, specialization, functionalization, coordination, planning and control, authority status, leadership, decision-making, communication, and power-structuring. Prerequisite, Management 201.

234 (II). WAGE AND SALARY ADMINISTRATION.
Objectives, procedures, and problems involved in establishment and administration of operative and executive compensation plans. Prerequisite, Management 214.

247 (II). PRODUCTION MANAGEMENT I.
Basic principles of production management. Use of statistical, mathematical, and simulation methods in production or operations. Prerequisite, Management 201.

248 (I). PRODUCTION MANAGEMENT II.
Application of principles and analytical techniques to design and operation of production systems. Quality control, inventory and production control. Prerequisite, Management 247.

253 (I). INTRODUCTION TO MANAGEMENT SCIENCE.
Introductory but rigorous treatment of optimizing and behavioral models in business management involving the use of elementary techniques in finite mathematics, calculus, statistics, and computer programming. Prerequisites, Comp. Sci. 121 or Management 110, and three semesters of college mathematics, including one semester of calculus, and one semester of statistics. (Also listed as G.B. 253.)

254 (II). TOPICS IN MANAGEMENT SCIENCE.
Deterministic and stochastic models of business management planning and control involving efficient allocation of resources, decision theory, organization theory, game theory, non-linear programming, and simulation. Prerequisite, Management 253 or equivalent. (Also listed as G.B. 254.)

265 (I), (II). BUSINESS AND ITS ENVIRONMENT.
Theories and doctrines relating the firm to its environment. Aggregate social, political, legal and economic factors integrated in a rigorous examination of competing concepts of the role of business in society. Prerequisite, senior standing or permission of instructor. (Also listed as G.B. 265.)

333. MANAGEMENT INTERNSHIP PROGRAM.
Summer service with a cooperating business firm or governmental agency. The student undertakes responsible duties and participates in managerial activities under supervision of experienced executive personnel. A written report is required. With permission of department chairman.

341 (I). MANAGEMENT DECISION SIMULATION.
Participation in management of a firm in a simulated industry. Students, organized into management teams, apply their knowledge of business administration and economics in a competitive struggle for profit and market position. Prerequisite, senior standing and permission of instructor.

342 (II). PLANNING AND CONTROL SYSTEMS.
Systems coordinating sales, production, finance and other business functions and producing information required for adjustment and reformulation of plans over time. Both single-use and continuous-use plans. Design of organization structure and development of control criteria. Prerequisite, senior standing.

344 (I). MANAGEMENT-UNION RELATIONS I.
Comparison of union-management objectives, functions, and structures, including scope and impact of union penetration into areas of managerial authority. Prerequisite, Management 201 or 214.

345 (II). MANAGEMENT-UNION RELATIONS II.
Problems in interpretation and administration of collective bargaining agreements, studied by the case method of analysis. Prerequisite, Management 344 or permission of instructor.

371 (II). BUSINESS POLICY AND STRATEGY.
An integrating course embracing all organic management functions. Cases are used as subjects for analysis and systematic decision-making practice. Prerequisites, Management 201 and senior standing.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I). SEMINAR IN ADMINISTRATION.
Advanced study and individual research in theory and practice of administrative organization and behavior. Prerequisite, senior standing and permission of instructor.

392 (II). SEMINAR IN PERSONNEL MANAGEMENT.
Advanced study of current problems in development and administration of personnel problems. Research methodology and recent research findings emphasized. Each student required to complete a major research project. Prerequisite, senior standing and permission of instructor.

393 (I), (II). SENIOR HONORS SEMINAR.
Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

394 (II). SEMINAR IN OPERATIONS MANAGEMENT.
Specialized topics and advanced techniques in production and operations management. Prerequisite, Management 247.

Marketing

Head of Department: Professor Jack S. Wolf. Professors Frederick, Paul, Smith; Associate Professors Buell, Johnson, Liander, Monroe, Schwartz, Worthing; Assistant Professors Barber, Guiltinan, Sawyer, Schewe, Wiek.

Curriculum in Marketing	Credits
Required "core" courses	15
Required course in the major:	
Marketing 216, Marketing Management	3
Functional Courses (any two of the following):	6
Marketing 221, Product Planning and Development	
Marketing 222, Marketing Communications	
Marketing 223, Marketing Network Analysis	
Marketing 224, Analysis for Pricing Decisions	
Tool Courses (any two of the following):	6
Marketing 210, Buyer Behavior	
Marketing 212, Marketing Research	
Marketing 214, Marketing Models	
Expansive Courses (any one of the following):	3
Marketing 213, Advanced Marketing Research	
Marketing 219, Marketing Strategy	
Marketing 237, International Marketing	
Marketing 390, Seminar in Marketing	
Marketing 385-6, Independent Study and Research	
Marketing 399, Honors	
One Advanced Behavioral Science Elective	3
One Advanced Economics Elective	3
Total Program Credits	39
Free Elective Credits	21

201 (I), (II). FUNDAMENTALS OF MARKETING.
The role of marketing in our economic and social structure. The planning, distribution, pricing and promotion of goods and services to consumer and industrial markets, viewed as internal activities of the firm, and as shaped by environmental forces.

210 (I), (II). BUYER BEHAVIOR.
Analysis of buyer motivation and buying behavior. Explanatory theories of consumer market behavior and models of the decision-making process for winning patronage. Prerequisite, Marketing 201 or permission of instructor. Mr. Paul.

212 (I), (II). MARKETING RESEARCH.
The systematic gathering, recording and analyzing of data about problems relating to the marketing of goods and services. Individual case study and research projects. Prerequisites, Marketing 201 and Statistics 315, or permission of instructor.
Mr. Monroe, Mr. Schewe.

213 (II). ADVANCED MARKETING RESEARCH.
Select areas of marketing research. Emphasis on nonsurvey research techniques. Substantive problems of experimental research and research design and analysis. Class problems consist of laboratory or field experiments. Prerequisite, Marketing 212, or permission of instructor.

214 (I), (II). MARKETING MODELS.
Relates a number of concepts and techniques to the analysis and solution of marketing management problems. Marketing models as aids to decision-making in marketing. Prerequisite, Marketing 201 or permission of instructor.
Mr. Frederick, Mr. Monroe.

216 (I), (II). MARKETING MANAGEMENT.
An advanced understanding of the nature and problems of marketing management: the process of marketing management, the environments facing the marketing manager, and the tools available for environmental analysis and control of marketing activities. Prerequisite, Marketing 201 or permission of instructor.

219 (I), (II). MARKETING STRATEGY.
Exposure to realistic problems through computerized simulation and analysis of cases. Practice in seeking solutions to marketing problems through an integration of factors pertinent to strategy development. Prerequisite, Marketing 216 or permission of instructor. Mr. Wolf.

221 (I), (II). PRODUCT PLANNING AND DEVELOPMENT.
Examination and analysis of the factors

pertinent to effective product decisions by marketing managers. The organization of the product planning function, matching products and markets, and methods for reducing new product risk. Prerequisite, Marketing 201 or permission of instructor.
Mr. Worthing.

222 (I), (II). MARKETING COMMUNICATIONS.
Development of effective marketing communication strategies based upon an understanding of the characteristics of audiences. Conceptual material from communications theory applied to advertising and other promotional problems. Prerequisite, Marketing 201 or permission of instructor. Mr. Sawyer, Mr. Wiek.

223 (I), (II). MARKETING NETWORK ANALYSIS.
A systems approach to the management of all activities that facilitate the movement of goods and coordination of supply and demand. Problems of designing and managing product distribution network. Prerequisite, Marketing 201 or permission of instructor. Mr. Guiltinan.

224 (II). ANALYSIS FOR PRICING DECISIONS.
The relationship of pricing objectives, methods, and policies to market behavior and the goals of the firm. Pricing models and contributions of behavioral sciences to pricing analysis. Prerequisite, Marketing 201 or permission of instructor.
Mr. Monroe.

237 (I). INTERNATIONAL MARKETING.
Background useful to United States business enterprises which market goods and services in foreign countries. Emphasis on the multinational firm's marketing operations and the design of marketing strategy. Prerequisite, Marketing 201 or permission of instructor. Mr. Liander.

385, 386. INDEPENDENT STUDY.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (II). SEMINAR IN MARKETING.
Advanced study and individual research on selected problems and current issues in marketing. Each student is required to complete a major research project. Prerequisites, senior standing and permission of instructor.

393 (I), (II). SENIOR HONORS SEMINAR.
Advanced study and research on selected topics in business administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

399 (I), (II). SENIOR HONORS THESIS.
Supervised independent study open to students with a 3.0 quality point average, or invited students. A thesis is required.
Credit, 6-9.

RELATED COURSES
Accounting 272, Administrative Costing and Control.
General Business 241, Management of Traffic and Physical Distribution
General Business 250, Administrative Statistics
General Business 253, Introduction to Management Science
Management 265, Business and Its Environment
Management 342, Planning and Control Systems

SCHOOL OF EDUCATION

Dwight Allen, *Dean*
Atron Gentry, *Associate Dean for Special Programs*
Earl Seidman, *Associate Dean for Academic Affairs*
Norma Jean Anderson, *Assistant Dean for Graduate Affairs*
Richard J. Clark, *Assistant Dean for Undergraduate Affairs*
Bob H. Suzuki, *Assistant Dean for Administration*

Professors Alschuler, Anthony, Cappelluzzo, Carew, Ertel, Fischer, Frederickson, Ivey, B. Jones, Jordan, Kesselheim, Kornegay, Reed, Schimmel, Simon, Ulin, Weinstein, Wolf, Woodbury, Wyman; Associate Professors Anderson, Blanchard, Coffing, Day, Damerell, Evans, Eve, Fanslow, French, Griffiths, Hambleton, Hutchinson, Konicek, Lauroesch, Rudman, Sinclair, Sullivan, Thelen, Tutman, Urch, E. Washington, K. Washington, Wellman; Assistant Professors Abraham, L. Blane, S. Blane, Budde, Bunker, Brainerd, Caban, Carmody, Christensen, F. T. Clark, Dede, DeTurk, Dye, Eachus, Eddy, Eiseman, Flight, Forsyth, Gorth, Hall, Hawkes, Higgins, Hruska, R. Jones, Keochakian, R. Kraus, W. Kraus, LaFrance, Lieberman, Love, Mackin, Masalski, Melican, Melnik, Miltz, Peck, Peelle, Preston, Rossman, Swaminathan, Wagschal, Wideman, Wiggins, Wuerthner; Lecturers Ball, Comissiong, Crosby, George, Greenebaum, Hamilton, Harris, McCollum, Parisi, Williams, Wilson.

The School of Education provides students with a variety of alternatives. Revision and reevaluation of curriculum and structure is continual and will result in new programs not included in the following information.

The following are School of Education policies and procedures pertaining to undergraduates:

1. The Education Major
   A. There are two types of Education majors:
      1. Students enrolled in Teacher Preparation Programs, usually on the elementary level.
      2. Non-teaching majors.
   B. The requirements of the Education major:
      1. Teacher preparation
         a. Completion of the University core requirements.
         b. Completion of 27 additional credits in Arts and Sciences.
         c. Completion of at least 30 credits in Education.
         d. Completion of the course "Kids, Schools and the School of Education: An Introduction."
         e. Acceptance by and completion of a TPPC program.
         f. Maintenance of a minimum 2.0 cumulative average.
         g. Have at least 15 graded credits in residence at the University.
         h. May not use more than 45 credits in Education toward the bachelor's degree, without prior approval.
      2. Non-teaching major
         a. Must complete a, b, c, f, g, and h, of Teacher Preparation requirements.
         b. Must submit program outline to Undergraduate Advising Office (UAO) for approval.
         c. Must complete program designed in cooperation with faculty sponsor; program must include 30 credits in Education.
         d. May not seek certification; may not student teach.

II. Organization of the School of Education for Undergraduates

A. All students, upon entrance to the University as Education majors, are the responsibility of and are responsible to, an adviser assigned by the Undergraduate Advising Office, located in Berkshire House. The staff of the UAO are the advisers for these students. This is usually the first student contact with the School of Education.

B. Students seeking teacher certification must enter a TPPC program. This usually occurs between the end of the third semester and the fifth, depending upon the program, and can only be done after a student has completed the course "Kids, Schools, and the School of Education: An Introduction." Once a student enters a program, the program staff becomes the adviser for the student, and will remain so until the student graduates or enters another program.

C. Students seeking secondary certification are usually not Education majors. They should, in most cases, be earning degrees in academic majors. Upon receiving the approval of their major departments, and after taking the course "Kids, Schools, and the School of Education: An Introduction," they are eligible to apply for entrance into a TPPC program.

D. Students seeking a non-teaching major must design a program of at least 30 credits in conjunction with a faculty sponsor and with

the approval of the center in which the student and his sponsor are concentrating. The program of study must be approved by the Undergraduate Advising Office for the Dean for Undergraduate Affairs.

III. Course Requirements
   A. All Education majors and other students seeking certification must complete the course "Kids, Schools, and the School of Education: An Introduction" or its equivalent.
   B. Students seeking certification must complete a TPPC program.
   C. A $30 fee will be collected from all students who practice teach in TPPC programs.

IV. Grades
   A. All School of Education courses are Pass/Fail. No undergraduates may receive a letter grade in an Education course.
   B. Transfer students must earn at least 15 graded credits in residence at the University. At least 6 credits should be taken for letter grades during the first semester of residence to establish a cumulative average.
   C. All students must have a cumulative average of at least 2.0 to be eligible for a TPPC program.

TEACHER PREPARATION PROGRAMS

The Teacher Preparation Programs Council (TPPC) is responsible for the School's undergraduate and graduate teacher preparation programs. The Council's major focus is on creating new options and alternative routes for meeting undergraduate degree and certification requirements. The Council presently sponsors approximately 20 programs which have different goals, approaches, lengths, and admissions criteria. All programs include a clinical experience. Specific information on individual programs is available from bhh School of Education Undergraduate Advising Office in Berkshire House. Following is a list and short description of representative teacher preparation programs.

Elementary Certification. Typically, students earning an elementary teaching certificate are majors in the School of Education. The School offers a variety of elementary teacher preparation programs from which the student may choose. Some examples of these alternatives are:

MARK'S MEADOW (TEPAM)—Four consecutive semesters combining course work with classroom teaching in Mark's Meadow elementary school. It closely relates theory and experience on the "integrated day" model.

METEP—A two-semester sequence open to elementary majors providing those competencies necessary to function effectively in integrated day programs or any educational setting where active learning is emphasized.

AMHERST ELEMENTARY—A wide range of practical alternatives for elementary majors. The program has various entry and exit points, and works in the Wildwood, Pelham and East Street Schools.

Secondary Certification. Students seeking secondary certification are usually not Education majors. They should, in most cases, be earning degrees in academic majors which reflect the subjects they wish to teach. Secondary students earn their certification by completing a secondary program. Some examples of current secondary programs are:

11+ PROJECT—A limited number of juniors and seniors complete secondary student teaching while working with an experimental curriculum based on the assumption that puberty is as much a psychological as physical upheaval.

HORIZONS—Run in conjunction with the BDIC program (Bachelor's Degree with Individual Concentration), this program is open to sophomores and juniors preparing to teach in interdisciplinary studies or traditional subjects with greater breadth and understanding.

ENGLISH EDUCATION—Students wishing to be English teachers are first screened by the English department. Courses are taken both in English and in Education and student teaching is now in sites such as Amherst and Springfield.

Elementary or Secondary Certification. There are a number of programs which are concerned with grades K-12. They lead to elementary certification for Education majors and to secondary certification for majors in other discipline areas. Some examples are:

ALTERNATIVE SCHOOLS (TASP)—A program for elementary and secondary students including an Outward Bound experience, semester-long internship in an alternative school, and courses for which the students share responsibility with professors.

INTERNATIONAL EDUCATION—A three-semester program for elementary and secondary students who are either sophomores or juniors. Courses explore other cultures in depth, ways to internationalize education, and how teachers can transplant another culture into their classrooms.

FUTURE STUDIES—A two- or three-semester program for sophomores and juniors to explore alternative possible futures for society, as well as to develop necessary teaching/learning skills.

OFF-CAMPUS—Elementary and secondary students practice teach in schools as far away as California and England working with innovations such as differentiated staffing, flexible scheduling, integrated day, open classroom.

OMNIBUS—Juniors and seniors risk a full academic year of living and learning in an alternative school on Cape Cod where high truancy rates are comparable to ghetto schools in urban areas. The program utilizes all kinds of community resources.

Specialized Certification. The School of Education has a number of programs that prepare students for specialized areas. The four programs currently in operation are:

COOPERATIVE EDUCATION—For secondary teaching candidates interested in the growing field of cooperative education; that is, working with high school students who spend half their time in classroom learning and half in work/learning experiences in hospitals, business offices, museums, and other community services.

READING SPECIALISTS—A two-year program for sophomores and juniors through which students can qualify as reading specialists as well as either elementary or secondary teachers.

AGRICULTURAL EDUCATION—For students with a major in the College of Food and Natural Resources interested in becoming vocational agriculture teachers. Combines practical experience and professional education. Student teaching sites located throughout Massachusetts.

MEDIA SPECIALISTS FOR THE DEAF—A three-year, non-certification program which prepares students to be media specialists in schools for the deaf.

LEARNING EXPERIENCES

The School of Education employs a flexible curriculum based on modular credit (i.e., mini-credits or mods); 100 MODULES OF CREDIT EQUAL ONE UNIVERSITY CREDIT. This necessitates a Learning Experience (LEX) number, in addition to the University number, for all School of Education courses.

The following offerings are open to students throughout the University. Additional courses are open to students enrolled in specific TPPC programs.

220. HUMAN RELATIONS LABORATORY.
Provides experiences for prospective elementary teachers with basic skills in human relations. Exercises in attention, flexibility, and decision-making. Individualized instruction using videotape and programmed texts.

221. STENGTH TRAINING.
Working with teacher, counselor and administrator performance through simulation and videotape feedback. Stress on what kind of "self" school personnel project to students. Pre- and in-service personnel are taught to evaluate their own behavior and the responses, feelings and perceptions of students.

222. EDUCATION OF THE SELF.
Based on recent techniques and teaching procedures developed by Perls, George Brown, Gerald Weinstein, Bernard Gunther and Carl Rogers. A variety of experiences aimed at description, analysis and experimentation with their identity. Continuous multi-media documentation of experiences and results.

226. CURRICULUM DEVELOPMENT IN INTERNATIONAL EDUCATION.
Examination of resources and concepts of curriculum development in International Education. Students develop units that can be taught in elementary or secondary schools.

227. CURRICULUM INNOVATIONS IN MUSIC AND SOUND IN EDUCATION.
Survey of methods, materials, techniques and problems related to the innovative use of music and sound in the classroom as an aesthetic medium for enhancing learning. Encouragement given to development and experimental application of innovations developed in course.
Credit, 1-6.

229. INTERNATIONAL EDUCATION.
Focuses on issues surrounding education as tool of development, in cross-cultural context, and through international exchange of persons and ideas. Substantial foreign student participation.

231. ISSUES OF FREEDOM AND RESTRAINT IN ACADEMIC POLICY.
Explores sociological, philosophical, economic, and anthropological considerations in issues of freedom and restraint conflict.

235. EDUCATIONAL MEDIA, TECHNOLOGY AND SYSTEMS.
Characteristics, capabilities, applications and implications of variety of media to variety of educational strategies. Survey course for media specialists and basic course in modern communications media and techniques for other educators.

237. MEDIA PRODUCTION SURVEY.
Helps teachers, trainees and specialists prepare audio-visual materials for use in education programs. Students prepare slides, graphics, recordings, still pictures and motion pictures.

241. EDUCATIONAL FILM PRODUCTION.
Theoretical data and project applications involving students in production of educational messages in motion picture film format. Practice provided through video tape.

242. CONTEMPORARY EDUCATIONAL PHILOSOPHIES.
Examination of contemporary philosophies of education, their social implications and relevance to educational practice.

250. CONCEPTIONS OF A LIBERAL EDUCATION.
Traditional and modern conceptions of liberal education analyzed with regard to relevance to contemporary societies and education.

251. FOUNDATIONS OF EDUCATION.
Issues in modern education viewed through a discipline such as educational sociology, history or philosophy, or comparative education or social psychology. Study may be done independently or through field experience.

254. EDUCATIONAL ANTHROPOLOGY.
Cultural anthropology concepts applied to education. Change, human behavior and interaction and cultural determinants within American culture viewed as vehicles which shed light on culture of schools and role in culture as a whole.

257. INTRODUCTION TO URBAN EDUCATION.
Survey of urban and suburban schools; the process of learning in urban classrooms, effects of present curriculum, and innovative techniques as they apply to urban schools.

258. BLACK AND AFRICAN STUDIES CURRICULUM FOR PUBLIC SCHOOLS.
Demonstrations and observations of certain Black cultural centers and other ethnic settings and situations. Credit, 4.

259. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SOCIAL STUDIES.
Area examined in terms of instructional strategies and curriculum practices. Students evaluate state, commercial and project social studies curricula and create a social studies unit.

260. THE ELEMENTARY SCHOOL CURRICULUM.
Viewed from the standpoint of content and methodology. Emphasis on unit method and activity programs. Prerequisites, elective in Foundations of Education and Child Psychology or Educational Psychology or Human Development.

261. PRINCIPLES AND METHODS OF TEACHING READING AND LANGUAGE ARTS IN THE ELEMENTARY SCHOOLS.
Approaches to teaching reading and language arts at the elementary level. Innovations in methods and materials presented, demonstrated and discussed.

262. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SCIENCE.
Prepares students for teaching science in elementary schools. Methods, materials, and latest curriculum work.

263. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY MATHEMATICS.
Introduction to structure of mathematics, role of mathematics education in school, and methods, materials and curriculum aspects of mathematics education in school.

264. PRINCIPLES OF ELEMENTARY EDUCATION.
Aim, organization, program and pupil population of elementary school and relationship between elementary and secondary school are studied.

265. EDUCATING THE DISADVANTAGED CHILD.
Examines issues and problems in education of disadvantaged children. Emphasis on urban elementary education, but rural education problems also addressed.

267. URBAN COMMUNITY RELATIONS.
Interrelationship of inner-city communities and established power within the school system. Community control, decision-making process and development of alternatives in different power relationships. Field experience included.

268. CURRICULUM DEVELOPMENT IN URBAN EDUCATION.
Examination of current curriculum, its effects on children, and its weaknesses. Alternative techniques to relate curriculum to children practiced and developed in class. Field experience included.

272. TEACHING READING TO SPECIAL POPULATIONS.
Approaches to teaching reading to such special populations as disadvantaged, gifted, emotionally disturbed, etc. Opportunity to study one group intensively.

274. READING CLINIC.
Work in School of Education Reading Clinic and special schools in area. Students assume supervised assignments, in consultation with instructor, in roles for which they are preparing, such as clinician, director or instructor.

275. DIAGNOSIS OF READING DISABILITIES.
Identification, diagnosis and case studies of reading disabilities. Each student participates in individual diagnosis, writes a case study and holds parent, school and other interviews. Evaluation techniques and current theories of diagnostic procedures discussed.

276. DEVELOPMENTAL READING AT THE HIGH SCHOOL, COLLEGE, AND ADULT LEVELS.
Evaluation of trends, techniques, programs and materials in teaching developmental reading and study skills. Includes work in college reading-study program, working with individuals and groups.

277. PRINCIPLES OF SCHOOL GUIDANCE.
Need for guidance in schools, nature of guidance, and overview of an adequate guidance service for a school system.

284. ORGANIZATION AND ADMINISTRATION OF A DISTRIBUTIVE EDUCATION PROGRAM.
Organization and administration of Distributive Education program at secondary level. Examination of activities necessary to initiate, maintain and improve a Distributive Education program. *Credit, 2.*

286. ORGANIZATION AND ADMINISTRATION OF A COOPERATIVE EDUCATION PROGRAM.
Organization and administration of Cooperative Education program at secondary level. Examination of activities necessary to initiate, maintain and improve Cooperative Education program. *Credit, 2-3.*

287. VOCATIONAL ADULT EDUCATION.
Organization and administration of vocational adult classes and interrelationships between secondary and adult education programs. *Credit, 2.*

288. DIRECTED OCCUPATIONAL EXPERIENCES (EXTERNSHIP PROGRAM).
Eight weeks of directed occupational experiences in each of three major fields of distribution (retial, wholesale, service). Planned individually by student, cooperating business, and vocational-technical education staff prior to enrolling. *Credit, 2-4.*

289. METHODOLOGY AND MATERIALS FOR DISTRIBUTIVE EDUCATION.
Provides prospective distibutive education personnel with information on securing, evaluating, organizing and presenting instructional materials and experiences. *Credit, 2.*

290. OBSERVATIONAL TECHNIQUES IN EARLY CHILDHOOD EDUCATION.
Observation of early childhood educational programs serving disadvantaged as well as middle-class children. Laboratory approach. *Credit, 1.*

291. EARLY CHILDHOOD EDUCATION MOVEMENT.
Contemporary purposes, programs, and problems of early childhood education from historical and philosophical perspectives.

292. SEMINAR IN CURRICULUM DEVELOPMENT FOR EARLY CHILDHOOD EDUCATION.
Curriculum components for children in early childhood education programs. Follows each field-teaching experience. Prerequisite, specialization in Early Childhood Education.

293. LABORATORY COURSE ON USING HUMAN DEVELOPMENT KNOWLEDGE IN EDUCATION.
Year-long laboratory course paralleling both field-teaching experiences for students concentrating on Early Childhood Education. Factors such as sex, environment, social status and culture examined for relationships to growth rates and patterns. Data taken from each teaching experience.

298. THE INDIVIDUAL AND THE ORGANIZATION OF HIGHER EDUCATION.
Analysis of effects of institutional and organizational structure and values on individual development.

299. ALTERNATIVE STRUCTURES IN HIGHER EDUCATION.
Review and analysis of organizational structures of institutions of higher education, and consideration and design of alternative models for governance and learning. *Credit, 4.*

309. PRINCIPLES AND METHODS OF TEACHING SECONDARY ENGLISH.
Analysis of purposes, problems, issues, methods and materials in teaching English at the secondary level. Case studies and projects included.

310. PRINCIPLES AND METHODS OF TEACHING SECONDARY SOCIAL STUDIES.
Pre-service offering examining possible goals and strategies for secondary social studies instruction aimed at helping prospective teachers develop defensible rationale for their teaching.

311. PRINCIPLES AND METHODS OF TEACHING SECONDARY MATHEMATICS.
Consideration of nature and content of mathematics, learning strategies, and values of self and society. Pre-service mathematics teacher formulates own philosophy and rationale for education in mathematics.

312. PRINCIPLES AND METHODS OF TEACHING SECONDARY SCIENCE.
Consideration of nature and content of science, learning strategies, and values of self and society. Pre-service science teacher formulates own philosophy and rationale for education in science.

330. ECONOMICS OF EDUCATION.
Introduction to work by economists treating education as an investment in human capital. Review of literature and discussion of issues raised by such a view.

332. INTRODUCTION TO MEASUREMENT AND EVALUATION.
Presentation of basic principles of measurement. Topics covered are descriptive statistics, reliability, validity, principles of test construction, item analysis and review of standardized tests.

355, 356. INTRODUCTION TO STATISTICS AND COMPUTER ANALYSIS, I & II.
Methods for reducing masses of data to a few descriptive terms and drawing inferences from them. First semester includes elementary descriptive statistics, control of computer terminal (how to use packaged programs), and beginnings of inferential statistics. Second semester includes inferential statistics, some programming concepts with computer language (FORTRAN). *Credit, 3 per phase.*

358, 359. INTRODUCTION TO SCHOOL ADMINISTRATION, I & II.
Introduces students to many disciplines on which an administrator calls. Each discipline offered by a faculty member from one of the Five Colleges. *Credit, 3 per phase.*

360. EDUCATIONAL BROADCASTING.
History of educational broadcasting surveying current status, development and availability of radio and television for educational purposes. Application and evaluation of radio and television in accordance with instructional and institutional objectives.

361. SCIENCE EDUCATION IN THE ELEMENTARY SCHOOL.
Lab course including content and pedagogy designed to update persons interested in elementary education in modern trends in elementary science education.

362. WORKSHOP IN EDUCATIONAL TELEVISION.
Designed to familiarize teachers and interns with hardware of television. Using television experimentally to solve educational problems.

369. PRACTICUM IN INTERNATIONAL EDUCATION.
Supervised practical experience in various areas of field of International Education. *Credit, 1-6.*

372. PRINCIPLES AND PRACTICES IN VOCATIONAL EDUCATION.
Principles and practices of vocational education emphasizing secondary and post-secondary programs and relationship of vocational education to total educational program. *Credit, 2-3.*

378. PRACTICUM IN HUMANISTIC CURRICULUM DEVELOPMENT.
Students become familiar with models for development of humanistic curricula, employ models in writing their own curricula, and evaluate efforts in light of existing curricula in field. Prerequisites, Education 222 and permission of instructor.

RELATED COURSES:
The following courses are highly recommended by the School of Education for students interested in becoming teachers. All of these courses satisfy both the University core and the School of Education Arts and Sciences requirements.

Entomology 126. General Entomology.
Botany 200, Zoology 200. Natural History.
Math 110. Elementary Techniques of Mathematics.
Math 151. Basic Concepts of Algebra.
Psychology 301. Educational Psychology.
Psychology 262. Child Psychology.
Psychology 263. Psychology of Adolescence.
Physics 130. Physics for Elementary Education Majors.
Lingnistics 201. General Linguistics.

SCHOOL OF ENGINEERING

Kenneth G. Picha, *Deon*
Lester C. Van Atta, *Associate Deon*
Joseph S. Marcus, *Associate Deon*
Roscoe F. Ward, *Associate Deon*

The School of Engineering has the following recommended program of common courses for the Freshman year.

1st Semester	Credits
Rhetoric 100	3
Mathematics 135	3
Chemistry 111	3
Engineering 103 or 104	3
Social Science Elective	3
Physical Education	1
	16

2nd Semester	
Humanities Elective	3
Mathematics 136	3
Chemistry 112	3
Engineering 103 or 104	2 or 3
Physics 161	4
Physical Education	1
	16 or 17

ENGINEERING

100. INTRODUCTION TO ENGINEERING AND TECHNOLOGY (E).
Engineering and technology as the management and processing of energy, material, and information. Major engineering concepts such as the system, feedback and optimization. The methods of engineering including analysis, design synthesis, and decision making. Case studies and student projects. Not open to engineering majors.

103. INTRODUCTION TO ENGINEERING A.
The nature of enineering practice, through lectures and problem work. Some generally useful concepts to be developed in more detail in later courses. Three 2-hour lecture, problem or laboratory periods per week. *Credit*, 2-3.

104. INTRODUCTION TO ENGINEERING B.
Continuation of Engineering 103. Three 2-hour lecture, problem or laboratory periods per week. *Credit*, 2-3.

251. NUMERICAL METHODS IN ENGINEERING.
A computer-oriented course introducing application and theory of numerical interpolation, solutions of transcendental equations, quadrature, solution of simultaneous linear equations, solutions of ordinary differential equations, and solving some simple boundary value problems. Prerequisites, Math. 165 or equivalent and an elementary FORTRAN or APL course.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Chemical Engineering

Head of Department: Professor John W. Eldridge. Professors Cashin, Douglas, Laurence, Lenz, Lindsey, Middleman, Roblee, Short, Vanpee; Associate Professors Kirk, Kittrell, McAvoy; Assistant Professor Novak; Adjunct Associate Professor Chappelear.

SOPHOMORE YEAR

1st Semester	Credits
Ch.E. 125, Fundamentals	3
Chem. 160, Organic	3
Physics 162, General Physics II	4
Math. 165, Analytic Geometry and Calculus III	3
Elective	3
Ch.E. 101, Chemical Engineering Practice I	1
	17

2nd Semester	
Ch.E. 126, Chemical Engineering Thermodynamics	3
Ch.E. 258, Organic Chemical Technology	3
Physics 163, General Physics III	4
Math. 187, Differential Equations for Engineers	3
Elective	3
Ch.E. 102, Chemical Engineering Practice II	1
	17

JUNIOR YEAR

1st Semester	Credits
Ch.E. 255, Chemical Engineering Fluid Mechanics	3
Ch.E. 374, Simulation	3
Chem. 285, Physical Chemistry	3
Electives	6
Ch.E. 201, Chemical Enineering Practice III	1
	16

2nd Semester	
Ch.E. 256, Chemical Engineering Heat Transfer	3
Ch.E. 257, Mass Transfer	3
Chem. 286, Physical Chemistry	3
Chem. 288, Physical Chemistry Laboratory	2
Engl. 331, Technical Writing	2
Elective	3
Ch.E. 202, Chemical Engineering Practice IV	1
	17

SENIOR YEAR

1st Semester	Credits
Ch.E. 358, Staged Operations	4
Ch.E. 380, Kinetics and Reactor Design	4
Ch.E. 383, Process Evaluation	3
Elective	3
Ch.E. 301, Chemical Engineering Practice V	1
	15

2nd Semester	
Ch.E. 376, Process Control and Dynamics	3
Ch.E. 384, Process and Plant Design	3
Ch.E. 392, Seminar	2
Chem. 219, Electronics Instrumentation	3
Electives	4-6
Ch.E. 302, Chemical Engineering Practice VI	1
	16-18

Note: The electives must include, to satisfy University core requirements, at least three 3-credit humanities courses plus at least three 3-credit courses in the social sciences. Note that any ROTC study must be in addition to the normal load.

101, 102, 201, 202, 301, 302. CHEMICAL ENGINEERING PRACTICE I-VI.
By means of laboratory investigations, classroom demonstrations, films, plant trips and invited speakers, theoretical lecture material is related to industrial practice. Each practice course is closely coordinated with lecture material the student is taking concurrently and emphasizes the application of basic concepts in the solution of industrial problems. Corequisite, the concurrent Ch.E. courses for that semester of the curriculum, or permission of the instructor. 3-hour laboratory period or 1-hour demonstration or lecture. *Credit, 1 each semester of the Sophomore, Junior and Senior years.*

125 (I). FUNDAMENTALS.
Nature and scope of chemical engineering through study of selected chemical processes and of material and energy balances. Prerequisite, Chem. 112 or 114.

126 (II). CHEMICAL ENGINEERING THERMODYNAMICS.
The fundamental principles of thermodynamics. An in-depth discussion of the First and Second laws; study of properties of single-component systems, thermodynamic cycles, phase and chemical equilibria. Solution methods for complex energy and material balance problems are introduced. Prerequisites, Chem. 160, Math. 165, Ch.E. 125.

255 (I). CHEMICAL ENGINEERING FLUID MECHANICS.
An introduction to momentum transport in fluids including the development of the Navier-Stokes equations and boundary layer analysis. Emphasis on the application of the theory to laminar and turbulent flow in chemical process equip-

ment such as: flow meters, pipes, pumps, packed beds, filtration equipment, sedimentation, and classification units, etc. Prerequisites, Ch.E. 126, Math. 187.

256 (II). CHEMICAL ENGINEERING HEAT TRANSFER.
Theory of heat transfer by conduction, convection, and radiation with applications to the Unit Operations of Chemical Engineering. Prerequisite, Ch.E. 255.

257 (II). MASS TRANSFER.
Theory and application of diffusional phenomena. Microscopic and macroscopic problems of mass transfer, diffusion in a boundary layer, diffusion and chemical reaction, interphase transfer. The continuous contactor provides the framework in which are analyzed absorption, extraction, chromatographic separators and simultaneous heat and mass transfer. Prerequisite, Ch.E. 255.

258 (II). ORGANIC CHEMICAL TECHNOLOGY.
Applications of the principles of structure and reaction mechanisms of organic chemistry in the preparation and use of industrially-important organic chemicals and polymers. Prerequisite, Chem. 160 or permission of instructor.

358 (I). STAGED OPERATIONS.
An introduction to the design of equilibrium stage processes. Topics include the thermodynamics of phase equilibria, binary and multicomponent distillation, absorption, extraction, leaching and azeotropic phenomena. Prerequisites, Ch.E. 126, Ch.E. 256 and 257. 3 class hours, 1 2-hour computation period. Credit, 4.

360. AIR POLLUTION CONTROL PROCESSES.
An introduction to the techniques of air pollution control particulate removal, wet and dry scrubbing processes, removal of selected species from gases (e.g., sulfur dioxide). Prerequisites, freshman chemistry, permission of instructor. 3 class hours.

361 (I). CHEMICAL ENGINEERING ANALYSIS I.
Mathematical techniques applied to chemical engineering problems. Emphasis on ordinary differential equations corresponding to specific problems and on their solution. Prerequisites, Ch.E. 256 and 257.

362 (II). CHEMICAL ENGINEERING ANALYSIS II.
Mathematical analysis of chemical engineering problems continued. Topics include: matrix methods, vector analysis, calculus of finite differences, numerical solution of ordinary and partial differential equations, complex variables and Laplace transformations. Emphasis on applying these techniques to real chemical engineering processes and on the physical and mathematical interpretation of the results. Prerequisite, Ch.E. 361.

363 (I). SURVEY OF NUCLEAR ENGINEERING I.
Principles of reactor physics and problems involved in design and operation of nuclear reactors; heat transfer, shielding, instrumentation and waste disposal. Prerequisites, Chem. 112 or 114; Physics 142 or 162; Math. 165, or equivalent, and permission of instructor. 2 class hours, 1 3-hour laboratory period.

364 (II). SURVEY OF NUCLEAR ENGINEERING II.
Continuation of Course 363; emphasis on reactor physics. Prerequisite, Ch.E. 363. 2 class hours, 1 3-hour laboratory period.

370. APPLIED POLYMER SCIENCE.
A survey of the methods of preparing important synthetic polymers, and their properties and applications. Prerequisite, undergraduate organic and physical chemistry.

374 (I). SIMULATION.
Simulation of physical processes using both analog and digital techniques. Topics include: programming of analog computers (linear and non-linear components, scaling, iterative operation), solutions of linear and non-linear differential equations, simulation languages, useful numerical techniques (Runge-Kutta, relaxation). Prerequisite, Math. 187. 2 class hours, 1 3-hour laboratory period.

376 (II). PROCESS CONTROL AND DYNAMICS.
Theoretical and practical factors governing automatic control of industrial processes; control systems, review of measurement devices, control modes, mathematical relationships and analysis of control systems. Prerequisites, Ch.E. 374, Math. 187. 2 class hours, 1 3-hour laboratory period.

380 (I). KINETICS AND REACTOR DESIGN.
Principles underlying rates of transformations of matter and energy. Review of pertinent differential equations; effect of temperature and catalysis on chemical reaction rates; application to design of chemical reactors. Prerequisites, Ch.E. 126, Chem. 286. 3 class hours, 1 2-hour computation period. Credit, 4.

383 (I). PROCESS EVALUATION.
Solution of problems which require the use and integration of principles studied in previous courses. Final results will be determined by application of economic considerations. Prerequisites, Ch.E. 256, 257; Chem. 286. 2 class hours, 1 3-hour computation period.

384 (II). PROCESS AND PLANT DESIGN.
Optimum design of selected chemical plants; production rates, site location, process flow diagrams, equipment design and sizing, total costs, etc. Prerequisite, Ch.E. 383. 2 class hours, 1 3-hour computation period.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

388 (I). OPTIMIZATION.
Fundamental ideas and application of optimization techniques in operation and design. Topics include: extrema of functions, effect of constraints. LaGrange multipliers, introduction to linear programming, geometric programming and dynamic programming. Prerequisite, Math. 187.

389 (II). OPTIMIZATION USING VARIATIONAL TECHNIQUES.
The application of the calculus of variations. Pontryogine maximum principle, and dynamic programming to the design and control of chemical process equipment. Systems described by both ordinary and partial differential equations. Topics include: optimal reactor design, the synthesis of optimal control systems and optimal periodic operation of processing units. Prerequisite, Math. 187.

392 (II). SEMINAR.
Preparation and discussion of professional topics. Prerequisite, Ch.E. 256, 257. 2 class hours. Credit, 2.

Civil Engineering

Head of Department: Professor Merit P. White. Professors Adrian, Archer, Berger, Boyer, Carver, Feng, Halitsky, Hendrickson, Heronemus, Higgins, Marcus, Nash, Osgood, Shuldiner, Weidmann; Associate Professors Adams, Bemben, Chajes, Colonell, Dzialo, Grow, Miller, Stockton, Ward; Assistant Professors DiGiano, Foess, Harris, Kuzminski, Mangarella, Stokoe, Webster.

SOPHOMORE YEAR

1st Semester	Credits
Rhetoric	3
Math., Multivariable Calculus	3
Phys. 162, General Physics	4
CE 101, Surveying	3
CE 140, Statics	3
	16

2nd Semester	
Humanities Elective	3
Department Requirement	3
CE 180, Measurement and Analysis	3
CE 141, Strength of Materials	3
CE 257, Elementary Fluid Mechanics	3
Social Science Elective	3
	18

JUNIOR YEAR

1st Semester	Credits
Math. Elective[2]	3
CE 102, Transportation Location	3
CE 230, Theory of Structures	3
CE 280, Engineering Materials	3
CE 260, Engineering Hydraulics	3
CE 258, Fluid Mechanics Laboratory	1
	16

2nd Semester

CE 220, Soil Mechanics	3
CE 210, Transportation Systems	3
CE 270, Basic Environmental Engineering	4
CE 331, Design of Metal Structures	3
CE 142, Dynamics	3
	16

SENIOR YEAR

1st Semester	Credits
CE 333, Reinforced Concrete Structures	3
Science Elective[3]	3
Humanities Elective	3
Professional[4] or Technical Electives[5]	6
Engl. 331, Technical Writing	2
	17

2nd Semester	
CE 396, Professional Problem	3
Social Science Elective	3
Professional[4] or Technical Electives[5]	9
	15

[2] Required: Math. 187, Math. 331, Math. 233, or COINS 251.
[3] Required: Geology, Zoology, Biology, Microbiology.
[4] Require department approval and must form a logical part of student's educational program.
[5] Require department approval. Courses from Engineering, Mathematics, Physics, Chemistry, Geology, Botany, Microbiology, or Zoology Departments.
Note that any advanced ROTC study must be in addition to the normal load.

100 (II). PLANE SURVEYING.
Taping, transit, level, stadia, topographic surveying and mapping, care and adjustment of instruments. (Not accepted for credit for Civil Engineering majors.) Prerequisite, trigonometry. 2 class hours, 1 3-hour laboratory period.

101 (I). SURVEYING.
Theory of surveying. Use, care and maintenance of tape, transit, and level; traverse computation; topographic surveying and mapping; property surveying. Prerequisite, trigonometry. 2 class hours, 1 3-hour laboratory period.

102 (I). TRANSPORTATION LOCATION.
Route location; horizontal and vertical alignment; construction computations. Prerequisite, CE 101. 2 class hours, 1 3-hour laboratory period.

140 (I), (II). STATICS.
Force systems, friction, first and second moments. Corequisite, integral calculus concurrently.

141 (I), (II). STRENGTH OF MATERIALS I.
Simple and combined stresses and strains in tension, compression, and shear; torsion; stresses and deflections in beams. Prerequisite, statics.

142 (I), (II). DYNAMICS.
Motions of particles and rigid bodies and the force systems associated with these motions. Prerequisite, statics.

180 (II). MEASUREMENTS AND ANALYSIS.
Introduction to engineering measurements and analysis, relating scientific principles to engineering applications. Prerequisites, physics and chemistry; CE 141 and 257 concurrently. 1 class hour, 2 2-hour laboratory periods.

210 (II). TRANSPORTATION SYSTEMS.
Planning, design and operation of highway and railroad systems. Computer methods used in conjunction with laboratory design and planning problems. Prerequisite, CE 102. 2 class hours, 1 3-hour laboratory period.

220 (I), (II). SOIL MECHANICS.
Engineering uses and mechanical properties of soils. 2 class hours, 1 3-hour laboratory period.

222 (I). SOIL TESTING.
Sampling and testing of soils for engineering purposes. Prerequisite, CE 220. 1 class hour, 2 3-hour laboratory periods.

230 (I), (II). THEORY OF STRUCTURES I.
Analysis of statically indeterminate structures. Prerequisite, CE 141.

232 (I). THEORY OF STRUCTURES II.
Analysis of statically indeterminate structures. Prerequisite, CE 230.

234 (II). THEORY OF STRUCTURES III.
Analysis of complex or special structures. Prerequisites, CE 232, 331, 333 concurrently.

235 (II). MATRIX ANALYSIS OF STRUCTURES.
Development and use of the flexibility and stiffness methods of matrix analysis for determinate and indeterminate structures. (Formerly CE 735.) Prerequisite, CE 232.

240 (I). STRENGTH OF MATERIALS II.
Calculation of stresses and strains in components of machines and structures. Prerequisite, CE 141.

256 (I). INTRODUCTION TO HYDRODYNAMICS.
Mathematical treatment of basic theorems of classical hydrodynamics including potential flow, conformal mapping, and wave and vortex motions. Prerequisite, Math. 186.

257 (II). ELEMENTARY FLUID MECHANICS.
Fundamentals of fluid mechanics including fluid properties, fluid behavior under static and dynamic conditions, and development of basic fluid flow equations. Prerequisite, statics.

258 (I). FLUID MECHANICS LABORATORY.
Laboratory investigations of fluid mechanics principles, pipe and open channel flow, hydraulic machinery, and fluid measurements. Prerequisite, CE 257. Corequisite, CE 260. 1 2-hour laboratory.
Credit, 1.

259 (II). ENGINEERING OCEANOGRAPHY.
Fluid mechanics problems of ocean and coastal engineering including currents, tides, surface waves, tsunami and seiche phenomena, and ocean circulation. Prerequisite, CE 257.

260 (I). ENGINEERING HYDRAULICS.
Civil Engineering applications of fluid mechanics including analysis of water distribution and drainage systems, basic hydrology, fluid drag on structures, and hydraulic machinery. Prerequisite, CE 257.

261 (I). OPEN CHANNEL FLOW.
Steady flow in open channels including channel transitions and controls, sediment transport, and elementary design of related hydraulic structures. Prerequisite, CE 257.

270 (I), (II). BASIC ENVIRONMENTAL ENGINEERING.
Quantity, quality and treatment of water and wastewater. Air pollution and solid waste problems. Prerequisites, Chem. 112; CE 257 concurrently. 3 class hours, 1 3-hour laboratory period. *Credit, 4.*

271 (I). INTRODUCTION TO ENVIRONMENTAL POLLUTION CONTROL.
Basic engineering aspects of environmental pollution control. (For students not majoring in Civil Engineering.)

275. ATMOSPHERIC DISPERSION OF POLLUTANTS.
Physical and dynamical properties of the atmosphere and their effect on dispersion of airborne material. Methods of calculation of concentration fields in simple and complex flowfields. Practical approaches to the analysis of diffusion from point, jet and urban area sources. Review of research techniques for measuring diffusion parameters. Prerequisite, integral calculus.
Credit, 1-3.

280 (I), (II). ENGINEERING MATERIALS.
Emphasis on physical behavior and the correlation between experiment and theory. Prerequisite, CE 141. 2 class hours, 1 3-hour laboratory period.

281. MATERIALS IN THE OCEAN ENVIRONMENT.
Treatment of the response of structural materials to the ocean environment; theory of corrosion, abrasion, erosion, and biological attack. Prerequisite, permission of instructor.

285 (II). CONSTRUCTION PROBLEMS.
Legal aspects of construction contracts; estimating and bidding; critical path scheduling.

286 (II). ENGINEERING GRAPHICS.
Theory and practice of engineering graphics. 2 3-hour lecture-laboratory sessions per week.

290. OCEAN ENGINEERING PAYLOAD DEVICES.
Techniques for augmentation of man's abilities in the sea. Underwater illumination, photography, manipulative and prosthetic devices, tools and instruments for underwater work. Prerequisite, permission of instructor.

291. OCEAN SYSTEMS ENGINEERING AND DESIGN.
Systems engineering applied to synthesis of systems capable of doing useful work in the deep oceans. Emphasis on design of submergence vessels. Prerequisite, permission of instructor. 3 class hours, 1 3-hour laboratory period. *Credit*, 4.

305 (I). ADVANCED SURVEYING.
Elements of astronomical, geodetic and photogrammetric surveying; coordinate systems and map projections. Prerequisite, CE 101. 2 class hours, 1 3-hour laboratory period.

311 (II). TRAFFIC ENGINEERING.
Engineering solutions to planning, design, and operations problems of urban and rural street and highway networks. Prerequisite, CE 210. 2 class hours, 1 3-hour laboratory period.

321 (I). FOUNDATION ENGINEERING.
Foundations and earth structures; interpretation of borings; analysis and design of piles, footings, piers, abutments and retaining walls. Prerequisite, CE 220.

323 (II). SOIL MECHANICS FOR TRANSPORTATION ENGINEERING.
Application of the principles of soil mechanics to the field of Transportation Engineering. Topics include the evaluation of the stability of soils as subgrade and embankment materials; the role of the subgrade properties of soils. Prerequisite, CE 220.

331 (I), (II). DESIGN OF METAL STRUCTURES.
Selecting and proportioning elements and connections of structural frames of buildings and bridges. Prerequisite, CE 230. 2 class hours, 1 3-hour laboratory period.

333 (I), (II). REINFORCED CONCRETE STRUCTURES.
Analysis and design of reinforced concrete structures. Prerequisite, CE 230.

334 (II). ADVANCED TOPICS IN CONCRETE.
Design of various types of reinforced concrete building frames; elastic theory and ultimate strength procedures. (Formerly CE 773.) Prerequisites, CE 232 and 333.

357 (I). THEORY OF HYDRAULIC SIMILITUDE.
Hydraulic similitude, dimensional analysis, methods of obtaining dynamic similarity in hydraulic models in actual practice, analysis of typical hydraulic models. Prerequisite, CE 257.

360 (I). HYDROLOGY.
The hydrologic cycle including precipitation, runoff, groundwater, flood routing, reservoir sedimentation, water law, and applications of hydrologic techniques to water resources engineering. Prerequisite, CE 257 or permission of instructor.

362 (II). WATER RESOURCES ENGINEERING.
Planning and design of dams, reservoirs, and other related hydraulic structures, including analysis of existing and proposed water resources projects. Prerequisite, CE 257 or permission of instructor.

365. ENVIRONMENTAL INSTITUTIONS AND POLICIES.
Public policies and laws relating to the use and conservation of water resources. Analysis of water-related governmental organization and programs at the Federal, state and local levels. Prerequisite, permission of instructor.

369. ENVIRONMENTAL ENGINEERING TECHNOLOGY.
The technology available to provide clean air, clean water, and to dispose of solid waste. Some field trips to see environmental effects, treatment plants, and quality monitoring stations. 1 4-hour laboratory (or field trip) period, and 1 1-hour lecture. Prerequisite, permission of instructor. *Credit*, 2.

370. ADVANCED ENVIRONMENTAL ENGINEERING PRINCIPLES.
The underlying physical, chemical and biological principles involved in engineering studies of air, water and solid waste pollution problems. Basin concepts combined with model pollution control systems and responses of the atmospheric, aquatic and terrestrial environments. Prerequisite, permission of instructor.

371 (II). INDUSTRIAL WASTE TREATMENT AND CONTROL.
Composition of industrial effluents; pollution criteria and effects of industrial wastes on receiving waters; physical, chemical and biological methods and applications in treatment. Prerequisite, permission of instructor. 2 class hours, 1 3-hour laboratory period.

372 (I). ENVIRONMENTAL ENGINEERING ANALYSIS I.
Application of chemical principles to environmental engineering analysis with specific reference to pollution indices. Prerequisite, Chem. 112. 2 class hours, 1 3-hour laboratory period.

373 (II). ENVIRONMENTAL ENGINEERING ANALYSIS II.
The fundamental microbiological and biochemical properties of the microorganisms important in environmental engineering practice. Prerequisite, CE 372 or permission of instructor. 2 class hours, 1 3-hour laboratory period.

374. RADIOLOGICAL HEALTH ENGINEERING.
Basic principles and procedures pertaining to safe control of all common sources of ionizing radiation. Prerequisite, permission of instructor.

375 (II). SURFACE WATER QUALITY CONTROL.
Evaluation and control of water quality in streams, lakes and reservoirs. Mathematical analysis of patterns of water movement and their relation to water quality.

376 (I). SOLID WASTES.
The production, collection, transportation, treatment, and disposal of solid waste products (including municipal, industrial, and agricultural wastes). 2 class hours, 1 3-hour laboratory period.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit*, 1-4.

396 (II). PROFESSIONAL PROBLEM.
A problem relating to the student's area of interest in Civil Engineering studied under the direction of a member of the faculty. May be a joint project with students from Civil Engineering or other departments. Oral and written reports required. Prerequisite, senior standing.

Electrical and Computer Engineering

Chairman of Department: Professor Jack K. Wolf. Professors Franks, Hutchinson, Lee, McIntosh, Monopoli, Navon, Sheckels, Thomas; Associate Professors Edwards, Fitzgerald, Glorioso, Jackson, Laestadius, Mohn, Scott, Tang, Yngvesson; Assistant Professors Bobrow, Ehrich, Herchenreder, Hill, Kohler.

ELECTRICAL ENGINEERING OPTION
SOPHOMORE YEAR

1st Semester	Credits
Humanities Elective (C)	3
Math. 165, Calculus	3
Phys. 162, General Physics II	4
ECE 141, Systems Analysis I	4
Rhetoric Elective	3
	17

2nd Semester	Credits
Humanities Elective (C)	3
Math. 167, Intro. to Linear Algebra	3
Physics 163, General Physics III	4
ECE 142, Systems Analysis II	4
MAE 135, Intro. to Materials Science	3
	17

JUNIOR YEAR

1st Semester	Credits
Engl. 331, Technical Writing	2
ECE 201, Electronic Materials and Devices	3

ECE 257, Field Analysis I	3
ECE 204, Circuit Theory	4
Math. Elective*	3
	15

*Math. 211, 241, or 331 or other Math. with consent of adviser.

ELECTRICAL ENGINEERING OPTION
JUNIOR YEAR

2nd Semester	Credits
ECE 202, Active Networks I	3
ECE 265, Random Signal Theory	3
ECE 205, Intermediate Laboratory	2
ECE 210, Digital Circuit Theory	3
ECE 258, Field Analysis II	3
ECE 394, Professional Seminar	1
	15

SENIOR YEAR

1st Semester	Credits
ECE 275, Advanced Laboratory	3
Technical Elective	3
Technical Elective	3
Social Science Elective (D)	3
ECE 203, Active Networks II	3
	15

2nd Semester	Credits
ECE 276, Advanced Laboratory	3
Technical Elective	3
Technical Elective	3
Social Science Elective (D)	3
Free Elective	3
	15

All elective courses listed in the above curriculum must be satisfied and must be approved by the adviser. Advanced Military or Air Science may be used for the free elective.

COMPUTER SYSTEMS
ENGINEERING OPTION
SOPHOMORE YEAR

1st Semester	Credits
Rhetoric Elective	3
Humanities Elective (C)	3
Math. 165, Calculus	3
Phys. 162, General Physics II	4
ECE 141, Systems Analysis I	4
	17

2nd Semester	Credits
Engl. 331, Technical Writing	2
Humanities Elective (C)	3
Math. 167, Intro. to Linear Algebra	3
Phys. 163, General Physics III	4
ECE 142, Systems Analysis II	4
	16

JUNIOR YEAR

1st Semester	Credits
Social Science Elective (D)	3
ECE 202, Active Networks I	3
COINS 223, Machine and Assembly Language	3
ECE 210, Digital Circuit Theory	3
Math. Elective**	3
	15

**Math. 211, 241, or 331 or other Math. with consent of adviser.

2nd Semester	Credits
Social Science Elective (D)	3
ECE 265, Random Signal Theory*	3
ECE 344, Programming Structures	3
COINS 235, Comparative Machine Design	3
Technical Elective	3
ECE 346, Laboratory I	1
ECE 394, Professional Seminar	1
	17

SENIOR YEAR

1st Semester	Credits
Non-technical Elective	3
Free Elective	3
ECE 350, Laboratory II	3
ECE 342, Non-numerical Processing	3
Technical Elective	3
	15

2nd Semester	Credits
Non-technical Elective	3
Free Elective	3
ECE 354, Laboratory III	3
COINS 271, Operating Systems	3
Technical Elective	3
	15

*Math. 233, Probability, may be substituted for ECE 265. All elective courses listed in the above curriculum must be satisfied and must be approved by the adviser.

141 (I). SYSTEMS ANALYSIS I.
Physical characteristics and mathematical models of system elements; techniques for writing and solving system dynamic equations. Prerequisite, Engr. 104 and Math. 132 or 136. 3 class hours, 1 3-hour problem/lab period. *Credit, 4.*

142 (II). SYSTEMS ANALYSIS II.
Concepts relating to transfer functions; digital and analog solutions of system equations, time and frequency domain analysis techniques and stability. Prerequisite, ECE 141. 3 class hours, 1 3-hour problem/lab period. *Credit, 4.*

143 (II). INTRODUCTORY LABORATORY.
Laboratory techniques in circuits and systems appropriate to the level of sophomore engineers. Corequisite, ECE 142. 1 3-hour laboratory period. *Credit, 1.*

201 (I). ELECTRONIC MATERIALS AND DEVICES.
Introduction to quantum theory of solids and quantum statistics, conduction processes in semiconductors and metals, theory of p-n junction diodes and transistors, field effect diode. Prerequisite, Physics 163.

202 (II). ACTIVE NETWORKS I.
Active network theory, emission, biasing, devise models and linear equivalent circuits, tuned and untuned amplifiers, power amplifiers, feedback switching mode applications, interfacing and integrated circuits. Prerequisites, ECE 142, 201.

203 (I). ACTIVE NETWORKS II.
Feedback amplifier and oscillators, bandpass amplifiers, mixing and frequency conversion, modulation and demodulation, noise, active filters, electronic instrumentation and systems, power supplies and regulators. Prerequisite, ECE 202.

204 (II). CIRCUIT THEORY.
Concepts used in the analysis of electrical circuits and systems: Fourier transforms, amplitude and phase responses, elementary synthesis, introduction to non-linear and time-varying networks. Prerequisite, ECE 142. 3 class hours, 1 3-hour problem/lab period. *Credit, 4.*

205 (II) INTERMEDIATE LABORATORY.
Laboratory techniques pertaining to electrical circuit theory, active network analysis and digital circuits appropriate to a junior year competence in electrical engineering. Prerequisite, junior standing, 2 3-hour laboratory periods. *Credit, 2.*

210 (II). DIGITAL CIRCUIT THEORY.
An introduction to the theory of digital circuits stressing general techniques for the analysis and synthesis of combinational and sequential logic systems. Prerequisite, junior standing.

241 (I). ENERGY CONVERSION I.
Electromechanical energy conversion. Dynamical systems analysis of incremental motion transducers and rotary energy converters. Prerequisites, ECE 142, 257.

243 (II). ENERGY CONVERSION II.
Direct energy conversion. Batteries, fuel cells, thermo-electric, photo-voltaic, thermionic and MHD generators. Prerequisite, ECE 201.

257 (I). FIELD ANALYSIS I.
Vector calculus. Conservative and non-conservative fields. Static and time-varying electromagnetic fields. Maxwell's equations, relations between field and circuit theory. Prerequisites, Physics 163, Math. 167.

258 (II). FIELD ANALYSIS II.
Continuation of ECE 257 with emphasis on time-varying electromagnetic fields and wave phenomena. Prerequisite, ECE 257.

265 (I). RANDOM SIGNAL THEORY.
Introduction to probability and stochastic processes. Correlation theory and its application to electrical engineering problems in communication and control systems. Prerequisite, ECE 142.

266 (I). SIGNAL PROCESSING AND COMMUNICATION SYSTEMS I.
Principles of design of modern communication systems. Mathematical description of digital and analog signals. Basic limitations of modulation techniques and information capacity of transmission systems. Prerequisite, ECE 142.

267 (II). SIGNAL PROCESSING AND COMMUNICATION SYSTEMS II.
Techniques for evaluating performance of modulation and information transmission systems. Extraction of signals from noise. Minimum error signals estimation and detection. Prerequisites, ECE 265, 266, or permission of instructor.

270 (I). SOLID STATE DEVICES.
Review of transistor physics, recombination statistics, avalanche and tunneling phenomena, varactor diodes, Schottky diodes, thyristors, tunnel diodes, junction and MOS field-effect devices, p-n junction lasers. Prerequisite, ECE 201.

271 (II). MICROELECTRONICS.
Principles and applications of microelectronics with particular emphasis on silicon monolithic integrated circuits. Fundamental limitations of micro-miniaturization, design constraints imposed by the monolithic technique, planar technology, digital and linear microcircuits. Prerequisite, ECE 201.

275 (I). ADVANCED LABORATORY I.
Projects designed to provide the student with laboratory experience related to his technical electives. Prerequisite, senior standing.

276 (II). ADVANCED LABORATORY II.
Laboratory techniques developed in ECE 275, used in a concentrated study in the student's area of interest. Prerequisite, ECE 275.

278 (I). DIGITAL SYSTEMS DESIGN.
The design of a digital system by the interface of subunits described in terms of register sets. The subunits are interfaced at the architectural level by a set of instructions and at the logic level by the Boolean equations derived from the corresponding register transfers. Prerequisite, ECE 210.

286 (II). POWER SYSTEM ANALYSIS.
Power transfer diagrams, voltage studies, system stability criteria, shortcircuit calculations, and protective methods. Prerequisite, ECE 241.

287 (II). MARINE INSTRUMENTATION.
A survey of the oceanographic parameters of interest to ocean engineers; the theory of measurement for those parameters. Typical examples of existing measuring equipment.

288 (II). PULSE ELECTRONICS.
Analysis and design of circuits for the generation, transmission and processing of information by means of pulses. Prerequisite, ECE 202.

292 (I). FEEDBACK CONTROL SYSTEMS I.
Time domain and frequency domain analysis and synthesis techniques for linear continuous control systems. The relationships between these techniques. Prerequisites, ECE 142 or permission of instructor.

293 (II). FEEDBACK CONTROL SYSTEMS II.
Analysis of nonlinear continuous control systems; introduction to digital control systems and optimization techniques. Prerequisite, ECE 292.

294 (I). MICROWAVE ENGINEERING I.
Electromagnetic theory applied to microwave propagation in waveguides and coaxial lines. Microwave circuit theory with applications to passive microwave networks. Prerequisite, ECE 258.

295 (II). MICROWAVE ENGINEERING II.
Continuation of ECE 294. Modern microwave components including filters, ferrite devices, multiport junctions, amplifiers and oscillators. Generation, radiation and detection of microwaves. Prerequisite, ECE 294.

298 (I). BIOMEDICAL ENGINEERING I.
Techniques and concepts from control and communication theory useful in biological, medical and psycho-physical research. Prerequisite, permission of instructor.

299 (II). BIOMEDICAL ENGINEERING II.
Engineering analysis of the visual, position-motion sensing, taste and smell biological communication channels; human tracking capabilities; analog and hybrid modeling. Prerequisite, ECE 298.

306 (I). ACOUSTICS.
The fundamentals of sound generation, propagation and detection. Applications of theory to underwater sound and human speech. Prerequisite, junior standing or permission of instructori

311 (II). APPLIED NONLINEAR ANALYSIS.
The analysis of nonlinear mechanical and electrical systems. Numerical, graphical and analytical methods used to determine the behavior of modern nonlinear devices. Prerequisite, Math. 167.

342. NON-NUMERICAL PROCESSING.
Introduction to basic mathematical and logical concepts relevant to description and manipulation of information structures such as lists, trees, and graphs in LISP. Prerequisite, COINS 223.

344. PROGRAMMING STRUCTURES.
Introduction to basic structures of algorithms and programming languages. Convergence of algorithms. Introduction to logic and programming languages for description and implementation of algorithms. Prerequisite, COINS 223.

346. COMPUTER SYSTEMS LABORATORY I.
Introduction to digital logic as building blocks for computer systems. Basic types of logic and their characteristics. Corequisite, ECE 210. Credit, 1.

350. COMPUTER SYSTEMS LABORATORY II.
Subunits of digital computer systems and their control. Registers, accumulators, arithmetic units, and memories and their interconnection. Prerequisite, ECE 346.

354. COMPUTER SYSTEMS LABORATORY III.
Project laboratory in advanced computer systems engineering including designs of integrated hardware/software systems and studies of current computer techniques. Prerequisite, ECE 350.

356. INTRODUCTION TO AUTOMATA THEORY.
Formal processes of computation. Computability, automata, algorithms, recursive functions. Formal systems, computing power of machines, and automata as examples of formal systems.

360. COMPUTER GRAPHICS.
Introduction to basic organization of computer-driven graphical display systems. Methods for generation and manipulation of vectors and characters for real-time display. Data structures for picture and text processing. Prerequisites, COINS 223, ECE 342.

362. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION.
Introduction to several aspects of self-organizing systems and pattern recognition including machine intelligence, adaptation, learning, and self repair.

366. ANALOG AND HYBRID COMPUTERS.
For computer science or engineering students interested in the hybrid computer as a computational tool. Reviews analog and digital computers and their combination. Prerequisites, Math. 167 and Engr. 104, or COINS 131. 2 class hours, 3 laboratory hours.

368. ADVANCED SWITCHING THEORY.
Contemporary topics in digital switching theory and logical design. State-of-the-art techniques in computer hardware design. Prerequisite, ECE 210.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

394 (I). PROFESSIONAL SEMINAR.
Current engineering developments discussed through students' reports. Instruction in the preparation of papers for publication and their presentation before technical audiences. Prerequisite, senior standing. 1 class hour. Credit, 1.

Industrial Engineering and Operations Research

Head of Department: Professor Richard W. Trueswell. Professors Balintfy, Miser, Rising; Associate Professors Davis, Duffy, Giglio, Kaminsky, Kroner, Lippert, Rikkers; Assistant Professor Sadowski.

SOPHOMORE YEAR

1st Semester	Credits
Humanities Elective	3
Physics 162, General Physics II	4
Math 165, Multivariable Calculus	3
IE/OR 151, Problems and Model Formulation	3

Economics 103, Introduction to Microeconomics	3
	16

2nd Semester	Credits
Humanities Elective	3
Engl. 331 Technical Writing	2
Basic Science Elective	3 or 4
Math 167, Intr. to Linear Algebra	3
IE/OR 353, Industrial Engineering Economics I	3
	14 or 15

JUNIOR YEAR

1st Semester	Credits
IE/OR 379, Operations Research I	3
IE/OR 271, Basic Probability for Engineers	3
IE/OR 354, Industrial Engineering Economics II	3
Economics Elective	3
Elective*	3
	15

2nd Semester	Credits
IE/OR 380, Operations Research II	3
IE/OR 272, Principles of Engineering Statistics	3
IE/OR 273, Simulation	3
IE/OR 260, Design of Man-Machine Systems I	3
Elective*	3
	15

SENIOR YEAR

1st Semester	Credits
IE/OR 378, Production Control	3
IE/OR 261, Design of Man-Machine Systems II	3
Electives*	9
	15

2nd Semester	Credits
Humanities Elective	3
Electives*	12
	15

*These 27 credit hours of electives must satisfy the following: 12 from any courses offered for credit in the University, nine in recognized engineering science courses (must include a sequence of at least two courses) and six in industrial engineering and/or engineering science.

151. PROBLEMS AND MODEL FORMULATION.
Introduction to Industrial Engineering (I.E.) and Operations Research (O.R.). Describes practical problems that arise in these fields, and shows how theoretical models have been developed to help with their solutions. Survey of the main currents of I.E. and O.R. that will be developed further in later courses. Insights into the varied pursuits of professionals in these fields.

253. METHODS AND STANDARDS ENGINEERING.
The principles involved in the simplification of the work pattern and the design of the work place, and in the establishment of production standards. 3 class hours, 1 3-hour laboratory period. Prerequisite, I.E. 271, previously or concurrently. *Credit, 4.*

256. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.
Principles and applications of data processing and electronic computer systems for use by Industrial Engineers as a management tool for control and decision making. Prerequisite, permission of instructor.

260. DESIGN OF MAN-MACHINE SYSTEMS I.
Introduction to principles of human factors engineering. Anthropometric, physiological and psychological data sources. Data gathering and analysis techniques useful to designers and industrial engineers. Occupational health and safety standards. Includes lectures, demonstrations and experiments. Project option.

261. DESIGN OF MAN-MACHINE SYSTEMS II.
Human factors data applications to design of equipment and industrial urban and vehicle environment. Decision processes, communication. Problems of layout in industry, hospitals, etc. Involves more complex problem application than I.E. 260. Includes lectures, demonstrations and experiments. Project option. Prerequisite, I.E. 260 or permission of instructor.

271. BASIC PROBABILITY FOR ENGINEERS.
Probability theory including: sample spaces; discrete and continuous random variables; functions of random variables; marginal and joint probability, density and cumulative distribution functions; and moments. Prerequisite, Math. 165.

272. PRINCIPLES OF ENGINEERING STATISTICS.
Statistical principles as applied to engineering problems including: estimation, hypothesis testing, analysis of variance, design of experiments, sampling plans, statistical quality control. Prerequisite, I.E. 271.

273. INTRODUCTION TO SIMULATION METHODS.
The principles and methods of computer simulation for the analysis and design of complex systems. Problems associated with developing valid and meaningful conclusions from simulation experimentation; emphasis on experimental design, model validation and verification, and analysis of results. Prerequisites, I.E. 271 and basic knowledge of FORTRAN. (Also listed as G.B. 273.)

286. INDUSTRIAL ENGINEERING PRINCIPLES.
Organization, plant location, plant layout, industrial costs, production control, production standards, incentives. For students other than industrial engineering majors. Prerequisite, junior standing.

288. MOTION AND TIME STUDY.
For junior and senior students outside the industrial engineering field. 2 class hours, 1 3-hour laboratory period. Prerequisite, junior standing.

341. HOSPITAL INDUSTRIAL ENGINEERING I.
Introductory course in the application of Industrial Engineering techniques to hospital management. Emphasis on the institution of Industrial Engineering programs in hospitals and the choice of suitable projects. Guest lecturers.

342. HOSPITAL INDUSTRIAL ENGINEERING II.
A projects course based upon material covered in I.E. 341. Study of previous Industrial Engineering projects in hospitals, followed by each student conducting a project of his own in a local hospital. Prerequisite, I.E. 341.

353. INDUSTRIAL ENGINEERING ECONOMICS I.
Emphasis on cost control in industrial operations. Topics include an introduction to accounting principles and financial record keeping methods, determination of costs of all aspects of manufacturing, inventory management, and budgetary planning and control. Open to all technically-oriented students. Prerequisite, Econ. 100-103.

354. INDUSTRIAL ENGINEERING ECONOMICS II.
An introduction to economic problems faced by engineers, comparison of alternatives in engineering projects, use of discounted cash flow techniques, breakeven and minimum cost points, and economic selection and replacement of structures and machines; decisions made in the face of risk and uncertainty. Instruction wherever advantageous by the case method. Intended as a service course for all technically-oriented individuals.

360. SAFETY ENGINEERING.
Design of equipment facilities and processes to minimize accidents. Evaluation and design of fire prevention equipment and accident control procedures in organizations.

375. JOB EVALUATION.
The principles used to determine an evaluation of all occupations in order to establish an equitable rating between them, to establish sound wage and salary policies. Prerequisite, I.E. 151. *Credit, 2.*

376. TIME STUDY.
The principles involved in the establishment of production standards and their application in the management functions of cost accounting, estimating, production control incentives, budgetary control. Prerequisite, I.E. 151 concurrently except for Business Administration majors.

377. LAYOUT AND DESIGN OF ORGANIZATIONAL FACILITIES.
The principles applying to plant layout, materials handling, and plant location. Modes of layout presentations illustrated

by means of a student project. Prerequisites, MAE 102, and IE/OR 151, or equivalents. Credit, 2.

378. PRODUCTION PLANNING AND CONTROL.
Analysis of quantitative and qualitative techniques for production planning and control. Emphasis on their application to various production systems. Prerequisites, I.E. 272, 353, 380.

379. OPERATIONS RESEARCH I.
The formulation and analysis of deterministic models for decisions including linear programming, network, integer programming and dynamic programming models. A science course for engineers of all disciplines and other technically-oriented individuals. Credit not allowed students who have taken Management 253, 254.

380. OPERATIONS RESEARCH II.
Stochastic models: decision theory, game theory, queueing theory, inventory theory, and general Markov processes. Credit not allowed students who have taken Management 253, 254. Prerequisites, I.E. 271, 379.

382. WORK SIMPLIFICATION.
The principles involved in the simplification of means of doing work and in the application and use of these principles.
1 class hour, 1 3-hour laboratory period. Prerequisites, MAE 268, and I.E. 376 concurrently. Credit, 2.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

394. PROFESSIONAL SEMINAR.
Presentation of papers on important subjects and recent developments. 1 class hour. Prerequisite, senior standing.
Credit, 1.

Mechanical Engineering

Head of Department: Professor J. Edward Sunderland. Professors Bates, Boothroyd, Crossley, Day, Dittfach, Dixon, Horvay, Picha, Poli, Zahradnik; Associate Professors Ambs, Costa, Cromack, Goss, Kirchhoff, McGowan, Nelson, O'Byrne, Patterson, Ritter, Russell, Umholtz, Wilson, Zinsmeister; Assistant Professors Jakus, Murch, Tartaglia.

SOPHOMORE YEAR

1st Semester	Credits
Rhetoric Elective	3
Math 165	3
MAE 144, Mechanics I	3
MAE 167, MAE Lab, I	3
Physics 162	4
	16
2nd Semester	Credits
Humanities Elective	3
Math 187	3
MAE 135, Introd. to Materials Science	3
MAE 137, Introd. to Materials Science Lab	1
MAE 145, Mechanics II	3
MAE 163, Thermodynamics I	3
	16

JUNIOR YEAR

1st Semester	Credits
MAE 235, Materials and Manufacturing	3
MAE 237, Materials and Manufacturing Lab	1
MAE 246, Mechanics III	3
MAE 264, Thermodynamics II	3
EE 141, Circuits I	4
Technical Elective	3
	17
2nd Semester	Credits
MAE 284, MAE Analysis I	3
MAE 293, ME Design I	3
MAE 265, Fluid Mechanics	3
EE 142, Circuits II	4
Technical Elective	3
	16

SENIOR YEAR

1st Semester	Credits
MAE 254, 283, 295 (choose one)	3
MAE 279, MAE Lab II	3
Soc. Sci. Elective	3
Technical Elective	3
Technical Elective	3
	15
2nd Semester	Credits
Math. Elective	3
Technical Elective	3
Technical Elective	3
Soc. Science Elective	3
Humanities Elective	3
	15

AERO-SPACE OPTION SOPHOMORE YEAR

	Credits
Rhetoric Elective	3
Math 165	3
MAE 144 Mechanics I	3
Physics 162	4
MAE 167, MAE Lab I	3
	16
	Credits
Humanities Elective	3
Math 187	3
MAE 135, Introd. to Materials Science	3
MAE 137, Introd. to Materials Science (Lab)	1
MAE 145, Mechanics II	3
MAE 163, Thermodynamics II	3
	16

JUNIOR YEAR

	Credits
MAE 235, Materials & Manufacturing	3
MAE 237, Materials & Manufacturing (Lab)	1
MAE 246, Mechanics III	3
MAE 264, Thermodynamics II	3
EE 141, Circuits I	4
Technical Elective	3
	17
	Credits
MAE 265, Fluid Mechanics	3
MAE 284, MAE Analysis I	3
MAE 293, ME Design I	3
EE 142, Circuits II	4
Technical Elective	3
	16

SENIOR YEAR

	Credits
MAE 274, Flight Vehicle Performance	3
MAE 279, MAE Lab II	3
Soc. Sci. Elective	3
Technical Elective*	3
Technical Elective	3
	15
	Credits
Math Elective	3
MAE 316, Stability & Control	3
Technical Elective	3
Soc. Sci. Elective	3
Humanities Elective	3
	15

*NOTE: One of the technical electives must be selected from the following, MAE 248, Structures; MAE 278, Propulsion; or MAE 315, Aerodynamics. Note also that MAE 287, Gas Dynamics, is a prerequisite for MAE 278, and MAE 274 is a prerequisite for MAE 315.

MATERIALS MAJOR SOPHOMORE YEAR

	Credits
Rhetoric Elective	3
Math 165	3
MAE 144, Mechanics I	3
Physics 162	4
MAE 167, MAE Lab I	3
	16
	Credits
Humanities Elective	3
Math 187	3
MAE 135, Introd. to Materials Science	3
MAE 137, Introd. to Materials Science (Lab)	1
MAE 145, Mechanics II	3
MAE 163, Thermodynamics II	3
	16

JUNIOR YEAR

	Credits
MAE 235, Materials and Manufacturing	3
MAE 237, Materials & Manufacturing (Lab)	1
MAE 246, Mechanics III	3
MAE 264, Thermodynamics II	3
EE 141	4
Technical Elective	3
	17
	Credits
MAE 265, Fluid Mechanics	3
Physics 319 or MAE 385	3
Math Elective	3
EE 201, Electronic Materials	3
Technical Elective	3
	15

SENIOR YEAR

	Credits
MAE 308, Physical Metal.	3
Chem. 285, Physical Chem.	3
Soc. Sci. Elective	3
Technical Elective	3
Technical Elective	3
	15
	Credits
Chem. Eng. 370, Polymer Science	3
MAE 309, Mechanical Properties	3

Technical Elective	3
Soc. Sci. Elective	3
Humanities Elective	3
	15

SUPPLEMENTARY RULES AND PROCEDURES

1. *Honors*—Sophomore, junior, or senior students who are selected for their outstanding performance by the Undergraduate Committee are eligible to participate in the Department's Honors program. Curriculum, other than School and University requirements, is completely open subject to the approval of the Honors Adviser, the Undergraduate Committee and Department Head. It is expected that Honors students will cover the Departmental core material but not necessarily by taking the regularly specified courses. Special Departmental recognition will be extended to the Honors students.
2. *ROTC*—No ROTC credits are acceptable in fulfillment of the 128 credit hour degree requirements of the Department.
3. *Non-Technical Electives*—Students may substitute one Non-Technical Elective for a Technical Elective provided the student presents evidence in writing that such a substitution is beneficial to the planned program. The substitution must have the approval of the student's Adviser and the Department Head.
4. *Technical Electives*—Technical electives may be satisfied by upper level courses in Engineering, Mathematics, Computer Science, or Physics, or by upper or lower level courses in Chemistry or the Life Sciences.
5. *Mathematics Electives*—Mathematics electives may be satisfied by upper level Mathematics or Computer Science courses, or by Probability and Statistics in Industrial Engineering.
6. *Technical Communication*—Any student paper or report considered poor on the basis of technical communication by any instructor will be submitted to a Technical Communication Committee for review, comment, and recording. Such reports will be required to be redone. Students who show consistently poor communications performance may be required by the Committee to take a course in Technical Writing in their senior year.

101 (I). ENERGY AND MAN (E).
Energy and its role in a technological society. The fundamental laws of energy and energy conversion. Secondary environmental effects of energy production and transmission. Energy resources and energy management. Not open to engineering majors.

135 (II). INTRODUCTION TO MATERIALS SCIENCE.
The atomic and molecular phenomena responsible for the behavior of materials. The relationship between the atomic structure of materials and their behavior is emphasized. Prerequisite, Chem. 112 or 114.

137 (II). INTRODUCTION TO MATERIALS SCIENCE LABORATORY.
Laboratory work to illustrate the concepts and principles of materials science. Prerequisite, MAE 135 concurrently. 1 3-hour laboratory period. Credit, 1.

144 (I), (II). MECHANICS I (STATICS).
A vector treatment of the equilibrium of particles and rigid bodies. Topics include: vector algebra, forces, moments, couples, equations of equilibrium, free-body diagrams, graphical techniques, constraints, structures and mechanisms, friction, centroids and moments of inertia, the method of virtual work. Prerequisites, Math 136, Physics 161.

145 (I), (II). MECHANICS II (STRENGTH OF MATERIALS).
Notions of stress, strain, and Mohr's circle. Tension shear and torsion. Plane stress and plane strain; moments of inertia. Shear force and bending moment diagrams. Deflection of beams; indeterminate beams; Castigliano's principle; plastic bending of beams. Mechanical properties of materials. Prerequisite, MAE 144.

163 (II). THERMODYNAMICS.
The laws of thermodynamics introduced and applied to various energy-transforming devices. Property relations. Emphasis on the science of thermodynamics, providing a background for further study in those areas that involve thermodynamic principles. Prerequisites, Physics 162, Math 165.

167 (I), (II). MECHANICAL AND AERO-SPACE ENGINEERING LABORATORY I.
Some basic mechanical engineering measurement techniques, introduction to statistical analysis of engineering data, and technical report writing. Prerequisites, Math 136 and digital computer programming (Eng. 103-104 or equivalent level). 1 hour lecture, 1 hour recitation, 1 3-hour laboratory period.

200. TECHNOLOGY AND SOCIETY.
History of technology, criticisms of modern technology, technological change and assessment, and the role of the engineer and his professional organizations.

220 (I). MATERIALS PROCESSING.
Analysis of the metal cutting process including mechanics of metal cutting, temperature generated, tool life and tool wear, cutting fluids and surface roughness, economics. The grinding process and electrical machining process. Analysis of metal forming processes including wire drawing, extrusion, deep drawing rolling, blanking. Prerequisite, senior standing.

221 (II). AUTOMATION IN MANUFACTURING.
Fundamentals of parts feeding, orientation and mechanized assembly including analysis of transfer machines parts feeders; the performance and economics of assembly machines. Numerical control of machine tools including studies of control systems, planning procedures and economics. Prerequisite, senior standing.

235 (I). MATERIALS AND MANUFACTURING.
The mechanical behavior of materials. Dislocations, material failures, creep, fatigue. Processing materials by plastic deformation and machining. Friction, lubrication, and wear. Casting and joining processes. Prerequisites, MAE 135 and 145.

237 (I). MATERIALS AND MANUFACTURING LABORATORY.
Laboratory work associated with MAE 235. Prerequisite, MAE 235 concurrently. 1 3-hour laboratory period. Credit, 1.

246 (I), (II). MECHANICS III (DYNAMICS).
A vector treatment of dynamics. Kinematics of a particle in two and three-dimensions. Dynamics of a particle; momentum, moment of momentum, and work-energy. Rigid bodies in plane motion; kinematics, and dynamics. Relative motion. Prerequisite, MAE 144.

248 (II). STRUCTURES FOR MECHANICAL AND AERO-SPACE ENGINEERS I.
Introduction to the load and temperature environment of structures. Review of stress and strain with an introduction to the theory of elasticity. Theories of bending, extension, torsion and shear of slender beams without structural discontinuities. Introduction to work-energy principles and their application to the deflection and stress analysis of complex structures. Examples from the fields of mechanical and aero-space engineering. Prerequisite, MAE 145.

249 (I). STRUCTURES FOR MECHANICAL AND AERO-SPACE ENGINEERS II.
A continuation of MAE 248. Elastic instability. Applications to axially symmetrical problems, curved beams and stress concentrations. Applications to plates and shells. Introduction to problems involving viscous and plastic behavior. Numerical methods. Prerequisite, MAE 248, or permission of instructor.

254 (I). PRODUCT DESIGN I.
Human values in design. Central philosophy of product design, with emphasis on the relation between technical and human values, creativity, and design methodology. Laboratory includes development of simple product concepts visualized in rapidly developed three-dimensional mockups. 2 class hours, 2 2-hour laboratory periods.

255 (II). AQUACULTURAL ENGINEERING SYSTEMS.
Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bioengineering comparison of several systems used in aquaculture. Field trip to inspect an aquacultural project in operation.

257 (II). PRODUCT DESIGN II.
Continuation of MAE 254, Product Design I. 2 class hours, 2 2-hour laboratory periods.

264 (II). THERMODYNAMICS II.
Application of the laws of thermodynamics to energy conversion devices. Introduction to irreversible thermodynamics. Prerequisite, MAE 163.

265 (I). FLUID MECHANICS.
Vector approach to the fundamentals of fluid dynamics, including the topics of fluid statics, kinematics of fluids, potential flow, vorticity, dimensional analysis. Introduction to viscous fluids and compressibility. Prerequisite, MAE 163.

268 (II). KINEMATICS.
Mechanism, including velocity and acceleration diagrams, instant centers, gear teeth and gear trains, cams, and various speed transmissions. Prerequisite, MAE 246. 2 class hours, 1 3-hour laboratory period.

274 (II). FLIGHT VEHICLE PERFORMANCE.
Aircraft performance static and maneuvering. Fundamental astronautics, two-body problem, transfer orbits, rendezvous, intercept, lunar and interplanetary trajectories.

275 (II). AIR CONDITIONING AND REFRIGERATION.
Principles and applications of air conditioning and refrigeration. Comfort conditions, load calculations, systems analysis and design, case studies, plant visits. Prerequisite, MAE 264.

276 (II). COMBUSTION.
Phenomenological study of combustion processes in flowing systems. Prerequisite, MAE 264.

277 (I). INTRODUCTION TO PROPULSION POWER PLANTS.
Thermodynamic and performance aspects of reciprocating gasoline and diesel engines. Prerequisite, MAE 264.

278 (II). AERO-SPACE PROPULSION.
Primary and auxiliary power sources. Matching of air-breathing and rocket motor with vehicle. Electrical and nuclear propulsion systems. Prerequisite, MAE 287.

279 (I). MECHANICAL AND AERO-SPACE ENGINEERING LABORATORY II.
Basic concepts of instrumentation as applied to mechanical engineering measurements. Topics include basic meters, transducers, and an introduction to analog computation. Prerequisites, EE 142, MAE 264, MAE 265, MAE 167, and Math 187. 1 hour lecture, 1 hour recitation, 1 3-hour laboratory period.

282 (I). HEAT TRANSFER.
Conduction, convection and radiation, with engineering applications. Prerequisites, MAE 163; Math 165.

283 (I). MACHINE DESIGN.
Principles of the design of various machine parts; economy of manufacture, safety, styling, invention and creativity. Prerequisites, MAE 235, 237, and 293. 2 class hours, 1 3-hour laboratory period.

284 (II). MECHANICAL AND AERO-SPACE ENGINEERING ANALYSIS I.
Engineering problem solving emphasizing problem recognition and formulation, simplifying assumptions, and valid analytical processes. Prerequisite, Math 165. 2 class hours, 1 3-hour laboratory period.

285 (I). VIBRATIONS I.
An introduction to the analysis of vibration of linear systems with emphasis on physical concepts rather than abstract mathematics. The vibrations of machines and machine structures including the setting-up and solution of the differential equations of motion for a wide variety of vibratory systems. Ways of reducing vibration including balancing, active and passive isolation, absorption, and damping. Laboratory demonstrations. Prerequisite, MAE 246.

286 (II). ADVANCED MACHINE DESIGN.
Continuation of 283. Additional elementary parts and some complete machines. Emphasis on invention and creativity. Prerequisite, MAE 283. 2 class hours, 1 3-hour laboratory period.

287 (I). GAS DYNAMICS.
Continuous and discrete media. Compressible flow equations and compressibility effects. Flow in variable area ducts, normal and oblique shocks. Two dimensional flow. Applications. Prerequisites, MAE 163 and 265. Credit, 4.

288 (I). PHYSICS OF SOLIDS.
Mechanical, electrical, magnetic and thermal properties of engineering materials. Prerequisites, Chem. 112 or 114, Physics 162 or 125 or their equivalents.

291 (II). MECHANICAL AND AERO-SPACE ENGINEERING ANALYSIS II.
Continuation of MAE 284. Emphasis on more complex problems and more advanced mathematical methods. Prerequisite, MAE 284.

293 (II). MECHANICAL ENGINEERING DESIGN I.
Introduction to the engineering design process, inventiveness, optimization, and decision-making. Prerequisite, MAE 284. 2 class hours, 1 3-hour laboratory period.

294. MECHANICAL AND AERO-SPACE SYSTEMS ANALYSIS.
Application of engineering analysis techniques to large scale systems. Concepts and methodology of systems engineering. Prerequisite, EE 142 or permission of instructor.

295 (I). MECHANICAL AND AERO-SPACE ENGINEERING DESIGN.
Application of fundamentals and technology to complex design projects. Prerequisite, senior standing. 1 class hour, 2 3-hour laboratory periods.

308 (I). PHYSICAL METALLURGY PRINCIPLES.
Principles underlying the structure and behavior of metals. Atomic arrangements, crystalline imperfections. Equilibrium and non-equilibrium phase relationships in one- and two-component systems. Kinetics of diffusion and nucleation. Phase transformations, heat treatment and hardenability. Prerequisite, MAE 135.

309 (II). MECHANICAL PROPERTIES OF METALS, POLYMERS, AND GLASS.
The mechanical properties of metal, polymers, and glass and the mechanisms which control these properties. Topics include: elasticity and its relationship to bonding, plasticity in terms of dislocation theory, time dependent flow of polymers and metals, brittle fracture in metals and glass, effect of alloy additions on metal properties. Prerequisite, MAE 135.

315. AERODYNAMICS.
Application of theoretical fluid mechanics to aerodynamics including topics of theory of lift; finite wing theory; the effect of compressibility and viscosity on lift and drag; slender body theory.

316. STABILITY AND CONTROL OF VEHICLES.
Introduction to the general concept of stability of motion. The stability of motion of air, space and ground vehicles.

350 (II). X-RAY DIFFRACTION.
Principles of crystallography. X-ray diffraction. Prerequisite, MAE 308.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

COLLEGE OF FOOD AND NATURAL RESOURCES

Arless A. Spielman, *Dean*
J. Richard Beattie, *Associate Dean*
Ernest M. Buck, *Associate Dean*
William J. Mellen, *Associate Dean*
John W. Denison, *Assistant Dean*

Agricultural and Food Economics

Head of Department: Professor N. E. Engel. Professors Brown, Christensen, Crossmon, Foster, Leed, Russell, Storey; Associate Professors Callahan, Fitzpatrick, Jarvesoo, Marion; Assistant Professors Bell, Lee, Spindler, Willis; Instructor Vertrees; Lecturer Schmitchel.

Majors will satisfy University and departmental graduation requirements as follows: 9 credits in humanities and fine arts, 6 credits in communication subjects, 6 credits in mathematics, 6 credits in natural sciences, 12 credits in economics, 6 credits in other social sciences, 6 credits in business courses, 3 credits in statistics, 12 credits in technical offerings of the College of Food and Natural Resources appropriate to the special interest of the student in resource economics, agricultural economics, or food economics; and 15 credits in the major field.

Thirty-six credits in electives are available to be used in a program consistent with the student's major interest as developed with the adviser. It should be noted that majors in this department will take 6 credits in social sciences in lieu of 6 credits in natural sciences required of other majors in the College of Food and Natural Resources.

110 (I). WORLD FOOD AND NATURAL RESOURCES (D).
Introduction to the natural, economic, and sociopolitical forces influencing world food and biological resource development. Potentials for meeting pressures on resources. 2 class hours, 1 2-hour discussion. Mr. Foster.

177 (I). BASIC BIOMETRY (E).
Introduction to applied statistical principles and techniques for biological data.

206 (II). AGRICULTURAL ECONOMICS.
Intensive review of the agricultural sector. Application of economic principles to problems of production and marketing, elements of price making. Income problems of agriculture. Mr. Fitzpatrick.

235 (I). AGRICULTURAL BUSINESS MANAGEMENT.
Decision-making principles, management tools, analytical methods and their application to management problems of commercial farms and other agricultural firms. 2 class hours, 1 2-hour discussion. Mr. Lee.

261 (I). FOOD MARKETING SYSTEMS.
Structure of food marketing systems. Operating principles, significant product characteristics, role of specialized marketing firms, government programs and policies. Mr. Fitzpatrick.

265 (I). FOOD MERCHANDISING.
Economic analysis of factors, internal and external to the firm, influencing sales of food firms. Food industry development, consumer behavior, competitive strategies, and legal considerations. Mr. Marion.

282 (I). WATER QUALITY ECONOMICS.
Principles for selection of welfare maximizing plans from among alternative pollution control policies and market and administrative decision-making processes for pollution control. Mr. Willis.

341 (I). PRICE THEORY AND ANALYSIS.
A study of price theory and the analytic tools of economic analysis. Emphasis is placed on the application of quantitative techniques in the analysis of practical economic problems. Material is related to managerial decision making. Mr. Christensen.

346 (II). REGIONAL COMPETITION AND MARKET INTERDEPENDENCY.
Interregional competition and interdependency in agricultural factor and product markets, in the context of aggregate demand and supply by regions as affected by spatial considerations. Mr. Christensen.

352 (I). AGRICULTURAL POLICY.
Analysis of farm price support programs, programs for alleviation of rural poverty, food trade and aid policies, other topical issues. Mr. Storey.

368 (II). FOOD DISTRIBUTION ECONOMICS.
A critical analysis of the food industry; the legal and competitive framework, performance and public policy; management practices with respect to site selection, budgeting, merchandising, expense control and employee training and evaluation in food distribution firms. Mr. Leed.

373 (II). RESOURCE AND CONSERVATION ECONOMICS.
Economic and institutional factors affecting land and water use. Land use planning. Elements of conservation economics. Mr. Foster.

376 (II). MARINE RESOURCE DEVELOPMENT ECONOMICS.
Economic analysis of alternative plans for attainment of social goals in the development of coastal and offshore marine resources. Mr. Storey.

381 (II). INTERNATIONAL AGRICULTURAL DEVELOPMENT.
Economic development of low income rural economies. Relation of agriculture to national economies. Exogenous and endogenous factors in development. Mr. Foster.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

399 (I), (II). DEPARTMENTAL HONORS.
Honors thesis work. Prerequisite, consent of Departmental Honors Committee. Credit, 6.

Entomology

Head of Department: Associate Professor T. Michael Peters. Professors Becker, Hanson, Lilly; Assistant Professors Edwards, Hall, Jensen, Stoffolano.

A departmental graduation requirement is successful completion of at least 15 semester hours of credit in Junior-Senior Courses (those numbered 200-399) offered by the Department. The flexibility allowed by this requirement enables students in consultation with their advisers to build an individual program of courses appropriately tailored to their future goals.

For students anticipating research or teaching careers which require graduate study, electives should stress basic sciences and liberal arts courses in botany, chemistry, English, modern languages, statistics, and zoology. Students interested in medical entomology should include microbiology, parasitology, and public health courses. For work in pest control, extension quarantines or agricultural chemicals, electives from plant pathology and soil sciences, forestry, business, speech, and applied entomology are recommended.

126 (I), (II). GENERAL ENTOMOLOGY (E).
A survey of the field; structure, development, evolution, classification, biology, and natural control of insects. Formation of an insect collection. 2 class hours, 1 3-hour laboratory period. Mr. Peters.

150 (I). PRINCIPLES OF APPLIED ENTOMOLOGY.
A broad basic course for both majors and non-majors. General principles of pest control stressed, instead of "how-to-do-it" details. 2 class hours, 1 2-hour laboratory period. Mr. Lilly.

260 (II). FOOD AND STRUCTURAL PESTS.
Identification, biology and specific control measures of arthropod and rodent pests in structures, foods, fabrics, and miscellaneous products during transportation and in homes. A prior course in zoology or entomology desirable. 2 class hours, 1 2-hour laboratory period. Mr. Lilly.

266 (I). PRINCIPLES OF APICULTURE.
Honeybees and their relatives, structure and biology of bees, methods of management, diseases, pollination, queen rearing, honey production, and history of beekeeping. Given in alternate years. Prerequisite, Ent 126 or permission of instructor. 2 class hours, 1 2-hour laboratory period. Mr. Edwards.

272 (II). FOREST AND SHADE TREE INSECTS.
The principles and methods of controlling insects which attack trees and forest products. Important species, their identification, biology and specific control measures. 2 class hours, 2 2-hour laboratory periods. Credit, 4. Mr. Becker.

279. ANIMAL ECOLOGY.
The basic principles and concepts that are operative at the various levels of biological organization (organismic, population, community, and ecosystem). Topics include: ecology and natural selection,

behavioral ecology, human ecology, and current ecological problems. 3-hour lecture (optional 1-credit laboratory).
Credit, 3 (or 4). Mr. Stoffolano.

295 (I), (II). EVOLUTION.
The course and dynamics of both inorganic and organic evolution. The implications of evolutionary concepts on human philosophy, behavior and welfare.
Mr. Hanson.

311. INSECT BEHAVIOR.
The specific behaviors of insects, analyzed in view of current experimental research, and used to demonstrate various neurobiological principles. An understanding of the behavioral dynamics of a specific insect as a basis for examining how the organism's behavior insures survival under the diverse environmental stresses. 3-hour lecture (optional 1-credit laboratory). Credit, 3 (or 4). Mr. Stoffolano.

355 (I), 356 (II). CLASSIFICATION OF INSECTS.
The identification of insects, including immature stages. First semester: Orthoptera, Hemiptera, Coleoptera; second semester: other orders. Either semester may be elected independently. Given in alternate years. Prerequisite, permission of instructor; Ent 126 desired. 3 2-hour laboratory periods.

357 (I). INSECT MORPHOLOGY.
The external anatomy of the major orders, with stress on phylogenetic relationships, as background for subsequent work in taxonomy and physiology. Given in alternate years. Prerequisite, permission of instructor; Ent 126 desired. 1 class hour, 3 2-hour laboratory periods.
Credit, 4. Mr. Hanson.

374 (II). MEDICAL AND VETERINARY ENTOMOLOGY.
Relationships of insects and their allies to the health of man and animals. The classification, biology and control of these pests. Given in alternate years. Prerequisite, Ent 126 or permission of instructor. 1 class hour, 2 2-hour laboratory periods.
Mr. Hall.

380 (II). INSECT CONTROL.
The science of pest control. Biological control and the need, economics, effectiveness, and hazards of insecticides. Given in alternate years. Prerequisite, Ent 126. 1 class hour, 2 2-hour laboratory periods.
Mr. Lilly.

381. INSECT PEST MANAGEMENT.
Application of the principles of insect pest management; pest recognition, properties of available control agents and their correct use in planning control programs. Prerequisite, Ent 126 or permission of instructor. Mr. Jensen.

382 (II). INSECT PHYSIOLOGY.
The organ systems, their functions in nutrition, reproduction, respiration, and growth, and the relationship of physiology to behavior. Given in alternate years. Prerequisites, Ent 126 and permission of instructor. 2 class hours, 2 3-hour laboratory periods. Credit, 4. Mr. Edwards.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Environmental Sciences

Head of Department: Commonwealth Professor Warren Litsky. Professors Feder, Gunner; Assistant Professors Coler, Deubert, Walker.

201. INTRODUCTORY ENVIRONMENTAL BIOLOGY (E).
The response of the biota to environmental stress induced by air, water and soil pollutants. Prerequisites, Botany 101, Zool 101 or equivalent.

215. AGRICULTURE AND ENVIRONMENTAL POLLUTION.
Agricultural pollutants and pollutants attributed to agriculture, their sources and their behavior in the environment. Major problems; analysis of cases involving real and alleged agricultural pollution.
Mr. Deubert.

285. MICROBIOLOGY OF THE SOIL.
Soil microorganisms; their distribution, ecology and transformation or organic and inorganic substrates including pesticides. Microbiology of the rhizosphere and the biological equilibrium. Mr. Gunner.

302. ADVANCED POLLUTION BIOLOGY.
The measurement and evaluation of the biotic response to environmental stress of the terrestrial and aquatic biocoenoses induced by air, water and soil pollutants. Prerequisites, Introductory Environmental Biology or equivalent. 2 1-hour lectures, 2 3-hour laboratory, field trips, demonstrations. Credit, 4.

303. AIR POLLUTION BIOLOGY.
The biological input used for the determination of air quality criteria, including organism/environment interaction and dose/response phenomena in adapted and stressed systems. 3-hour lecture, no laboratory. Mr. Feder.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391, 392. SEMINAR.
Topics of current Environmental Sciences interests. Credit, 1-3.

Food and Agricultural Engineering

Head of Department: Professor J. T. Clayton. Associate Professors Fletcher, C. Johnson, E. Johnson, Light, Norton, Whitney; Assistant Professors Chen, Pira, Rha. Lecturer Purohit.

255 (I). AQUACULTURAL ENGINEERING.
Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bioengineering comparison of several systems used in aquaculture. A field trip to inspect an aquacultural project in operation. Mr. Zahradnik.

261 (I), (II). HOUSING DESIGN AND CONSTRUCTION.
Space arrangement, construction materials, construction problems and discussion, utilities, financing, maintenance and remodeling. Emphasis on planning and evaluation procedures and factors. 1 class hour, 1 3-hour laboratory period.
Mr. C. Johnson.

281 (I). FUNDAMENTALS OF FOOD SERVICE SYSTEMS ENGINEERING.
The fundamental engineering principles involved in the planning, equipping and operation of a commercial restaurant. Emphasis on application of these principles to specific situations within the kitchen. Mr. Fletcher.

331 (I). INSTRUMENTATION.
Instrumentation applied to research, covering recorders, indicators, controllers and transducers in general. Emphasis on applications and limitations. Prerequisite, Physics 104 or equivalent. 2 class hours, 1 2-hour laboratory period.
Mr. E. Johnson.

356 (I). CONTROL SYSTEMS FOR SOIL MOISTURE.
Design of systems for soil drainage and crop irrigation; soil requirements, climatology and hydraulics as applied to engineering problems involved in these systems. 2 class hours, 1 2-hour laboratory period. Mr. E. Johnson.

361 (I). STRUCTURES AND RELATED EQUIPMENT.
Fundamental aspects of planning modern farm structures; emphasis on design, environmental control and integration of mechanical equipment. 2 class hours, 1 2-hour laboratory period. Mr. Light.

365 (II). PHYSIOLOGICAL UNIT OPERATIONS.
Introduction to physiological systems, studies of thermodynamics, fluid dynamics, heat transfer and mass transfer in biological systems, concepts in biological regulatory systems and biological engineering designs with specific examples. Prerequisites, Approval of department, or Chem. E. 256, or MAE 265 & 382. Mrs. Rha.

375 (I). FOOD PROCESSING SYSTEMS ANALYSIS.
Continuous and batch processing systems for food and biological products, using flow analysis, systems analysis, scale-up, and simulation techniques. Analysis of machine operating principles, sanitary requirements, fabrication limitations and machine interrelations. Laboratory exercises in flow analysis, plant layout, and systems analysis of existing plant operations. Prerequisite, permission of instruc-

tor. 2 class hours, 1 2-hour laboratory period. Mr. Whitney.

376 (I). MECHANIZATION IN CROP PRODUCTION.
Principles of operation, maintenance, and selection of farm tractors and field machinery; irrigation and drainage systems and equipment. Emphasis on management practices and discussions. 1 class hour, 2 2-hour laboratory periods. Mr. Whitney.

381 (I). ELEMENTS OF PROCESS ENGINEERING.
Fundamental engineering principles involved in the processing of biological materials; emphasis on heat transfer, mass and energy balances, refrigeration, psychrometry, properties of fluids and fluid flow. 2 class hours, 1 2-hour laboratory period. Mr. Fletcher.

384 (I). UNIT OPERATIONS IN FOOD ENGINEERING.
Application of engineering concepts to the processing and handling of biological materials, including evaporation, dehydration, irradiation, freeze drying, cost analysis, material handling, manual motion economy and packaging. 2 class hours, 1 2-hour laboratory period. Mr. Fletcher.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Food Science and Technology

Head of Department: Professor F. J. Francis. Professors Esselen, Fagerson, Hankinson, Hayes, Hultin, Nawar, Stumbo; Associate Professors Buck, Evans, Hunting, Levin, Potter, Sawyer; Assistant Professors Bluestein, Clydesdale.

101 (II). THE STRUGGLE FOR FOOD (E).
Modern advances in science in the growth, production, and use of both natural and synthetic foods in alleviating the world food crises. Mr. Clydesdale, Mr. Francis, Mr. Nawar.

251 (I). INTRODUCTORY FOOD SCIENCE.
Primarily for department majors. Seminar on food manufacture, preservation, processing, and distribution. Credit, 2.

258 (II). ANIMAL PRODUCTS.
Principles of processing, handling, packaging and storage of animal and other protein foods. Chemical and structural aspects of muscle as they relate to quality evaluation and preservation. 2 class hours, 1 2-hour lecture-demonstration.
Mr. Buck, Mr. Hayes.

275 (I), (II). SURVEY OF FOOD TECHNOLOGY.
For non-Food Science and Technology majors. 2 class hours, 1 2-hour laboratory period. Mr. Esselen, Mr. Hayes.

352 (II). FOOD CHEMISTRY.
The chemistry of food products. Chemical and biological changes in foods during storage and processing. Emphasis on changes at the cellular and molecular levels. Prerequisite, organic chemistry or concurrent registration. Mr. Hultin.

361 (II). FOOD PROCESSING.
Introduction to the food industry, principles of processing and preservation in current usage. Statistical quality control procedures. 3 class hours, laboratories by arrangement. Mr. Bluestein.

362 (I). FOOD PROCESSING LABORATORY.
Application and utilization of pilot plant equipment to study and evaluate principles of commercial practice in the food industry. Introduction to advanced techniques of food processing. 1 class hour, 1 4-hour laboratory period. Prerequisite, Food Science 361. Mr. Bluestein.

365 (I). UNIT OPERATIONS.
Technical principles involved in the processing of food, milk and dairy products. 2 class hours, 1 2-hour laboratory period. Mr. Hankinson.

366 (I). HYGIENIC PRINCIPLES OF FOOD HANDLING.
The application of hygienic principles to the preparation, processing and handling of foods. Emphasis on the training of supervisory personnel.
Mr. Evans, Mr. Stumbo.

371 (I). ANALYSIS OF FOOD PRODUCTS.
Physical, chemical, microbiological and microscopical methods. Prerequisite, Analytical Chemistry. 2 class hours, 1 4-hour laboratory period. Mr. Hunting

372 (II). OBJECTIVE ANALYTICAL METHODS AND INSTRUMENTATION.
Continuation of 371. Prerequisite, Food Science 371. 2 class hours, 1 4-hour laboratory period. Mr. Hunting.

380 (I), (II). SPECIAL TOPICS IN WORLD FOOD TECHNOLOGY.
Selected problems concerned with applications of food technology in solution of world food problems in developing countries. 2 class hours.
Credit, 2. Mr. Esselen.

384 (II). SENSORY EVALUATION METHODS.
An introduction to sensory measurements in the evaluation and acceptance of foods. Panel tests and their statistical interpretations; taste, odor, color, and texture measurements. Methodology of consumer testing and statistical interpretation of data. For seniors only. 2 class hours, 1 2-hour laboratory period. Mr. Sawyer.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). FOOD SCIENCE SEMINAR.
For seniors who major in Food Science and Technology. 2 class hours.
Credit, 2.

Forestry and Wildlife Management

Head of Department: Professor Donald R. Progulske. Professors Abbott, C. F. Cole, Gatslick, MacConnell, Mader, Rhodes; Associate Professors Bond, Carlozzi, Dodge, Greeley, Hoadley, Larson, Reed, Rice, Wilson; Assistant Professors A. B. Cole, Johnson, Mawson, McNamara.

FORESTRY

121 (II). TIMBER HARVESTING.
Timber harvesting and primary conversion of wood products. Mr. A. B. Cole.

212 (I), (II). DENDROLOGY.
Taxonomic features, silvical characteristics, and distribution of principal tree species of temperate North America; a description of the forests of the world, their distribution and economic importance. 3 class hours, 2 2-hour laboratory periods.
Credit, 4. Mr. Abbott, Mr. A. B. Cole, Mr. Rhodes.

223 (I). SILVICS.
Principles of forest ecology as a foundation for silviculture and forest management, environmental factors; development of trees and forest communities; forest influences. Forestry 112 recommended. 3 class hours, 1 4-hour laboratory period.
Credit, 4. Mr. Mader, Mr. Wilson.

224 (II). FOREST SOILS.
Effects of soil properties on tree growth; relationship of soils to silviculture, harvesting, watersheds, wildlife, and forest recreation; forest soil description, classification, and mapping. 2 class hours, 1 4-hour laboratory period. Mr. Mader.

225 (I) and Summer. THE ELEMENTS OF FOREST MENSURATION.
The measurement of trees, stands, and forest products; practice in timber estimating and log scaling; collection and compilation of forest inventory data. 2 class hours, 1 4-hour laboratory period. Summer course, 3 40-hour weeks.
Mr. Mawson, Mr. MacConnell.

226 (I). THE PRINCIPLES OF SILVICULTURE.
Culture of forest crops; regeneration and intermediate cuttings, silvicides, slash disposal; planting, direct seeding, nursery management; interactions with forest management for water, wildlife, and recreation. Forestry 223 recommended. 3 class hours, 1 4-hour laboratory period.
Credit, 4. Mr. Rhodes, Mr. Abbott.

227 (II). TREE PHYSIOLOGY.
Growth and development during the life cycle of trees, emphasizing the whole-plant approach and phenomena best studied in trees; the physiological basis of silviculture. Prerequisite, Botany 211 or equivalent. 2 class hours, 1 3-hour laboratory period. Mr. Wilson.

228 (I). FOREST HYDROLOGY.
Principles and factors controlling the hydrologic cycle on forest lands. Review of forest watershed management research on the influence of soils, vegetation, and management practices on water yields and water quality. Watershed management as a part of integrated forest land

management. 2 lectures, 1 3-hour laboratory recitation period. Mr. Mader.

229 (II). FOREST PROTECTION.
Principles of protecting forests from fire, insects, disease, domestic animals, wildlife, and atmospheric agencies with emphasis on the prevention and control of forest fires. Mr. Abbott.

231 (I). AERIAL PHOTOGRAMMETRY.
The application of photogrammetry in forestry, wildlife biology, geography and other fields concerned with large land surfaces; photographic interpretation and map making from aerial photographs. 2 class hours, 1 4-hour laboratory period. Mr. MacConnell.

232 (II). FOREST TREE IMPROVEMENT.
Tree introduction, geographic variation, tree selection, vegetative propagation, controlled pollination and hybridization, seed orchard management. Prerequisite, Forestry 112. 3 class hours. Mr. Abbott.

234 (II). ADVANCED FOREST MENSURATION.
The theory and application of sampling techniques in forest survey, Continuous Forest Inventory techniques; analysis of growth and yield techniques. Prerequisites, Forestry 225 and basic statistics. 2 class hours, 1 4-hour laboratory period. Mr. Mawson.

235 (I). FORESTRY ECONOMICS.
The application of economic principles to the allocation of land, labor, and capital in forest enterprises; marketing and pricing theory of forest crops. Prerequisite, Econ. 103. Mr. Bond.

236 (II). FOREST RESOURCES POLICY.
Forest policy in the United States: institutional, social, political and economic factors affecting forest resources policy development. Current policy problems. 2 class hours, 1 2-hour seminar. Mr. Bond.

239 (II). THE FOREST RESOURCES OF NORTH AMERICA.
The forest resources of North America and their management for multi-purpose economic and social benefits; regional physiography, climate, vegetation, demography and economic base; environmental, economic, and socio-political constraints affecting management. For seniors and graduate students with natural resource, regional planning, or similar backgrounds. Mr. Rhodes.

240 (II). PRINCIPLES OF FOREST MANAGEMENT.
Multiple-use management of forest land for wood, water, wildlife, and recreation; organization of the forest for sustained-yield management; preparation of management plans. Prerequisite for the laboratory, Forestry 225. 3 class hours, 1 4-hour laboratory period. Laboratory period optional for non-forestry majors.
Credit, 5 or 3 (lectures only).
Mr. MacConnell, Mr. Mawson.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). FORESTRY SEMINAR.
Specialized study in a selected area of forestry. For seniors only.

NATURAL RESOURCES

100 (I) and Summer. CONSERVATION OF NATURAL RESOURCES.
Conservation principles and their application to problems in soils, water, forests, wildlife, mineral and general landscape resources; relationship of conservation to national development.

302 (II). ECOLOGICAL PRINCIPLES OF RESOURCE PLANNING.
Analysis of ecological principles and their relationship and importance to resource planning. State and federal conservation programs chosen for critical case study. Prerequisite, permission of instructor. Mr. Carlozzi.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). NATURAL RESOURCES SEMINAR.
Specialized study in a selected area of natural resources. For seniors only.

399 (I), (II). SENIOR HONORS.
Credit, 6.

WOOD TECHNOLOGY

201 (I). WOOD ANATOMY AND IDENTIFICATION.
A basic anatomical study of wood elements, their structural characteristics and function; identification of woods. Prerequisite, Botany 100. 2 class hours, 1 3-hour laboratory period. Mr. Hoadley.

202 (II). PRIMARY TIMBER CONVERSION.
Survey of operations, principally sawmilling, in the primary conversion of logs into lumber and allied by-products; drying, grading, handling and market distribution of sawmill products. Not open to students in Forest Management except by special permission. Mr. Rice.

203 (I). FOREST PRODUCTS.
A survey of the principal forest products, their manufacture and distribution. Mr. Gatslick.

204 (II). PROPERTIES OF WOOD.
The physical and mechanical properties of wood and their importance in wood utilization. Techniques for physical measurement and mechanical testing. Prerequisite, Wood Tech. 201. 2 class hours, 1 3-hour laboratory period. Mr. Hoadley.

206 (II). WOOD MACHINING TECHNOLOGY.
Fundamental principles of knife and sawtooth action as applied to problems of severing, surfacing, and shaping; general survey of commercial wood machining equipment. Several field trips. Prerequisites, Wood Tech. 201 and 204. 2 class hours, 1 3-hour laboratory period. Mr. Rice.

208 (I). WOOD SEASONING AND PRESERVATION.
Properties of wood in relation to drying and preservation; theory and practice of air seasoning, kiln drying, and preservative treatment. Several field trips. Prerequisite, Wood Tech. 204 recommended. 2 class hours, 1 3-hour laboratory period. Mr. Rice.

211 (I). WOOD ADHESIVE TECHNOLOGY.
Basic concepts, theories, and applied techniques of gluing wood and fibrous composites. Prerequisites, Wood Tech. 201 and 204. Organic Chemistry recommended. 2 class hours, 1 3-hour laboratory. Mr. McNamara.

212 (II). WOOD COATING TECHNOLOGY.
Basic concepts and applied techniques in wood substrate surface modification, including materials and methods for finishing wood and fibrous composites. Prerequisites, Wood Tech. 201 and 204. Organic Chemistry recommended. 2 class hours, 1 3-hour laboratory period. Mr. Gatslick.

238 (II). WOOD CHEMISTRY.
Introduction to the chemistry and surface phenomena of the principal products found in wood. Prerequisite, Organic Chemistry. Mr. McNamara.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). WOOD TECHNOLOGY SEMINAR.
Specialized study in a selected area of wood utilization and technology. For upperclassmen only.

WILDLIFE AND FISHERIES BIOLOGY

The first professional degree in Wildlife and Fisheries Biology is the master's degree; for this reason study toward the bachelor's degree should be regarded as a pre-professional program. Students who do not plan to enter graduate school are urged to meet with their advisers to select electives and plan their course of study accordingly.

WILDLIFE BIOLOGY

261 (I). PRINCIPLES OF WILDLIFE MANAGEMENT.
Fundamental ecology and principles of wildlife management. Emphasis on population characteristics and responses. 2 class hours, 1 4-hour laboratory period. Mr. Greeley.

262 (II). TECHNIQUES OF WILDLIFE MANAGEMENT.
Methods of collecting and interpreting data in wildlife management. Emphasis on field and laboratory experience in census methods and criteria for determining sex, age and other characteristics of wild birds and mammals. Prerequisite, elemen-

tary statistics. 2 class hours, 1 4-hour laboratory period. For Wildlife majors only.
Mr. Larson.

263 (I). MANAGEMENT OF WETLAND WILDLIFE (1972-73).
Life histories, identification, and habitat requirements of waterfowl and marshland furbearing animals; management of wetland habitats. Prerequisites, Wildlife Biology 261 or elementary ecology. 2 class hours, 1 4-hour laboratory period.
Mr. Larson.

264 (II). MANAGEMENT OF UPLAND WILDLIFE (1973-74).
Life histories, identification, and habitat requirements of upland game birds, game mammals, and furbearers; management of upland habitats. 2 class hours, 1 4-hour laboratory period. Mr. Greeley.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). WILDLIFE SEMINAR.
Specialized study in a selected area of wildlife biology or management. For upper level students only. Credit, 1-3.

399 (I), (II). SENIOR HONORS.
Credit, 6.

FISHERIES BIOLOGY

265 (I). TECHNIQUES OF FISHERIES BIOLOGY.
Principles and techniques of fishery management, stressing population and growth dynamics, and field procedures. Prerequisite, Zool. 300. Mr. Johnson.

267 (I). LABORATORY IN PRINCIPLES OF FISHERIES BIOLOGY.
Field techniques in fisheries biology; operation and use of fishery research and management equipment. Laboratory analysis of field-collected data. Concurrent enrollment in Fisheries Biol. 265. 1 4-hour laboratory. Credit, 1.

270 (II). ECOLOGY OF FISHES.
Biological response of fishes to the environment. Aspects of growth, speciation, zoogeography, schooling, homing, and population and community dynamics will be considered. Prerequisites, Fisheries Biol. 265 and Zool. 300 or permission of instructor. Mr. Johnson.

272 (II). INTRODUCTION TO MARINE FISHERIES.
Factors affecting world marine fisheries resources and development. Review of selected species of commercial importance and selected world fisheries. Prerequisites, Fisheries Biol. 265. 2 class hours, 1 4-hour laboratory. Several overnight field trips requiring Saturday attendance by arrangement; one oceanic field trip by arrangement. Mr. C. F. Cole.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I), 392 (II). FISHERIES SEMINAR.
Specialized study in a selected area of fisheries biology. For upper level students only. Credit, 1-3.

Hotel, Restaurant, and Travel Administration

Head of Department: Professor Donald E. Lundberg. Professor Eshbach; Adjunct Professor Tabler; Associate Professors Cournoyer, Fletcher, Lundy, Manning, McCullough, Wrisley. Instructor Johnson, Lecturers Grinnan, Stoneham.

All students are required to complete at least 800 hours of paid work experience in the hotel, restaurant, or travel field—or 400 hours of paid work experience and completion of HRTA 310 and HRTA 311. Students may elect a concentration of courses in one of these areas of study: Hotel Administration, Restaurant Administration, Travel and Tourism, or Institution Management. See the Departmental bulletin, *The Posskey*, for details.

100 (I), (II). INTRODUCTORY.
Hotel, restaurant, and travel operations. The development of the industry, current trends, and an analysis of the various types of operations that make up the industry. Mr. Lundberg.

102 (I). PERSONNEL MANAGEMENT IN HOTELS, RESTAURANTS, AND THE TRAVEL INDUSTRY.
The management of people in food service, hotels, and the travel industry; leadership and motivation, organization, training and management development, job analysis, wage and salary administration, and work simplification.
Mr. Cournoyer.

120 (II). TRAVEL AND TOURISM.
Travel: trends, travel-modes, economic impact on destination area. Tourism development and marketing. Prerequisite, HRTA 100 or permission of instructor.
Mr. Lundy.

130 (I), (II). SCHOOL FOOD SERVICE MANAGEMENT.
School food service administrative policy, funding, recordkeeping, personnel management, food production logistics, relationships with power groups, legislation, and current trends. Scheduled field trips. Prerequisites, HRTA 156, Accounting 120, Management 214 or other management course. Mrs. McCullough.

156 (I), (II). FOOD PRODUCTION MANAGEMENT I.
Basic principles of menu planning and the management of purchasing, food production, and service. 2 class hours, 1 3-hour laboratory. Mrs. McCullough.

168 (II). WINES AND SPIRITS IN FOOD SERVICE OPERATIONS.
The selection, pricing, merchandising, and service of wines and spirits in restaurants, clubs, and other food service operations. Factors in determining which wines should be offered in a particular food service operation. Recognition of better known wines, American and imported. 1 class hour. Credit, 1. Mr. Wrisley.

200 (I). MANAGERIAL ACCOUNTING FOR THE HOSPITALITY INDUSTRY.
Financial practices and systems used in hotels and restaurants. Controls, capital budgeting, operational budgeting, use and interpretation of financial statements, and specialized hotel accounting procedures. Prerequisite: course in accounting. Nonmajors require permission of instructor.
Mr. Wrisley.

201 (II). HOTEL, RESTAURANT AND TRAVEL LAW.
Laws as applied to hotel, food service establishments, and the travel industry; a consideration of bailments, contracts, torts, regulations, insurance, and sanitation. Mr. Cournoyer.

203, 204 (I). GUEST LECTURE SERIES.
Analysis of trends and practices by leaders of the hotel, restaurant and travel field. 1 class hour. Credit, 1.

300 (II). HOTEL AND RESTAURANT MERCHANDISING.
Market environment in which the firm operates; communication principles and their application to sales goals; and effective utilization of techniques and tools of merchandising in hotel, restaurant, and similar enterprises. For seniors: others by permission of instructor. Mr. Eshbach.

310 (I), (II). HOTEL SYSTEMS AND OPERATIONS.
Analysis and evaluation of hotel systems and operations. Emphasis on analytical techniques, systems, computer-assisted operations, and change-induced problems. Opportunity to participate in operations of Campus Center. Prerequisites, HRTA 102, 200, 211. 1 class hour, 2 2-hour laboratories. Mr. Grinnan.

311 (I), (II). FOOD AND BEVERAGE SYSTEMS AND OPERATIONS.
Analysis and evaluation of the food and beverage systems and operations. Emphasis on analytical techniques, systems, and operational decision-making within the food and beverage complex. Opportunity to participate in the food and beverage operations of the Campus Center. Prerequisites, HRTA 102, 200, 211. 1 class hour, 2 2-hour laboratories.

350 (I), (II). QUANTITY FOOD MANAGEMENT.
Management of food production in institutions, quality control, recipe standardization, portion and cost control, menu planning, and simplification. Prerequisite, HRTA 156. 2 class hours, 1 4-hour laboratory. Credit, 4. Mrs. McCullough.

351 (I). INSTITUTIONAL ADMINISTRATION.
Principles of organization, management, sanitation, food service planning, and equipment selection. Three field trips. Prerequisite, HRTA 130 or 156. 2 class hours, 1 4-hour laboratory.
Credit, 4. Mrs. McCullough.

367 (I), (II). FOOD PRODUCTION MANAGEMENT II.
Analysis of factors affecting food production in the food service industry, emphasizing maintenance of food quality and nutritive value. Evaluation of convenience foods, new food ingredients, and commercial equipment. Prerequisite, HRTA 156 or permission of instructor. 1 class hour, 1 4-hour laboratory.
Mr. Manning.

372 (II). QUANTITY FOOD PURCHASING.
Food distribution and merchandising processes as they relate to the purchasing of food for food service. Prerequisites, Accounting 110, Econ. 104.
Mrs. McCullough and Mr. Eshbach.

385, 386 (I), (II). SPECIAL PROBLEMS.
Examination of a special problem, to be arranged with a faculty member. Conferences by arrangement.
Credit, 1-6.

391. SEMINAR IN TRAVEL AND TOURISM.
The interaction between the broad area of the travel industry and its relationship to hotels, restaurants, and similar firms. Attention to management decisions made in this broader context. 2 class hours.
Credit, 2. Mr. Lundy.

392. SEMINAR ON LABOR RELATIONS PROBLEMS.
The labor relations problems peculiar to the hotel, restaurant, travel, and institutional management area. Attention to negotiation, grievances, and collective bargaining. 2 class hours.
Credit, 2. Mr. Bloodsworth.

393 (I). SEMINAR IN FOOD SERVICE PROBLEMS.
Reports and discussion of current research studies in food. Permission of instructor required. 1 to 3 class hours.
Credit, 1-3.

394 (II). SEMINAR IN INSTITUTION ADMINISTRATION.
Reports and discussions of current research studies in Institutional Administration. Permission of instructor required. 1 to 3 class hours.
Credit, 1-3. Mrs. McCullough.

395. SEMINAR.
Selected restaurant and hotel problems; seeks to develop analytical and decision-making abilities in management and operations. 2 class hours. *Credit, 2.*

396. SEMINAR.
Relationships between hospitality industry problems, trends, and developments, and the emerging problems and changes of society. 2 class hours. *Credit, 2.*

Landscape Architecture and Regional Planning (Environmental Design)

Acting Head of Department: Professor Paul N. Procopio. Professors Bacon, Costley, King, Mosher, Scheffey, Zube; Associate Professors Davis, Fabos, Greenbie, Hamilton, Kent, Martin; Assistant Professors Dines, Gluck, Kirley, Olson, Platt, Sears; Lecturers Braun, Jarm, Schwarz.

Three programs are available under the general curriculum in Environmental Design: Park and Open Space Administration, Pre-Landscape Architecture and Pre-Planning. In addition to the University core requirements, the student must satisfy the departmental requirements which consist of a total of 15 courses distributed among the following Subject Block Areas: History and Theory of Environmental Design, Planning and Design, Ecology & Plants, Man & Environment, Communication, and the student's Area of Concentration. The flexibility necessary to permit the student to pursue his particular area of interest is achieved by allowing selection of appropriate courses from the set of courses in each Subject Block Area. The minimum number of courses required from and the set of courses within each subject block area are as follows: four from History & Theory (ENV. DES. 241, 243, 244, 273, 347, 348); two from Planning & Design (ENV. DES. 221, 274, 328, 368), two from Ecology & Plants (Botany 121, 126, 221, 226, ENV. DES. 235, 236, Forestry 112); two from Man & Environment (ENV. DES. 305, Geography 155, Sociology 251, 261, 266, Zoology 176); two from Communication (Art 102, 230, English 331, 334, 337, ENV. DES. 212, 315, Speech 201, 202, 204) and three from Area of Concentration (ENV. DES. 231, 263, 264, 353, 356, 367, 377, 378). Selection of appropriate courses is made with faculty assistance.

140 (II). VISUAL AWARENESS OF THE PHYSICAL ENVIRONMENT (D).
A survey course intended to improve the ability to perceive, understand and discuss the physical/visual environment, its use and its problems. Concentrates on the breadth rather than the depth of environmental complexity and deals with different environments, their component parts, processes and problems. Emphasizes an expanded consciousness of environment and a developed, directed and focused concern. Outlines or delimits courses of citizen action. 2 class hours, 1 discussion period.

212 (II). GRAPHIC COMMUNICATION I.
The theories of projection as related to graphic communication. Prerequisite, Env. Des. 221. 1 class hour, 6 studio hours.
Credit, 4.

221 (I). BASIC DESIGN.
Principles of two- and three-dimensional design and their relationship to the designed human environment. 4 2-hour studio periods. *Credit, 4.*

231 (I). PRINCIPLES OF ARBORICULTURE.
Maintenance of shade and ornamental trees. Development of municipal and private shade tree programs. 2 class hours, 1 2-hour laboratory period.

235 (I), 236 (II). PLANT MATERIALS.
Introduction to trees, shrubs and other plant material useful in landscape plantings. Prerequisite, Botany 100 or 101. 1 class hour, 2 2-hour laboratory periods.
Credit, 3 per semester.

241 (I). HISTORY AND PHILOSOPHY OF PARKS.
The historical, social and economic development of parks. Initial investigation of the philosophy of private, municipal, county, state and national parks.

243 (I). HISTORY AND THEORY.
A broad survey of the history of the designed human environment; from the origins of human society to the Renaissance.

244 (II). HISTORY AND THEORY.
A broad survey of the history of the designed human environment; the Renaissance to the present. 2 class hours, 1 discussion period. Can be elected independently of 243.

263 (I). PARK ADMINISTRATION.
Analysis of park policies and procedures at the several governmental levels.

264 (II). PARK MANAGEMENT AND OPERATION.
The principles and purposes of operational and maintenance practices. Selection and adaptability of maintenance equipment by field inspection. Field trip required.

273 (I). CITY PLANNING HISTORY.
The historical aspects of changing land uses, the evolution of community form and the development of urban areas.

274 (II). CITY PLANNING.
Planning techniques and legal tools for guidance and control of contemporary urban and metropolitan development. Special problems of land use, housing, transportation, and related urban elements. Can be elected independently.

305 (I). THE DYNAMICS OF HUMAN HABITATIONS.
The complex interactions between man and his physical environment. Borrows information and viewpoints from psychology, sociology, biology, ecology, ethology, art, architecture, and planning in an attempt to locate and demonstrate fundamental organizing principles in the human perception and use of space, and its effect on interpersonal relations.

315 (I). GRAPHIC COMMUNICATION II.
Current techniques used in the graphic communication of the analysis and solution of environmental design problems; and the development of facility in the use of various media. Prerequisite, Env. Des. 212. 1 class hour, 6 studio hours.
Credit, 4.

328 (II). APPLIED DESIGN.
The development of an approach embodying the application of theory and design principles to the solution of environmental design problems. Prerequisites, Env. Des. 347. 1 class hour, 6 studio hours.
Credit, 4.

347 (I). THEORY.
Natural factors which influence environmental planning and site development. Influences of climate, land form, soil, water and vegetation. 2 class hours, 1 discussion period.

348 (II). THEORY.
Theories and techniques relevant to the analysis of design problems. Functional requirements. Consideration of human needs and responses to the designed environment. 2 class hours, 1 discussion period.

353 (I). LAND FORM.
Studies in the manipulation of land surfaces and its graphic representation through topographical plans, cross sections, profiles and models. Prerequisite, Env. Des. 212. 2 class hours, 1 2-hour laboratory period.

356 (II). CONSTRUCTION MATERIALS.
The materials used in landscape construction, their design potential and limitations.

367 (I). PARK FISCAL AND PERSONNEL MANAGEMENT.
Evaluation of the methods utilized in the preparation, presentation and justification of the financial and personnel requirements of municipal, county, state and national parks.

368 (II). OPEN SPACE PLANNING AND DESIGN.
The relationship of open space planning to city and regional planning; the various functions of open space; the problems of planning and designing parks and recreation areas to satisfy varying needs. 2 2-hour lecture/seminar periods.

377 (I). URBAN PROBLEMS I.
Survey and analysis of planning issues confronting communities, particularly in their regional implications. Specific issues include housing and urban blight, exclusionary zoning and relocation of industry. Prerequisite, Env. Des. 274, or permission of instructor.

378 (II). URBAN PROBLEMS II.
A continuation of Env. Des. 377; can be elected independently. Specific planning issues include fiscal and taxation problems, administrative organization, local participation in the planning process, and transportation, each with emphasis of their regional considerations. Prerequisite, Env. Des. 274, or permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

RELATED COURSE:
Leisure Studies and Services 361 (I). Introduction to Outdoor Recreation.

Plant Pathology

Head of Department: Professor Richard A. Rohde. Professors Gilgut, Holmes, McKenzie; Associate Professor Agrios; Assistant Professor Mount.

251 (I). GENERAL PLANT PATHOLOGY.
The causes, nature and control of plant diseases. Mechanisms, biochemistry and genetics of plant disease induction, development and control. Prerequisite, a course in botany. 2 class hours, 1 3-hour laboratory period. Mr. Agrios.

269 (I). FOREST AND SHADE TREE PATHOLOGY.
The nature, cause and control of principal types of disease in trees, including decay of forest products, and of standing and structural timbers. 2 class hours, 1 3-hour laboratory period.

340 (I). GENETICS OF PLANT-PATHOGEN INTERACTION.
Characterization of genetic factors which control plant disease reaction and virulence. Includes the influence of environment on genetic stability of pathogens, mutations and parasexuality as a factor in pathogenic variation, and plant population genetics in relation to disease development. Prerequisite, Plant Path. 251 or permission of instructor.
Mr. Mount.

361 (I). PLANT VIROLOGY.
Structure and properties of plant viruses. Virus transmission. Virus infection and synthesis. Symptomatology and physiology of virus infected plants. Assay and purification of plant viruses. Identification and control of plant viruses. Prerequisite, Plant Path. 251 or permission of instructor. 3 class hours, 1 3-hour laboratory period. Credit, 4. Mr. Agrios.

378 (I). NEMATOLOGY.
Anatomy, morphology, and classification of plant-parasitic and other soil-inhabiting nematodes, parasitic relationships with plants and principles of control. Prerequisite, a year of biological science. 3 class hours, 1 3-hour laboratory period.
Credit, 4. Mr. Rohde.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Plant and Soil Sciences

Head of Department: Professor F. W. Southwick. Professors Boicourt, Colby, Drake, Gunner, Havis, Lachman, Lord, Maynard, Thomson, Troll, Vengris, Weeks; Associate Professors Baker, Barker, Bramlage, Goddard, Marsh, Rosenau, Stewart, Zak; Assistant Professors Anderson, Carrow, Emino, Greene, Jennings.

100 (II). BASIC PLANT SCIENCE (E).
Some important structural features, physiological principles, and environmental factors related to the growth and development of economic crops. 2 class hours, 1 2-hour laboratory period.
Mr. Jennings, Mr. Maynard.

105 (II). SOILS.
Fundamentals of soil science covering development, properties and management of soils and the interrelationship of soils to plant growth. 2 class hours, 1 2-hour laboratory period. Mr. Zak.

110 (I). PLANT PROPAGATION.
The science of plant reproduction. 2 class hours, 1 2-hour laboratory period.
Mr. Goddard.

115 (I). THE PLANT ENVIRONMENT AND CROP PRODUCTION (E).
Important environmental factors affecting plant growth and development, the interrelationships which exist between these factors and plants, and the effects resulting from environmental modification attributable to man's activities.
Mr. Rosenau, Mr. Jennings.

120 (II). ORGANIC FARMING AND GARDENING (E).
Basic principles of plant nutrition and culture, soil fertility and management by organic methods, biological and natural control of insect pests, weeds and plant diseases, variety selection, and alternative chemical methods. 2 class hours, 1 2-hour laboratory and discussion period.
Mr. Barker.

200 (I). DECIDUOUS ORCHARD SCIENCE.
The physiological and nutritional principles upon which deciduous tree fruit production is based. Responses of the plants to environmental influences and cultural practices. 2 class hours, 1 2-hour laboratory period. Mr. Anderson.

205 (I). SMALL FRUIT TECHNOLOGY.
Basic principles underlying the production of small fruits. 2 class hours, 1 2-hour laboratory period. Mr. Anderson.

210 (II). RETAIL FLORAL DESIGN.
Basic principles of design as applied to commercial floral arrangements. Non-majors excluded without special permission. 2 3-hour laboratory periods.
Mr. Boicourt.

215 (II). FLORICULTURAL SCIENCE.
The science and art of this phase of horticulture for non-majors. 2 class hours, 1 2-hour laboratory period. Mr. Emino.

220 (II). PHYSIOLOGY OF GREENHOUSE CROPS.
Fundamentals of the artificial environment of greenhouses as they influence the vegetative and reproductive growth of plants. 2 class hours, 1 2-hour laboratory period. Mr. Rosenau.

225 (I). PRINCIPLES OF VEGETABLE CROPS.
Factors influencing the growth and culture of vegetable plants. 2 class hours, 1 2-hour laboratory period. Mr. Maynard.

230 (I). PLANT NUTRITION.
The accumulation and transport of inorganic ions in plants and their function in plant metabolism. 2 class hours, 1 2-hour laboratory period. Mr. Maynard.

235 (I). TAXONOMY OF ECONOMIC PLANTS.
Plant families, genera, species and cultivars of importance in the horticultural and agronomic fields. 2 class hours, 1 2-hour laboratory period. Mr. Boicourt.

240 (II). PLANT BREEDING.
Improvement of horticultural crops using established genetic principles and methods. Prerequisite, Zoology 240 or equivalent. 2 class hours, 1 2-hour laboratory period. Mr. Lachman.

245 (II). POST-HARVEST PHYSIOLOGY.
The physical and chemical processes of plants before and after harvest and the influence of environmental, chemical, and storage factors on these processes. 2 class hours, 1 2-hour laboratory period. Mr. Bramlage.

250 (II). FORAGE AND FIELD CROPS.
Analysis of the principles involved in the establishment, fertilization, and harvest management of forage and field crops. 2 class hours, 1 2-hour laboratory period. Mr. Colby.

255 (I). AGROSTOLOGY.
The establishment and maintenance of turf grasses used on lawns, athletic fields, highways, airports, cemeteries and turf nurseries. 2 class hours, 1 2-hour laboratory period. Mr. Troll.

260 (I). ECOLOGY AND CONTROL OF WEEDS.
Identification and ecology of common weeds and principles of weed control with emphasis on the use of chemical herbicides. 2 class hours, 1 2-hour laboratory period. Mr. Vengrisi.

265 (I). SOIL FORMATION AND CLASSIFICATION.
The development and classification of soils as related to physical, chemical, biological, climatic and geological factors. 3 class hours, 1 2-hour laboratory period. *Credit, 4.* Mr. Weeks.

270 (II). SOIL PHYSICS.
Physical properties of soils including water retention and movement, soil air and temperature microclimatology, soil texture and structure; their measurements, evaluation and influence in soil systems. Prerequisite, Plant and Soil Sci. 105, Physics 103-104 or their equivalents. 2 class hours, 1 3-hour laboratory period. Mr. Stewart.

275 (I). SOIL CHEMISTRY.
The inorganic and organic chemical reactions related to the nutrient supply in soils and soil nutrition of plants. Colloidal aspects of soil chemical reactions and soil-plant mineral relationships. Prerequisites, Chem. 127 and Plant and Soil Sci. 265 or equivalents. 2 class hours, 1 3-hour laboratory period. Mr. Baker.

280 (II). SOIL-PLANT MINERAL NUTRITION.
Mineral nutrition in the growth of plants; the use and interactions of fertilizers and other soil amendments; soil reaction; mineral deficiencies and toxicities in plants. 2 class hours, 1 2-hour laboratory period. Mr. Drake.

285 (II). MICROBIOLOGY OF THE SOIL.
Soil microorganisms; their distribution, ecology and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium. Prerequisite, Microbiol. 250 or permission of instructor. 2 class hours, 1 3-hour laboratory period. Mr. Gunner.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390 (I). SEMINAR.
Review of literature in the plant and soil sciences. *Credit, 2.* Mr. Maynard.

Veterinary & Animal Sciences

Head of Department: Professor T. W. Fox. Professors Anderson, D. Black, W. Black, Damon, Smith, Smyth; Associate Professors Borton, Grover, Howe, Smyser, Weinack; Assistant Professors Denison, Duby, Lyford, Marcum.

The Department of Veterinary and Animal Sciences offers a program of study in the animal sciences. All students are expected to take Animal Science 121, 219, 220, 330, 334, 321, 308, 255, an animal management course and Microbiology 140. The curriculum provides for an important degree of flexibility depending upon the students' interests and ability.

Pre-veterinary students in the College of Food and Natural Resources major in animal science as freshmen. Students completing two semesters of academic work with a satisfactory cumulative average (2.5) may apply to the pre-medical advisory committee in their third semester for entrance into the pre-veterinary curriculum. Such students are counseled in the Department of Veterinary and Animal Sciences.

121 (I). INTRODUCTORY ANIMAL SCIENCE.
Modern animal and poultry science and the many scientific disciplines it encompasses. The poultry, dairy, meat, recreational and laboratory animal industries in terms of national and world economics and their role in serving mankind. 2 class hours, 1 2-hour laboratory. Mr. Borton.

150 (I), (II). RIDING, BEGINNER I.
Grooming the horse, saddling, bridling, mounting, position in the saddle, control of the horse, walking and trotting, (sitting and rising), developing exercises. *Credit, 1.*

151 (I), (II). RIDING, BEGINNER II.
Perfecting skills in Beginner I, developing exercises, rising on the diagonal, ring figures, beginning canter. Prerequisite, performance of skills in Beginner I. Permission of instructor required. *Credit, 1.*

152 (I), (II). RIDING, INTERMEDIATE I.
Review of basic skills. Working without stirrups at the trot and canter, beginning jumping and cavaletti work. Prerequisite, Beginner I or II or previous formal instruction. Permission of instructor required. *Credit, 1.*

153 (I), (II). RIDING, INTERMEDIATE II.
Detailed work at the canter, ring figures at the trot and canter with and without stirrups, jumping position and exercises over fences. Prerequisite, proficiency in skills taught at lower levels plus previous formal instruction. Permission of instructor required. *Credit, 1.* Miss Jaskiel.

154 (I), (II). RIDING, ADVANCED.
Achievement of greater unison between rider and horse. Individual problems, elementary dressage and intermediate jumping. Development of know-how and flexibility to ride any type of horse. Prerequisite, proficiency in all skills through Intermediate II. Previous formal instruction. Permission of instructor required. *Credit, 1.* Miss Jaskiel.

155 (I, II). SPECIAL PROBLEMS IN RIDING.
Permission of instructor required. *Credit, 1.* Miss Jaskiel.

219 (I). INTRODUCTORY ANIMAL PHYSIOLOGY.
The presentation of homeostatic circuits available to the living body; such as fluid, gaseous, neural, muscular and specialized integrated mechanisms. 2 class hours, 1 2-hour laboratory. Mr. Howe.

220 (II). SYSTEMIC ANIMAL PHYSIOLOGY.
A comparative study of the organ physiology of mammals and birds. Emphasis on those aspects most pertinent to animal science. 3 class hours, 1 3-hour laboratory. *Credit, 4.* Mr. Howe.

256 (II). LIVESTOCK MANAGEMENT.
Beef, sheep and swine production in New England and the United States. Field trips cost $5-$10. 3 class hours, 1 2-hour laboratory. *Credit, 4.* Mr. Borton.

308 (II). COMPARATIVE ANIMAL GENETICS.
The mechanisms of heredity and variation in livestock and poultry; the role of selection and breeding systems in genetic improvement and their evaluation. Prerequisite, Zool. 240. Mr. Fox.

321 (I). PHYSIOLOGY OF REPRODUCTION.
Comparative aspects of anatomy, embryology, endocrinology and physiology of reproduction and lactation. 3 class hours, 1 2-hour laboratory period. *Credit, 4.* Mr. W. Black.

330 (I). PRINCIPLES OF ANIMAL NUTRITION.
Scientific principles of nutrition in both ruminants and nonruminants. Mr. Anderson.

334 (II). APPLIED ANIMAL NUTRITION.
Application of scientific principles of

nutrition to practical feed formulation and feeding systems for poultry and livestock. Prerequisite, Animal Science 330. 1 class hour, 2 2-hour laboratory periods. Mr. Anderson.

353 (I). POULTRY MANAGEMENT. Principles of poultry business management. A comprehensive view of all phases of the poultry industry. Field trips cost $10-$15. 2 class hours, 1 2-hour laboratory. Mr. Grover.

354 (II). DAIRY HERD MANAGEMENT. Dairy cattle and milk production in New England and the United States. Managerial problems concerned with successful dairying. Field trips cost $10-$15. 2 class hours, 2 2-hour laboratory periods. Credit, 4. Mr. Duby.

358 (I). LIGHT HORSE MANAGEMENT. An introduction to the breeds, feeding, training, care and management of the horse. Lab fee $5-$10 covers cost of field trips. Open to all University students. 1 class hour, 1 2-hour laboratory. Credit, 2. Mr. Borton.

359 (II). LIGHT HORSE SCIENCE. An advanced course in the nutrition, physiology, genetics, reproduction and health of the horse. Limited to Animal Science majors or by permission. Lab fee $5-$10. 2 class hours, 1 2-hour laboratory. Mr. Borton.

361 (I). INTERMEDIATE BIOMETRY. Emphasis on design of experiments conducted in the biological sciences. Methods of analysis of such designs, expectations of mean squares, selection of appropriate error terms, individual and multiple comparison, and trend analyses. Prerequisite, introductory course in biometrics, or statistics, such as Stat. 121. Mr. Damon.

362 (II). ADVANCED BIOMETRY. Analysis of data with disproportionate subclass numbers; includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses. Prerequisite, An. Sci. 361. Mr. Damon.

370 (II). ANIMAL PATHOLOGY. An introduction to the study of animal diseases. The causes, development, transmission and control, with application to diseases of animals which are of economic and/or public health importance. Prerequisites, Microbiol. 140 or Zool. 135 or An. Sci. 219. Mr. Smith.

385, 386. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

390 (I). JUNIOR SEMINAR. Review of current literature in Animal Science. Credit, 1.

391 (II). SENIOR SEMINAR. Review of current literature in Animal Science. Credit, 1.

SCHOOL OF HOME ECONOMICS

William J. Mellen, *Acting Deon*
Winifred I. Eastwood, *Director, Head of Extension Division for Home Economics*

PLEASE NOTE: The various curricula of the School of Home Economics are undergoing revision and are expected to be changed greatly in the near future. Please consult the School for changes currently planned in the program in which you are interested.

Home Economics Education

Head of Department: Associate Professor Helen R. Vaznaian; Professor Merchant; Assistant Professors Meeks, Sullivan.

In the fall of 1971, the areas of Home Economics Education, Cooperative Extension, and Management and Family Economics were integrated as one department, an effort to expand opportunities in community service education.

MAJOR IN HOME ECONOMICS EDUCATION

	Credits
I. University Core Requirements (Psych 101, Sociol 101 and Econ 100 are recommended for the D requirement)	33
II. Physical Education	2
III. School of Home Economics Core (H.Ec. 151, 152)	6
IV. Social Problem Orientation: 3 courses directed toward one social problem; choices will come mainly from the social science area but are not restricted to this.	9
V. Humanities Orientation: 3 courses in one chosen area. University core requirements may be used to help fulfill this.	9
VI. Departmental Major 30 credits with a minimum of 5 courses from one department in the School, 2 courses from two others, and one from the fourth.	30
VII. Professional Options	
A. *Consumer Economics Option*	
1. Professional Electives	15
HEEd. 211, Economic Problems of the Family	
HEEd. 212, Consumer Economics	
HEEd. 310, Legal Aspects of Consumer Interest	
HEEd. 215, The Consumer and Economic Problems	
Econ 345, Economics of Human Resources	
HEEd. 389, Field Study	
2. Electives	16
Total Credits	120

(*Note:* The professional electives may overlap with the departmental major requirements, thus increasing the number of electives.)

B. *Community Services and Extension Option*
This major permits individualization in the programming of studies offered at the University. Its major thrust is towards the future goals of the student in preparation for participation in the helping professions associated with community service.

	Credits
1. Professional Electives	15
HEEd. 381, Adult Education in Home Economics	
HEEd. 371, Community Resources & Services	
HEEd. 389, Field Study	
Selected Electives	
2. Electives	16
Total Credits	120

C. *Home Economics Education Option*

	Credits
1. Departmental major increased by 15 additional credits, resulting in a total as follows:	15
a. A minimum of six courses in one department	
b. At least four courses in two other departments	
c. At least one course in the remaining department.	

Suggested patterns of courses—select one of the following:

	1	or 2 or 3
Human Development	18 hrs. 12	12
Textiles, Clothing & Environmental Arts	12 18	12
Nutrition and Food	12 12	18
Home Economics Education (Community Services)	3 3	3

2. *Professional Teacher Certification*	16-25
Psych 301, Educational Psychology	
Educ 251, Foundations of Education	
HEEd. 382, Curriculum and Methods in Home Economics (4)	
Educ 285, Observation & Student Teaching (6-15)	
Total Credits	120-129

211. ECONOMIC PROBLEMS OF THE FAMILY. Personal finance at various income levels and during different stages of the life cycle.

212. CONSUMER ECONOMICS. Application of macro- and micro-economic theories and concepts to an understanding of consumer demand within a market economy, income distribution, consumer spending and saving.

215. THE CONSUMER AND ECONOMIC PROBLEMS. Contemporary economic problems as they affect families. Affluence and poverty, fiscal policies, delivery of public goods.

220. THEORY AND APPLICATION OF MANAGEMENT.
Interrelationships in management and decision-making of family values, goals, and circumstances; use of human and material resources for maximum economy, satisfaction and family well-being.

260. HOUSEHOLD EQUIPMENT.
Physical principles, construction, materials, and economic considerations underlying selection, use and care of household equipment. 2 class hours, 1 2-hour laboratory period.

274. CONSUMER ATTITUDES AND DEMAND.
The motives, attitudes, and expectations of consumer behavior as influencing variables operating within and on the market. Prerequisites, Econ 100, Psych 101, Sociol 101, or permission of instructor.

310. LEGAL ASPECTS OF CONSUMER INTEREST.
Consumer protection as afforded the consumer in the market by Federal, State and private agencies and recent court decisions. Protections which should be afforded the consumer, legal and otherwise.

320. RESOURCE MANAGEMENT FOR EXCEPTIONAL FAMILIES.
Special managerial problems faced by families with exceptional imbalances in resources. Analysis of techniques of compensating for resource limitations in families in poverty, with health handicaps, with young mothers in the labor force, one-parent families, student couples, and retired couples.

371. COMMUNITY ORGANIZATIONS AND SERVICES.
An experience of short-term reciprocity between theory and practice emphasizing the principles, methods and problems of community planning to meet a diversity of human needs. Personnel and recipient attitudes, agency relationships, public and private agency roles and responsibilities and contemporary movement.

381. ADULT EDUCATION IN HOME ECONOMICS.
Philosophy and principles of adult education, and the community and organizational factors affecting their development. Field trips include observation of adult education programs in community organizations and agencies.

382. CURRICULUM AND METHODS IN HOME ECONOMICS.
Organization, scope and sequence of learning experiences in home economics education. Philosophy and content of curriculum, development or resource units, and methods of teaching. Prerequisites, Psych 301, 263, and Educ 251. 4 class hours. Credit, 4.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

389. FIELD STUDY. Credit, 1-15.

390-392. SEMINAR IN HOME ECONOMICS EDUCATION.
Reports and discussion of current research studies in Home Economics Education. 1-3 class hours. Credit, 1-3.

Human Development

Head of Department: Professor Ellis G. Olim. Professor Burroughs; Associate Professor Collard; Assistant Professors Craig, Forman, Karlson, Schumacher, Turner; Instructor Dumas.

MAJOR IN HUMAN DEVELOPMENT

	Credits
General Education	30
Physical Education	2
Pre-Professional	12
Human Development Core Courses	6
Additional Requirements for Major	18
Additional courses required for graduation (Professional and Electives)	52
Total Credits	120

I. General Education — Credits
- Rhetoric 6
- One (C) Philosophy course OR History 100 or 101 3
- Two additional Humanities (C) courses 6
- Zoology 101, Introductory (E) 3
- Two additional Natural Science or Mathematics (E) courses 6
- Psychology 101, Elementary (D) 3
- Anthropology 104, Intro. to Cultural Anthropology (D) 3

II. Pre-Professional
- Psychology 270, Personality (D) OR Human Development 360 3
- Psychology 325, Abnormal (D) 3
- Two Sociology courses 6

III. Human Development Core Courses
- HD 270, Child Development 3
- HD 370, Human Development in Adolescence & Young Adulthood 3

IV. Major Requirements
Human Development majors are required to take a minimum of 24 semester hours of credit. Core courses (see III above) are counted toward the 24-hour requirement. Also, Human Development courses listed in V below may be counted toward the 24-hour requirement as well as any other courses described below in the description of courses.

V. Teacher Certification Requirements
- HD 272, Observational Child Study 3
- HD 381, Laboratory School Management 3
- HD 382, Philosophy and Theories of Early Childhood Education 3
- HD 383, Student Teaching 3-6
- HD 384, Internship in a Child-Serving Profession 3
- TCEA 230, Art for the Young Child 3
- Education 251, Foundations of Education 3

VI. Special Professional and Educational Programs
Special programs may be arranged. Students may elect a semester or two of study at the Merrill-Palmer Institute of Human Development. Please consult the Department for information on other special programs.

VII. Electives
Students shall elect an additional number of courses to bring the total credit hours to at least 120.

270. CHILD DEVELOPMENT.
The child from the development point of view. Interaction of heredity and environment on development. Prerequisites, Sociol 101, or Psych 101, or permission of instructor.

272. OBSERVATIONAL CHILD STUDY.
Directed experience in observation techniques with laboratory school children. Prerequisite, HD 270 or equivalent.

300. HUMAN DEVELOPMENT IN INFANCY.
Development of the infant from birth to age two. Prerequisite, HD 270, or permission of instructor.

310. LANGUAGE AND COGNITIVE DEVELOPMENT.
Language and cognition from the developmental point of view. The relationship between language and thought and changes in the relationship in the course of cognitive growth. Prerequisite, HD 270 or equivalent.

315. CROSS-CULTURAL STUDY OF PERSONALITY DEVELOPMENT.
Personality development viewed cross-culturally. Prerequisite, HD 270, or permission of instructor.

350. RESEARCH METHODS IN HUMAN DEVELOPMENT.
Introduction to methods of studying human development. Prerequisite, HD 270 or equivalent; may be taken concurrently with HD 270.

360. THEORIES OF HUMAN DEVELOPMENT.
Major theories devised to explain human development. Emphasis on psychological theories and concepts. The relevance and relationship of biological, social, and anthropological concepts. Prerequisite, HD 270 or equivalent.

370. HUMAN DEVELOPMENT IN ADOLESCENCE AND YOUNG ADULTHOOD.
Human development during the second decade of life. Emphasis on biological, psychological, and sociological aspects. Theories of adolescent development. Prerequisite, HD 270 or equivalent, or permission of instructor. Open only to Human Development majors.

375. THE GHETTO FAMILY.
Family relationships and styles of life of lower socio-economic status families. Emphasis is on social and psychological factors that influence interpersonal relationships and life strategies among the poor. Prerequisite, HD 270, or permission of instructor.

376. ALTERNATE FAMILY STYLES.
Study and comparative evaluation of the traditional nuclear monogamous family and alternative family structures developed in this society.

380. HUMAN DEVELOPMENT IN ADULTHOOD.
Human development from young adulthood through old age. A social, psychological perspective of change across the adult life span. Prerequisite, HD 270 or equivalent, or permission of instructor.

381. LABORATORY SCHOOL MANAGEMENT.
Principles and methods of early childhood education. Teaching methods and curriculum planning for two- to five-year-old children. Prerequisite, HD 270 or equivalent.

382. PHILOSOPHY AND THEORIES OF EARLY CHILDHOOD EDUCATION.
Philosophy, theories and history of early childhood education. Field trips. Prerequisite, HD 381 or permission of instructor.

383. STUDENT TEACHING.
Students plan, direct, and teach curriculum in the laboratory school under staff supervision. Prerequisite, HD 270.
Credit, 3-6.

384. INTERNSHIP IN A CHILD-SERVING PROFESSION.
Teaching or work with normal or exceptional children, Head Start children, or the emotionally disturbed. Prerequisite, HD 270 or permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

389. FIELD STUDY. *Credit, 1-15.*

391-397. SEMINAR IN HUMAN DEVELOPMENT.
Reports and discussion of current research topics and studies in Human Development. 1-3 class hours. *Credit, 1-3.*

Nutrition and Food

Head of Department: Peter L. Pellett.

Professor Wright; Associate Professors Beal, Bert, D. Davis; Assistant Professor Weatherholtz.

MAJOR IN NUTRITION AND FOOD

	Credits
I. General Education	
Humanities, Fine Arts and Communications: Three "C" courses	9
Rhetoric: Two "B" courses—One must be Rhet 100 or 110	6
Substitute for either 100 or 110 may be Rhet 140, 145, 160, 165, or 170	
Social/Behavioral:	
Econ 100, Elements of	3
Psych 101, General	3
Sociol 101, Introduction	3
Natural Sciences:	
Zool 101, Introduction to Zoology	3
Zool 135, Physiology	3
Microbiol 250 or 140/141	4
Chem 111/112	6
H.Ec. 151, 152, Basic Concepts of Human Development	6
II. Departmental Requirements	
Statistics 121, Elementary	3
Chem 160/162, Organic	4
Biochem 220, Elementary	4
NF 240, Basic Nutrition	3
NF 241, Methods of Nutrition Research (Lab.)	2
NF 340, Nutrition in the Life Cycle	3
NF 342, Community Nutrition	3
NF 343, Nutritional Problems in the U.S.	3
NF 390, Seminar in Nutrition	1-3
III. Professional Options	
A. Human Nutrition	
Chem 127, Analytical Chemistry	3
Fd Sci 352, Food Chemistry	3
Fd Sci 361, Food Processing	3
Fd Sci 371, Food Analysis	3
NF 344, Nutritional Problems in Developing Nations	3
NF 391, Seminar in Food	1-3
B. Community and Public Health Nutrition	
NF 342, Community Nutrition	1-3
NF 344, Nutritional Problems in Developing Nations	3
NF 345, Nutrition in Disease	3
Pub Hl 301, Prin. Comm. Health Educ.	4
Pub Hl 378, Prin of Epidemiology	3
Pub Hl 383, Intro. to Pub. Health Practice	4
Pub Hl 384, Org. and Adm. Pub. Health Programs	4
C. Dietetics	
NF 210, Meal Management & Scien. Food Prin.	3
HRTA 350, Quantity Food Management	4
HRTA 311, Institutional Administration	4
NF 312, Experimental Foods	3
HRTA 372, Quantity Food Purchasing	3
NF 345, Nutrition in Disease	3
NF 391, Seminar in Food	1-3
Mgt. 214, Personnel Management	3
Acctg. 120, Intro. to Accounting	3
D. Foods in Business	
NF 210, Meal Management & Scien. Food Prin.	3
NF 391, Seminar in Food	1-3
HEEd. 274, Consumer Attitudes & Demands	3
HEEd. 211, Economic Problems of the Family	3
Mktg. 201, Fundamentals of Marketing	3
JS 201, Intro. to Mass Communication	3
Speech 223, Program Process in Television	3
NF 312, Experimental Foods	3
E. Computerization in Nutrition and Food Service	
NF 210, Meal Management & Scien. Food Prin.	3
NF 360, Adv. Meth. of Computerization in Nutrition and Food Service	3
NF 391, Seminar in Food	1-3
Mgt. 110, Intro. Computers for Business	3
Math 110, Elem. Techniques of Math	3
Math 115, Elem. Linear Algebra	3
IV. Extra electives depending on option	22-32
V. Physical Education	2
Total Credits	122

140. MAN AND NUTRITION.
Fundamentals of nutrition and its role in contemporary life. Development of man's food habits encompassing psychological, social, racial, economic and geographical factors. Not for Nutrition and Food or Nursing majors.

210. MEAL MANAGEMENT AND SCIENTIFIC FOOD PRINCIPLES.
Meal management with emphasis on the nutritional, economic, time, ethnic, and cultural factors. Experimental application of the chemical and physical properties of food in food preparation. Prerequisite, Chem 112 or equivalent. 2 class hours, 1 3-hour laboratory period.

240. BASIC NUTRITION.
The basic principles of nutrition. The nutrients: energy, protein, vitamins, minerals and water, and their chemical and physiological roles in metabolism.

241. METHODS OF NUTRITION RESEARCH.
Laboratory study of methods available for assessment of nutritional status and the intakes of nutrients. Prerequisite, NF 240. 2 3-hour laboratory periods. *Credit, 2.*

312. EXPERIMENTAL FOODS.
Fundamental principles of food quality evaluation; development of independent

research problems. Prerequisite, NF 210, Chem 160 or permission of instructor. 1 class hour, 2 3-hour laboratory periods.

340. NUTRITION IN THE LIFE CYCLE. Nutritional needs at various stages in the life cycle; i.e., pregnancy and lactation, infancy, childhood, adolescence, adult life and the aged. Prerequisite, NF 240 or permission of instructor.

342. COMMUNITY NUTRITION. Community response through its agencies and institutions, public, private and voluntary, in providing nutrition care services and education. Prerequisite, NF 340 or permission of instructor. Lecture and field studies. Given alternate years. *Credit, 1-3.*

343. NUTRITIONAL PROBLEMS OF THE UNITED STATES. The factors within the developed countries, especially the United States, resulting from and causing malnutrition. Obesity, coronary heart disease, diabetes, alcoholism, food fads and quackery, food additives and unintentional residues. Prerequisite, NF 340 or permission of instructor.

344. NUTRITIONAL PROBLEMS OF DEVELOPING NATIONS. Malnutrition as it exists in developing nations and its socio-economic background. Protein-energy malnutrition in childhood, famine, vitamin and mineral deficiency diseases and the relationships with diets as consumed in such regions. Consideration of the synergism between nutrition and infection and the role of international agencies in fighting malnutrition. Prerequisite, NF 340 or permission of instructor.

345. NUTRITION IN DISEASE. Physiological basis for therapeutic diets in certain diseases. Current medical and nutrition literature used. Prerequisite, NF 340, Biochem 220, Zool 135, or permission of instructor. Given alternate years.

360. ADVANCED METHODS OF COMPUTERIZATION IN NUTRITION AND FOOD SERVICE. The mathematical foundations of computations with food nutrient and recipe data. The data file structure of computerized food and nutrient accounting systems. The principle of mathematical optimizations techniques and its utilization in computerized menu planning and scheduling models. Laboratory work with computer applications. Prerequisite, NF 340, Mgmt 110 and Math 115 or equivalents.

385. SPECIAL PROBLEMS IN FOOD. Individual study of selected problems for qualified students. By arrangement with members of the department. *Credit, 1-3.*

386. SPECIAL PROBLEMS IN NUTRITION. Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

389. FIELD STUDY. *Credit, 1-15.*

391. SEMINAR IN NUTRITION. Reports and discussion of current research studies in nutrition. Prerequisite, permission of instructor. *Credit, 1-3.*

392. SEMINAR IN FOOD. Reports and discussion of current research studies in food. Prerequisite, permission of instructor. *Credit, 1-3.*

Textiles, Clothing and Environmental Arts

Head of Department: Professor Arnold Friedmann. Professor Niederpruem; Associate Professors V. Davis, S. Hawes, H. Paston; Assistant Professors Miller, Moroney. Randall; Instructor Rainsford.

MAJOR IN CLOTHING

	Credits
I. University Core (Psych 101, Sociol 101, Econ 100 recommended for Social and Behavioral Science requirements)	33
Physical Education	2
II. Required Courses	20-26
TCEA 125, Design Fundamentals	3
TCEA 257, Contemporary Fashion Analysis	3
TCEA 255, Man and Clothing	3
TCEA 240, Textiles for Consumers I	3
TCEA 259, Quality Analysis of Apparel	3
Speech 201, Public Speaking	3
TCEA 389, Retailing Field Experience (Opt. A)	8
TCEA 389, Field Study (Option B)	2-8
III. Professional Options	
A. Fashion Marketing For those interested in product promotion, fashion related business and retailing.	
1. Required Courses	20-26
2. Professional Requirements	18
TCEA 170, Fashion Marketing	3
TCEA 272, Principles & Concepts of Retailing	3
TCEA 276, Product Analysis: Non Textiles	3
TCEA 374, Retail Sales Promotion	3
Mktg. 201, Fundamentals of Marketing	3
Mktg. 210, Buyer Behavior	3
3. Restricted Electives (Min. of 6 credits in two areas) Sociology, Anthropology, Psychology, Economics, Art, Journalism, Radio & TV, Marketing, Management, Statistics, Computer Science, Speech, Theatre, TCEA.	21
4. Electives	21
Total Credits	121
B. Consumer Services Promotion For those who wish to combine depth in textiles and clothing with a collateral interest in communications (education) and/or business.	
1. Required Courses	20-26
2. Professional Requirements	27
English 337, Adv. Expository Writing OR English 341, Creative Writing	3
TCEA 170, Fashion Marketing	3
TCEA 272, Principles & Concepts of Retailing	3
TCEA 342, Textiles for Consumer II	3
TCEA 365, Perspectives in the Clothing Profession	3
TCEA 374, Retail Sales Promotion	3
Mktg. 201, Fundamentals of Mktg.	3
Mktg. 210, Buyer Behavior	3
Mktg. 222, Marketing Communications	3
3. Restricted Electives (Min. of 6 credits in two areas) Sociology, Anthropology, Psychology, Economics, Art, Journalism, Radio & TV, Marketing, Management, Statistics, Computer Science, Speech, Theatre, TCEA.	18
4. Electives	14-20
Total Credits	120-126
C. Individualized Program in Clothing For those students interested in combining depth in clothing and textiles and related areas with social sciences and certain other disciplines such as humanities. Strongly interdisciplinary, this program is designed on an individual basis to meet specific needs of students in their chosen areas of specialization.	Credits
1. Required Courses	20-26
2. Professional Requirements	30-36
3. Restricted Electives	12-18
4. Electives	11-17
Total Credits	120

MAJOR IN INTERIOR DESIGN

I. University Core		33
Physical Education		2
II. Required Courses		24
TCEA 125, Design Fundamentals	3	
TCEA 227, Interior Design I	3	
TCEA 228, Interior Design II	3	
TCEA 329, Interior Design III	3	
TCEA 330, Interior Design IV	3	
TCEA 383, Shelter Technologies & Design	3	
TCEA 385, 386, Problems in Interior Design	6	

III. Professional Options

A. Professional Interior Design

For those students who would like to be eligible for student membership and professional membership upon graduation in professional organizations such as National Society of Interior Designers (N.S.I.D.) and American Institute of Interior Designers (A.I.D.). This program meets the high educational and professional standards necessary for accreditation by these and other professional associations.

	Credits
1. Required Courses	20-26
2. Professional Requirements	39
TCEA 241, Textiles for Interiors 3	
TCEA 233, History of Decorative Arts 3	
Ag. Eng. 261, House Planning 3	
Art 122, Basic Design II 3	
Art 111, Survey, Early Cultures & Civilization 3	
Art 113, Survey, Renaissance to Modern 3	
Land. Arch. 243, 244, History & Theory I & II 6	
Art 291, 293, Modern Architecture 6	
Art 295, American Art 3	
TCEA 389, Field Study 6	
3. Electives	22-24
Total Credits	120-122

B. Individualized Program in Interior Design and Related Areas

For those students who are interested in the area of interior design and related areas other than the professional study of residential housing and commercial spaces. It requires intensive study and research in the social sciences and is strongly interdisciplinary in structure. This program will be designed on an individual basis to meet specific needs of students in their chosen areas of specialization. The required courses from the Department, School and University will be determined in consultation with an adviser.

1. Required Courses	24
2. Professional Requirements	31
TCEA 389, Field Study 6	
Courses from Department, School and University determined in consultation with adviser.	
3. Electives	30
Total Credits	120

125. DESIGN FUNDAMENTALS.
The language of two-dimensional design relationships, studied through a series of design problems. Provides a basic visual grammar; may serve as a foundation for further study.

227. INTERIOR DESIGN I.
Introduction to graphics, interior layouts, normative and descriptive elevations, 2- and 3-point perspective drawing, architectural measuration and theory of proportion. Prerequisite, TCEA 125 or equivalent.

228. INTERIOR DESIGN II.
Advanced elevations, layouts and perspectives; freehand perspective, theory of color, light. Prerequisite, TCEA 227 or equivalent.

230. ART FOR THE YOUNG CHILD.
The teaching of art in relation to the growth and development of children; program planning, evaluation, studio projects and art resources.

233. HISTORY OF DECORATIVE ARTS.
The development of man's crafts from Ancient to Modern: furniture, ceramics, glass, precious metals, etc. Style as an insight into socio-historic context. Study tours.

235. APPLIED DESIGN: TEXTILES.
Experimental design projects in loom weaving and surface patterns using the techniques of silkscreen, tie-dye, Batik and block printing. Prerequisite, TCEA 125, Art 120 or equivalent.

240. TEXTILES FOR THE CONSUMER.
Theories and processes underlying manufacture and development of textile products as a basis for the application of decision-making processes.

241. TEXTILES FOR THE INTERIOR.
Basic factors related to durability, maintenance, appearance, appropriateness, performance and cost of textiles used in residential, commercial and public interiors.

255. MAN AND CLOTHING.
The impact of clothing and textiles on the individual and society; sociological, psychological and economic implications as seen in historical and contemporary perspective. Prerequisite, recommended: Psych 101, Soc 101 or Anthro 104.

257. CONTEMPORARY FASHION ANALYSIS.
Development of current fashion, current fashions in relation to the principles of design and color, and individual variables. Prerequisite, TCEA 125.

259. QUALITY ANALYSIS OF APPAREL.
Analysis of quality standards in apparel; emphasis on aesthetic design and creative expression, functional characteristics and satisfactions of construction and materials, economic factors of cost and maintenance. Students receiving less than Level 1 on Clothing Pre-Test (administered at first class meetings) must sign up for special 1-credit individualized modular program.

265. HISTORY OF COSTUME.
Western costume from ancient civilizations to the present; exploration of the relationship of clothing to the period. Prerequisite, History 100 or 110.

272. PRINCIPLES AND CONCEPTS OF RETAILING.
Principles and concepts requisite for successful retail distribution; history and current trends in retailing. Prerequisite, TCEA 170, Marketing 201.

276. PRODUCT ANALYSIS: NON-TEXTILE.
Study of consumer products from design through the manufacture and distribution channels. Evaluation of products as they relate to consumer needs and ecology.

329. INTERIOR DESIGN III.
Planning, design, analysis and programming of interior spaces both residential and public. Study of interior materials, uses, applications, specifications and schedules. Prerequisites, TCEA 227 and 228 or equivalent.

330. INTERIOR DESIGN IV.
Continuation of Interior Design III with addition of research studies and design problems exploring programming and coordination of colors and furnishing. Portfolio preparation and presentation. Prerequisites, TCEA 227, 228, 329.

342. TEXTILES FOR THE CONSUMER II.
Current developments and research in the field of textiles affecting consumer

satisfactions with product serviceability and legislative projections. Prerequisite, TCEA 240 or 241.

361. APPAREL DESIGN I, FLAT PATTERN.
Theory of apparel design developed through flat pattern methods. Problems include fitting master pattern, creation and execution of original designs. Prerequisite, TCEA 259, or Level 2 score on Clothing Pre-Test and special 1-credit problem on fitting and alterations.

363. APPAREL DESIGN II, COMPARATIVE MATERIALS AND METHODS.
Experimentation, execution and evaluation of methods and materials as they relate to design, performance and maintenance factors in advanced structuring and creation of apparel. Prerequisite, TCEA 259, or Level 2 score on Clothing Pre-Test and special 1-credit problem on fitting and alterations.

365. PERSPECTIVES IN THE CLOTHING PROFESSION.
Literature, research, current issues and trends with implications for the clothing professional in educational programs, social, and governmental agencies, consumer and business organizations.

374. RETAIL SALES PROMOTION.
Principles and concepts of sales promotion, including advertising types and techniques and methods of display. Prerequisite, TCEA 272.

383. SHELTER TECHNOLOGIES.
Historic and contemporary construction techniques in wood, stone, concrete and plastic. Design/construction relationships. Materials and components of architectural interiors and furnishings.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department..
Credit, 1-3.

389. FIELD STUDY. *Credit, 1-15.*

391-394. SEMINAR IN TEXTILES, CLOTHING AND ENVIRONMENTAL ARTS.
Reports and discussion of current research studies. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

SCHOOL OF NURSING

Lillian R. Goodman, *Acting Deon*
Professors Earles, Helming, Winder; Associate Professors Clarke, Condron, Friedman, Getchel, Petrunenko, Salenius, Sharp, Smith, Walker, Haase; Assistant Professors Auton, Entrekin, Flynn, Grancio, Hall, C. Hines, J. Hines, Hopkins, Johnson, LaMonica, Murphy, Sheridan, Sweeney, Whitbeck; Instructors Ceriale, Cole, Craig, Dembishack, Foster, Giles, Lehman, Moynihan, Murdock, Shea, Sjoberg.

The curriculum in the School of Nursing is in the process of revision. The nursing major will begin in the junior year. Information about prerequisites and about the program may be obtained through the School of Nursing.
Senior courses offered 1973-74 follow:

300 (I), (II). MATERNAL AND INFANT NURSING.
Application of basic concepts and principles of nursing to care of mothers during maternity cycle and to newborn infants. Correlated practicum provides experience in care of selected mothers and infants in the hospital and home. Prerequisite, Nursing 200, 210. The Maternal and Child Nursing, Public Health Nursing and Mental Health Nursing Faculties; allied professional staffs of the Wesson Women's Hospital and other community health agencies. *Credit, 6.*

301 (I), (II). NURSING IN THE COMMUNITY.
Application of basic concepts of public health and public health nursing to the care of individuals, families and community groups. Correlated practicum provides experience in the care of selected individuals, families and groups served by official and non-official public health nursing services. Prerequisite, Nursing 200, 210. Public Health Nursing, Maternal and Child Nursing and Mental Health Nursing Faculties; professional staffs of the Visiting Nurse Association of Springfield, the Springfield Health Department and other community health agencies.
Credit, 6.

302 (I), (II). PSYCHIATRIC-MENTAL HEALTH NURSING.
Aims at acquisition of knowledge and skills needed to function with beginning proficiency as a professional nurse on psychiatric-mental health team. Correlated clinical practicum provides opportunity for establishing the basis for therapeutic communication with individuals and groups of patients with psychiatric problems. Prerequisite, Nursing 200, 210. Psychiatric-Mental Health Nursing Faculty and professional staffs of the Northampton State Hospital and other community health agencies. *Credit, 6.*

303 (I), (II). ADMINISTRATION OF NURSING CARE.
The professional's role in evaluating, planning and organizing nursing care which is relevant to specific conditions and responsive to changing demands. Patterns of organization in a variety of clinical settings, with opportunity to apply principles to the nursing team. Prerequisite, Nursing 200, 210. Clinical Nursing Faculty and professional staffs of the Wesson Memorial Hospital and other community health agencies.
Credit, 6.

304 (I). PROFESSIONAL FOUNDATIONS OF NURSING.
Professional responsibilities and relationships of the nursing practitioner. Enrollment limited to senior students of nursing.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

392 (I), (II). THE NURSING PROCESS.
The use of a definitive nursing process in the solution of clinical nursing problems. Emphasis on independent functions of the professional nurse. Correlated practicum provides opportunity to test the theoretical content. Prerequisite, junior or senior status. *Credit, 6.*

ORCHARD HILL INTERDISCIPLINARY COURSES

The courses listed will not necessarily be offered in 1973-74. Please check with the Master's Office before registering for any Orchard Hill course. Consult the Master's Office for a complete course listing each semester.

201. INTERDISCIPLINARY APPROACH TO AESTHETICS (C).
Combines some studio work in the visual arts, music, and literature with general discussion of different philosophies of art.

202. BEYOND CORPORATE CAPITALISM (D).
Current problems of the American economy; analysis of the distribution of income and economic power. Attention to building the necessary conceptual and theoretical tools for analyzing capitalism. Prerequisite, Econ. 125-126 or permission of instructor.

205. RADICAL PSYCHOLOGY (D).
The works of selected modern psychologists, with emphasis on the radical nature of their work and its implication for health in Western society. Prerequisite, permission of instructor.

207. POETRY AND MAGIC (C).
The relationship between poetry and magic seen as more than formal or methodological, but philosophical, since the artist and the magician share essentially the same view of reality and the same goals.

SCHOOL OF PHYSICAL EDUCATION

David C. Bischoff, Deon
Professors Coffey, Locke; Assistant Professor Cobb; Instructor Purnell.

Physical Education for Men

Head of Department: Professor H. J. VanderZwaag. Professors Lewis, Zunic; Associate Professors Garber, Loy; Assistant Professors Barber, Brosky, Gundersheim, Redmond; Instructors Ariel, Callahann, Dunn, Kjeldsen.

Physical Education for Women

Head of Department: Professor Betty

Spears. Associate Professors Gerber, Hubbard, Ogilvie, Riggs, Vendien, Wallace; Assistant Professors Oglesby, Patton, Peterson, Shute; Instructors Diggs, Evans, Farr, Griffin, Jaeger, Kjeldsen, Watkins.

JOINT DEPARTMENTAL COURSES

*100. PHYSICAL EDUCATION.
Skills courses in sport, dance, equitation, and other forms of physical activity available to all students in the University. *Credit*, 1.

*101. PHYSICAL EDUCATION.
Theoretical and/or skill instruction in sport, dance and other forms of physical activity. 3 to 6 class hours or equivalent. *Credit*, 1 or 2.

*Each student in the University is required to complete 2 credits in physical education.

MAJOR ACTIVITY COURSES FOR WOMEN

Courses designed for women majors in physical education. Instruction focuses both on skill in the activity and learning to teach the skill. Activities are offered in aquatics, gymnastics, and sports. 6 class hours. *Credit*, 1.

102, Fundamentals
103, Hockey I
104, Gymnastics I
106, Soccer-Speedball-Flag Football
107, Basketball
110, Syncro. Swim. and Aqua. Comp.
111, Competitive Swim. and Diving
115, Gymnastics II
116, Gymnastic Teaching
117, Rhythmic Gymnastics and Routine Comp.
121, Officiating Sports *Credit*, 2.
122, Officiating Gymnastics *Credit*, 2.

MAJOR ACTIVITY COURSES FOR MEN

Courses designed primarily for men majors in physical education. Instruction focuses both on skill in the activity and learning to teach the skill. All majors must take basic skill courses in gymnastics, track and field, and aquatics. Other courses cover the wide spectrum of individual, dual, and team sports in this culture. *Credit*, 1.

130, Gymnastics
131, Aquatics
132, Weight Training and Conditioning
133, Football Coaching
134, Basketball
135, Basketball Coaching
136, Baseball
137, Baseball Coaching
138, Gymnastic Coaching
139, Wrestling
140, Wrestling Coaching
141, Lacrosse
142, Lacrosse Coaching
143, Hockey
144, Hockey Coaching
145, Soccer
146, Soccer Coaching
147, Squash and Handball
148, Tennis Coaching

CO-ED MAJOR ACTIVITIES *Credit*, 1.
150, Swimming for the Handicapped
151, Aquatics
155, Educational Gymnastics
160, Bowling
161, Golf
162, Advanced Golf
163, Tennis and Badminton
165, Track and Field
166, Track and Field Coaching
167, Volleyball
180, Folk and Square Dance
181, Improvisation
182, Dance I
183, Dance II
184, Dance III
185, Dance IV
186, Dance V
187, Ballet I
188, Ballet II
198, Officiating—Men *Credit*, 2.
199, Officiating—Women *Credit*, 2.

200. SOCIOLOGY OF SPORT AND PHYSICAL ACTIVITY.
Social action theory, group structure, social institutions, social processes, current cultural trends, and social problems in sport. Prerequisite, Soc. 101.

201. PSYCHOLOGY OF SPORT AND PHYSICAL ACTIVITY.
Variables of skilled performance; behavioral patterns and interactions in games, sports, and dance activities; evaluation of skilled performance. Prerequisite, Psych. 101.

202. HISTORY OF SPORT AND PHYSICAL ACTIVITY.
A survey of the history of sport, dance, and other forms of organized, physical activity throughout the Western world. Prerequisite, Hist. 100 or 101.

203. PHILOSOPHY OF SPORT AND PHYSICAL ACTIVITY.
A philosophical analysis of sport and physical activity. Consideration of the nature and values of sport and its role as a meaningful activity. Prerequisite, Philos. 105.

206. PERCEPTUAL MOTOR DEVELOPMENT.
Motor development in the child, particularly focusing on conditions affecting the learning of motor skills.

240. DANCE HISTORY.
History of dance as a performing art in Western culture.

243. DANCE PRODUCTION.
Dance production relating to both the artistic and technical direction of the performing art. 2 class hours, 1 2-hour laboratory period.

245. DANCE COMPOSITION.
Choreography. 1 class hour, 1 2-hour laboratory period. *Credit*, 2.

253. PHYSICAL EDUCATION FOR ELEMENTARY SCHOOLS.
Program content for elementary school physical education and methods used for teaching physical education activities at the elementary school level.

261. WORLD HISTORY OF SPORT.
Factors influencing the rise of sport and the role of sport in society. Prerequisite, PE 202.

263. ANALYSIS OF RHYTHM.
Analysis of rhythmic structure of music and its application to motor activity. 2 class hours, 1 2-hour laboratory period.

264. PHILOSOPHY OF SPORT.
A philosophical analysis of key concepts which influence the objectives and content of various programs in the broad realm of sport. Prerequisite, PE 203 or equivalent.

265. SOCIOLOGY OF SPORT.
Sport as a social institution, including structure and function. Topics include theories explaining the role of sport in society; the incidence, form, and regulation of sport in society; physical activity in contemporary society; and the social psychology of sport, including personality, attitude, and motivation. Prerequisite, PE 200.

275. PREVENTION AND CARE OF INJURY IN ACTIVITY.
Theory and techniques in preventing and treating all types of physical injuries including first aid treatment as well as therapeutic aids and clinical use of physiotherapy equipment. Prerequisite, PE 205. 2 class hours, 1 2-hour laboratory period.

276. PRINCIPLES OF PHYSICAL EDUCATION.
Aims and objectives in physical education; also presentation and critical analysis of curricular, methodological and adapted principles as they apply to the teaching of physical education.

277. PSYCHOLOGY OF COACHING.
Analysis of psychological content in athletics and coaching. Topics include personality and motivation, mental health aspects, competitive spirit, sportsmanship, and selected problems in coaching pertaining to psychological factors. Prerequisites, Psych 101 and 263 or permission of instructor.

354. PHYSICAL EDUCATION IN THE SCHOOL.
Content and presentation of methods designed to prepare the student for the educational internship in the schools. The applicability of micro-teaching techniques to situations in teaching physical education activities.

362. HISTORY OF SPORT IN THE UNITED STATES.
Sport in America from earliest times to the contemporary period. Emphasis on the social, political, and economic factors which affected the development of sport. Prerequisite, PE 261.

363. COMPARATIVE SPORT.
A comparative analysis of sport and athletics in selected countries. Emphasis on historical, cultural, and social values affecting the status of sports and recrea-

tion, and current international cooperation. Prerequisite, PE 261.

370. ORGANIZATION AND ADMINISTRATION.
Discussion of administrative theory and practice as they relate to the program of physical education in the schools.

381. ADMINISTRATION OF INTRAMURAL PROGRAMS.
Objectives, tourney design, organization and administration of intramural programs. 2 class hours. Credit, 2.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-6.

390. SEMINAR.
Analysis of studies and issues in physical education.

Exercise Science

Head of Department: Professor H. K. Campney. Professors Kroll, Plagenhoef, Ricci; Associate Professor James; Assistant Professor Edington.

204. HUMAN ANATOMY.
Gross structure and function of the body. 2 lecture hours, 1 2-hour laboratory period.

205. KINESIOLOGY.
Anatomical application as a basis to a thorough understanding of mechanical problems in motor skills. Prerequisite, PE 204. 2 lecture hours, 1 2-hour laboratory period.

259. KINESIOTHERAPY.
Programs of developmental activities, suited to interests and capacities of students with disabilities who are restricted from participation in activities of the general physical education program. Prerequisite, PE 205.

274. THEORY OF MEASUREMENT AND EVALUATION.
Construction, interpretation, and evaluation of tests, including the theory of grading.

278. PHYSIOLOGY OF EXERCISE.
Application of basic physiological concepts of the program of physical education, emphasizing physiological effects and adjustments accruing from participation in physical activity. Prerequisite, Zool 135. 2 class hours, 1 2-hour laboratory period.

321. PHYSIOLOGICAL BASIS OF HUMAN PERFORMANCE.
Analysis and interpretation of cardiovascular-pulmonary adjustment, metabolic requirement, and heat regulation during exercise. Prerequisite, PE 278. 2 class hours, 1 2-hour laboratory period.

331. MECHANICAL ANALYSIS OF HUMAN MOTION.
Application of the principles of mechanics to the analysis of human motion. Prerequisite, PE 205 or equivalent. 2 class hours, 1 2-hour laboratory period.

341. MOTOR INTEGRATION.
Examination of the control of muscular activity by the nervous system. Topics include basic motor system reflexes, cross transfer, fatigue, kinesthetic sense, lateral dominance, and neuromuscular facilitation techniques. Prerequisites, PE 205 and PE 278.

351. THEORY OF THERAPEUTIC EXERCISE.
The theory of therapeutic exercise for the mentally retarded, physically handicapped, and normal. Prerequisite, PE 259 or equivalent.

352. PHYSICAL ACTIVITY AND MENTAL RETARDATION.
Physical activity relative to the behavior of the mentally retarded. Prerequisite, PE 259.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Leisure Studies and Services

Head of Department: Professor William E. Randall. Assistant Professor Sherrow; Instructors Robb, Willmann.

SOPHOMORE YEAR

1st Semester	Credits
LS&S 111, Leisure Activity Analysis	3
Humanities and Fine Arts Elective (C)	3
Speech 201, Public Speaking	3
Program Activities Elective	3
Sociology Elective*	3
LS&S 004, Field Experience II	0
	15
2nd Semester	
LS&S 230, Group Leadership	3
Math. or Natural Science Elective (E)	3
Social Science Elective***	3
Psychology Elective*	3
Option Course	3
	15

JUNIOR YEAR

1st Semester	Credits
LS&S 320, Leisure Service Facilities	3
English 337, Adv. Expository Writing	3
Social Science Elective***	3
Two Option Courses	6
	15
2nd Semester	
LS&S 313, Leisure Service Programming	3
Option Courses	6
Arts and Sciences Electives	3
Sociology Elective*	3
	15

SENIOR YEAR

1st Semester	Credits
Accelerated Block Semester***	
LS&S 332, Supervision in Leisure Services	3
LS&S 351, Outdoor Recreation	3
LS&S 352, Organization and Adm. for Leisure Services	3
LS&S 380, Internship	6
	15
2nd Semester	
LS&S 391, Seminar	1
Arts and Sciences Electives	6
Free Electives	8
	15

*One of these five courses must be a "D" course.
**Select freely from anthropology, economics, geography, political science, more psychology, or more sociology. Economics 125 and Political Science 100 recommended.
***Prerequisites: 2.0 Cumulative Quality Point Average and senior standing as a major in Leisure Studies and Services. The first three courses are taught at double speed for half of the semester with final examinations by the end of the seventh week. Remainder of the semester, including Reading Days and Final Examination Period, is devoted solely to Internship. Because of the intensive nature of this plan, extended field tripping, probability that Internship may be a considerable distance from campus and demands of irregular hours, students may not enroll in additional courses nor be employed regularly during this semester.

003, 004. FIELD EXPERIENCE.
Supervised experience as a volunteer, in leadership or other appropriate roles, in approved settings, for not less than 20 hours per semester. Enrollment limited to leisure studies and services majors.
Credit, 0.

101. MAN AND LEISURE.
Concepts of leisure, play and recreation and their societal implications. Examination of leisure opportunities and experience with emphasis on the delivery of leisure services. Field trip.

111. LEISURE ACTIVITY ANALYSIS.
Analysis of leisure activities in terms of inherent characteristics and values for various participant types. Leadership skills and resources needed for a broad variety of program areas.

112. ADAPTED ACTIVITIES FOR SPECIAL POPULATIONS.
Pertinent characteristics of individuals and groups requiring adapted and/or modified programming. Adapting activities to meet the needs of these special populations. Practicum experience included. All-day field trips. Prerequisite, LS&S 111 or permission of instructor. 2 class hours, 1 2-hour laboratory.

131. ORGANIZED CAMPING.
Operating procedures of organized camps. Camper guidance, program skills, and practical leadership experience. Two-night camping trip, plus one-day trip. 2 class hours, 1 2-hour laboratory.

230. GROUP LEADERSHIP.
Foundations and tools for leadership. Successful leadership techniques for large

and small groups such as clubs and committees. Field trip. Non-major admission only by permission of instructor.

313. LEISURE SERVICE PROGRAMMING.
Critical determination of individual and group needs and objectives and the selection, planning, development and evaluation of comprehensive programs. Prerequisite, LS&S 111.

320. LEISURE SERVICE FACILITIES.
Principles, practices, and problems in the planning, development, and management of areas and structures in the facilitation of leisure programs and services. Prerequisites, LS&S 101, 111, or equivalent.

332. SUPERVISION IN LEISURE SERVICES.
Nature, functions, principles and methods of supervision in leisure services. The supervisory process as related to paid and volunteer staff. Prerequisite, LS&S 230 or equivalent.

351. INTRODUCTION TO OUTDOOR RECREATION.
Characteristics, principles, and practices of outdoor recreation, including current developments; relationship to other uses of land and water resources. Field trip.

352. ORGANIZATION AND ADMINISTRATION FOR LEISURE SERVICES.
A pragmatic approach to functions and methods for administrative personnel in the leisure service field. Problems, role simulation, field trip, guests.

353. ENVIRONMENTAL INTERPRETATION.
Principles and practices in interpretation for public appreciation of natural archaeological and historical features in parks, museums and similar settings. Field trips. Prerequisites, 18 credits in one of the following areas: American History, Natural Resources, or the natural sciences; and permission of instructor. 2 class hours, 1 2-hour laboratory period.

354. PERSPECTIVE IN THERAPEUTIC RECREATION.
Historical and contemporary foundations and philosophies in therapeutic recreation. Professional functioning and state of the art are emphasized. Interdisciplinary relationships, research and demonstration needs, and future perspectives are analyzed. Field trips. Prerequisites, LS&S 112, Exc. Sci. 204 or Zool. 135, 18 credits in pertinent Psychology or Sociology, and junior or senior standing, or permission of instructor.

361. INTRODUCTION TO OUTDOOR RECREATION.
Same course as 351, but for non-leisure studies and services block students. Field trip.

362. ORGANIZATION AND ADMINISTRATION FOR LEISURE SERVICES.
Same course content as 352, but for non-leisure studies and services block students. Field trip.

380. INTERNSHIP.
Professional field experience with an approved cooperating leisure service agency appropriate to the student's career choice. Only open to majors in the concentrated senior block. *Credit, 6.*

385, 386. SPECIAL PROBLEMS.
Individual intensive study of an aspect of leisure studies and services and the presentation of results in written form. *Credits, 1-6.*

391. SEMINAR.
Critical consideration of basic philosophies and problems in leisure studies and services. Prerequisite, LS&S 101 or 351.

Athletic Department

Deportment Head: Frank McInerney; Assistant Athletic Director: Robert O'Connell; Financial Manager of Athletics: Aloysius Rufe; Ticket Manager: Walter Novak; Sports Information Director: Richard Page; Director of Intramurals: Theodore Schmitt; Assistants: Peter Graham and Merrie Fidler; Staff Associate: Victor Fusia; Staff Assistant: Albert Grenert.
Head Football Coach: Richard MacPherson; Assistants: George Flood, Robert Harris, William Maxwell, Larry Pasquale, Robert Pickett, Robert Lord, and Errol Prisby.
Head Basketball Coach: John Leaman; Assistants: Raymond Wilson and Roland Gaudette.
Head Track Coach: Kenneth O'Brien; Assistant: Gideon Ariel.
Head Baseball Coach: Richard Bergquist; Assistant: Arlan Barber.
Tennis Coach and Director of Stockbridge Athletics: Stephen Kosakowski.
Golf Coach: Roland Gaudette.
Wrestling Coach: Homer Barr.
Gymnastics Coach: Tom Dunn.
Swimming Coach: Joseph Rogers.
Cross Country Coach: Kenneth O'Brien.
Soccer Coach: Gerald Redmond.
Head Hockey Coach: John Canniff; Assistant: Russell Kidd.
Ski Coach: William MacConnell.
Lacrosse Coach: Richard Garber; Assistant: Russell Kidd.
Supervising Physiotherapist: Victor Keedy; Trainers: James Laughnane and William Smith.

DEPARTMENT OF PUBLIC HEALTH

Head of Deportment: Professor William A. Darity. Professors Gage, Litsky, Peterson; Associate Professors Gross, Lynch, Moustafa, Ortiz, Peters; Assistant Professors Chen, DiNardi, Goggin, Stamps, Tuthill, Wisnieski; Instructor Crowley; Lecturers Reed, Stryker, Zapka.

PUBLIC HEALTH
Instruction in the Department of Public Health provides a comprehensive view of public health and prepares interested students for the many professional opportunities open in this area. Each student will be expected to gain a broad background in the natural, biological and social sciences upon which health professional preparations are based.

The department offers three optional areas at the undergraduate level. These are community health, environmental health and medical technology. In each option students are prepared for further study at the graduate level.

COMMUNITY HEALTH:

Freshman Year	Credits
First Semester	
*Rhetoric 100 or 110	3
**Math 127	3
+Chemistry 111	3
Zoology 101	3
Psychology 101 or	
*Sociology 101	3
General Physical Education	1
Second Semester	
*Rhetoric 100 or 110	3
**Math 128	3
+Chemistry 112	3
Sociology 101 or	
*Psychology 101	3
***Elective	3
General Physical Education	1

*May be taken either semester.
**On basis of placement tests and interest in advanced science.
***Elective chosen from Humanities. If a language is elected, intermediate proficiency is required
+With Departmental approval Chemistry 101 and 102 may be substituted.

Sophomore Year	Credits
First Semester	
*Physics 141	4
**4 Electives	12
Second Semester	
Zoology 230, Systems of the Human Body	4
*Physics 142	4
Microbiology 140	3
**Electives	3

Junior Year	Credits
First Semester	
PH 320, Introduction to Health Administration	4
PH 301, Principles of Community Health Education	4
Statistics 121	3
***Sociology Elective	3
Second Semester	
PH 304, School Health	3
Education Elective	3
PH 330, Principles of Epidemiology	3
PH 360, Principles of Environmental Health	3
2 Electives	6

Senior Year	Credits
First Semester	
+PH 382, Field Training and Studies	3-10
PH 385, Problems and/or	3
**Electives	3-7
Second Semester	
++PH 302, Community Development and Health Education or Elective	3
PH 386, Problems	3
**3 Electives	

*Students with Departmental approval may take Physics 121 and Physics 122. However, they must take an additional public health course with a laboratory, for example, PH 379 or PH 389 or another course approved by the department.
**Elective chosen from Humanities, or Social and Behavioral Sciences or PH 301 or CE 374 or Rhetoric 140, 145, 160, 165, or 170. (3 credits)
***Students who take Statistics 231 and 232 instead of Math 127 and 128 will not be required to take this course.
+This is an option based on student's future plans.
++This is an option based on student's interests.

ENVIRONMENTAL HEALTH:

Freshman Year	Credits
First Semester	
*Rhetoric 100 or 110	3
**Math 127	3
Chemistry 111	3
Zoology 101	3
Psychology 101 or *Sociology 101	3
General Physical Education	1
Second Semester	
*Rhetoric 100 or 110	3
**Math 128	3
Chemistry 112	3
Zoology 230	3
Sociology 101 or *Psychology 101	3
General Physical Education	1

*May be taken either semester.
**On basis of Placement tests and interest in advanced science.
If a language is elected, intermediate proficiency is required.

Sophomore Year	Credits
First Semester	
Physics 141	4
Chemistry 127	4
***Electives	
Second Semester	
Physics 142	4
**Chemistry 160	4
English 331	2
***2 Electives	6

***Electives chosen from Social and Behavioral Sciences (3 credits), Humanities (6 credits), and Rhetoric 140, 145, 160, 165, or 170 (3 credits).
**Chemistry 261, 263, 262, 264, may be elected if a more comprehensive organic chemistry sequence is desired.

Junior Year	Credits
First Semester	
PH 361, Environmental Health Practices	3
PH 320, Introduction to Health Administration	4
Microbiology 250, General	4
PH 340, Public Health Statistics	3
PH 350, Basic Public Health Laboratory Procedures	3
Second Semester	
Microbiology 289, Pathogenic	4
PH 351, Advanced Public Health Laboratory Procedures	3
PH 330, Principles of Epidemiology	3
Electives	3

Summer: PH 382, Field Training 3-10 Credits

Senior Year	Credits
First Semester	
PH 362, Principles of Air Pollution	3
CE 271, Introduction to Environmental Pollution Control	3
Chemistry 220, Biochemistry or	4
PH 385, Problems	3
Electives	6
Second Semester	
PH 363, Principles of Radiation Protection	3
PH 386, Problems	3
PH 370, Introduction to Occupational Health	3
Elective	3

NOTE: Recommended courses include: Sociology 261, Population; Political Science 220, Municipal Government; Political Science 100, American Government; Economics 125, Elementary Economics; Management 201, Principles of Management; Management 231, Administrative Theory (201 required as a prerequisite); Political Science 272, Public Administration; Sociology 292, Introduction to Social Welfare; Education 266, Preparation and Use of Visual Aids.

123 (I), (II). DYNAMICS OF PERSONAL AND COMMUNITY HEALTH.
Development of understanding and attitudes relative to personal, family and community health needs. Attention to mental and physical well-being, drugs, sexuality, communicable and chronic diseases and health services.

263 (I), (II). INSTITUTIONAL HYGIENE AND SANITATION.
Application of bacteriology to the prevention of food poisoning events. Evaluation of sanitary measures designed to prevent disease transmission via food and institutional environments.

264 (II). MICROSCOPY OF WATER.
Microscopic forms of life, exclusive of bacteria. Counting and control of plankton in potable waters. Elements of limnology. Prerequisite, Microbiol. 140. 3 class hours, one 2-hour laboratory period.

301 (I). PRINCIPLES OF COMMUNITY HEALTH EDUCATION.
Principles of health education. Exploration of methods and approaches to community health. Family, school, and community dimensions and potentials. Types and use of various methods leading to community action. Permission of instructor required. 3 class hours, one 2-hour laboratory period. *Credit, 4.*

302 (II). COMMUNITY DEVELOPMENT AND HEALTH EDUCATION.
Latest approaches in community development and community organization procedures. Exploratory readings, field assignments, and leadership emphasis: emphasis on coordinated community action. Permission of instructor required.

304 (I), (II). SCHOOL HEALTH.
The principle concepts, methods, and dynamics of the organization of a school health program at the elementary and secondary level. Stress on planning and teaching in problem areas, (*i.e.*, sex education, mental health and drugs). Prerequisite, junior or senior standing or permission of instructor.

305 (II). CURRENT ISSUES IN HEALTH EDUCATION.
Latest issues in the field of health. Emphasis on controversial issues such as sex, drugs, and suicide education.

311 (II). HUMAN SEXUALITY AND SEX EDUCATION.
Human sexuality as it may appear in the infant, the child, the adolescent, and the young married adult; examination and clarification of some of the crucial dynamics of the present era. Prerequisite, junior or senior standing and permission of instructor.

312 (I). PUBLIC HEALTH AND FAMILY PLANNING.
Public Health problems associated with family health and population limitation. Historical factors, limitation methods, and barriers and facilitators related to family health and size. Prerequisites, PH 123, Soc. 101 or permission of instructor.

313 (II). PEER SEX EDUCATION.
A training course for selected students who will serve as peer resources with educational, counseling, and referral responsibilities. By arrangement with instructor only. Ms. Zapka.

314 (I). PSE—IN-SERVICE TRAINING I.
In-service training for Peer Sex Education counselors who are working with an assigned target group. By arrangement with instructor only. Prerequisite, PH 391. Ms. Zapka.

315 (II). PSE—ADVANCED IN-SERVICE TRAINING.
In-service training for Peer Sex Education counselors who are working with an assigned target group. By arrangement with instructor only. Prerequisite, PH 391. Ms. Zapka.

320 (I). INTRODUCTION TO HEALTH ADMINISTRATION.
Introduction to the philosophy, nature, and scope of modern health services. Major health issues and programs. Organization of health services by local, national, and international health agencies. Prerequisites, Soc 101 and Zool 101, or permission of instructor. 3 class hours, 1 2-hour laboratory period.
Credit, 4.

321 (II). ORGANIZATION AND ADMINISTRATION OF HEALTH PROGRAMS.
The organization of health programs to meet the needs of people. Emerging health problems and approaches to their solution. Emphasis on comprehensive planning and evaluation procedures. Prerequisites, PH 320 or permission of instructor. 3 class hours, one 2-hour laboratory period. *Credit*, 4.

330 (I). PRINCIPLES OF EPIDEMIOLOGY.
An epidemiological perspective of health. General approaches for describing the patterns of disease in groups of people and elucidating the various processes involved in creating the differing levels of health in human groups. Lecture and lab examples illustrate a wide range of contemporary health problems.

340 (I). PUBLIC HEALTH STATISTICS.
Principles of statistics applied to the evaluation of public health practices. Prerequisite, permission of instructor. 3 class hours, one 2-hour laboratory period.

350 (I). BASIC PUBLIC HEALTH LABORATORY.
Standard methods used in present day applied bacteriology; soils, dairy products, water and shellfish, and air. Prerequisites, Microbiol 140 or permission of instructor. 2 class hours, two 2-hour laboratory periods.

351 (II). ADVANCED PUBLIC HEALTH LABORATORY PROCEDURES.
Public Health laboratory procedures; field collection of samples, stream pollution study, food poisoning and infection, standard methods of food analysis. Prerequisite, permission of instructor. One 4-hour laboratory and one 2-hour laboratory period.

352 (II). CLINICAL BACTERIOLOGY.
Procedures in clinical laboratory work. Prerequisite, Microbiol 250 or permission of instructor. 1 class hour, two 2-hour laboratory periods. *Credit*, 4.

360 (II). PRINCIPLES OF ENVIRONMENTAL HEALTH.
The application of scientific knowledge to the control of man's environment as applied to human health. The physical, chemical and biological aspects of the air, water, land, food, housing, and occupation environments. Public Health or science majors with junior standing, or permission of instructor. Mr. Peters.

361 (I). ENVIRONMENTAL HEALTH PRACTICES.
Control methods used by the environmental health and engineering practitioner. Topics include: water, waste water, solid wastes, food sanitation, vector control, housing, and accident control measures. Limited to environmental health and engineering majors. Other science majors by permission of instructor. Mr. Peters.

362 (I). PRINCIPLES OF AIR POLLUTION.
Presents air pollution as a major public health problem. Topics include: air pollutants and their sources, health and economic effects, meteorology, sampling and analysis, air quality criteria and standards, control technology, control regulations and programs. Limited to public health and engineering majors. Other science majors by permission of instructor. Mr. Peters.

363 (II). PRINCIPLES OF RADIATION PROTECTION.
Effect and control of radiation in the mammalian system. Includes sources, measurements, radio-sensitivity, radiation chemistry, cellular effects and acute and delayed effects in occupational, medical, and environmental exposures. Prerequisite, permission of instructor.

370 (II). PRINCIPLES OF OCCUPATIONAL HEALTH.
The relation of the occupational environment to the health, efficiency, and well-being of workers. Emphasis on industrial hygiene, including toxic materials, physical stresses and control methods. Limited to public health and engineering majors. Other science majors by permission of instructor. Mr. Peters.

382 (I), (II). SUPERVISED FIELD TRAINING.
A summer field training program with an official health agency, approved by the department. Must be under faculty supervision. *Credit*, 3-10.

385 (I), 386 (II). PROBLEMS.
Qualified seniors with permission of the department may arrange for independent work on special problems.
Credit, 1-3.

391 (I), (II). SEMINAR. *Credit*, 1.

392 (II). PUBLIC HEALTH SEMINAR II —HEALTH SERVICES.
A seminar to develop an awareness of health services, particularly at the University; to promote health education and an awareness of minor health problems and first aid. Permission of instructor.
Credit, 1. Ms. Zapka.

MEDICAL TECHNOLOGY

There are two courses of study which a Medical Technology major may option in pursuit of a Bachelor of Science degree. Students electing Option I are required by the affiliated hospital schools of Medical Technology to have maintained averages of "C" or better in their science and mathematics courses. These students must have earned a total of 90 academic credits and satisfied the departmental and University curriculum requirements before beginning their hospital internships. Transfer students must in most cases, elect Option II.

OPTION I.

This curriculum consists of a three-year academic program followed by a 12-month internship in an accredited school of Medical Technology affiliated with the University. After successful completion of the 12-month internship and after satisfying the requirements of the department, a student will receive a Bachelor of Science degree in Medical Technology. A total of 130 academic credits is necessary for graduation with this option. Forty academic credits are earned during the fourth year, upon successful completion of the internship.

FRESHMAN YEAR

1st Semester	*Credits*
Rhetoric 100 or 110	3
Mathematics 123	3
Zoology 101	3
Chemistry 111, General	3
Social Science or Foreign Language	3
Physical Education	1
2nd Semester	
Rhetoric	3
Zoology 145, Human Genetics	3
Chemistry 112, General	3
Social Science or Foreign Language	3
Physical Education	1
Medical Technology 101	3

SOPHOMORE YEAR

1st Semester	*Credits*
Humanities Elective	3
Chemistry 261, 263, Organic	4
Zoology 223, Histology	3
Physics 121 or 141	3 or 4
Elective (Humanities or Social Science)	3
2nd Semester	
Humanities Elective	3
Chemistry 262, 264, Organic	4
Zoology 230, Anatomy and Physiology	4
Physics 122 or 142	3 or 4
Elective (Humanities or Social Science)	3

JUNIOR YEAR

1st Semester	*Credits*
Chemistry 220, Elementary Biochemistry	4
Microbiology 250, General	4
Elective	3
Statistics 315	3
2nd Semester	
Chemistry 127, Analytical	4
Microbiology 280, Pathogenic	4
MT 390, Seminar	1
Electives	6

SENIOR YEAR

During the fourth year, students serve a 12-month internship in a hospital laboratory accredited by the Council on Medical Education of the American Medical Association and the Board of Schools of Medical Technology of the American Society of Clinical Pathologists and one with which the University of Massachusetts has reciprocal affiliation. If placement opportunities are limited, preference will be given to those students with superior overall records. The student must complete all of the requirements set by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. The student who begins a hospital internship for credit toward a degree must complete the full year of hospital training in order to be granted any credit. The course of training must be consistent at all times with the curriculum formulated by the Board of Schools of Medical Technology as approved by the American Society of Clinical Pathologists, the College of American Pathologists, the American Society of Medical Technologists, and the Council on Medical Education and Hospitals of the American Medical Association.

The curriculum offered by the hospital staff of the accredited affiliated hospital shall have the following schedule:

Course No.	Title	Minimum Lecture Hours	Credits
MT 301	Clinical Microbiology	24	10
MT 302	Clinical Biochemistry	24	10
MT 303	Urinalysis	8	3
MT 304	Hematology	20	10
MT 305	Immunohematology	16	4
MT 306	Histology	8	3

In addition to clinical instruction within the hospitals, all the interning medical technology seniors meet regularly for didactic lectures given by the combined staffs of the hospitals and the University.

The hospital internship consists of 50 weeks at 40 hours per week, or 2,000 hours.

OPTION II.

This is a four-year academic program leading to a Bachelor of Science degree. Following graduation, the student will be assisted in arranging for a 12-month internship in an accredited school of Medical Technology. The student must complete all of the requirements established by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. A total of 120 academic credits is necessary for graduation with this Option.

Students electing Option II should follow Option I program for Freshman, Sophomore and Junior years.

SENIOR YEAR

1st Semester

Courses to be advised.

Electives to complete University graduation requirements.

2nd Semester

Courses to be advised.

101 (II). INTRODUCTION TO MEDICAL TECHNOLOGY.
Basic clinical laboratory procedures and professional aspects of Medical Technology. Discussions, demonstrations, field trips, visiting lecturers and selected readings. 2 2-hour lectures, 1 2-hour laboratory period.

301. CLINICAL MICROBIOLOGY.*
Lectures and supervised training in the areas of bacteriology, parasitology, virology and mycology, emphasizing methods for isolating and identifying specific disease-causing organisms. *Credit, 10.*

302. CLINICAL BIOCHEMISTRY.*
Lectures and supervised training in the analytical methods useful in the diagnosis of diseased states characterized by various abnormalities in the body chemistry. Emphasis on method development, quality control, and clinical interpretation. *Credit, 10.*

303. URINALYSIS.*
Lectures and supervised training in the chemical and microscopic methods used in the diagnosis of renal disease and other metabolic disorders.

304. CLINICAL HEMATOLOGY.*
Lectures and supervised training in the principles of normal and abnormal blood cell production and the methods used in the diagnosis of specific blood diseases. *Credit, 10.*

305. IMMUNOHEMATOLOGY.*
Lectures and supervised training in the principles of blood banking and serology, emphasizing the genetic and immunologic qualities of the blood itself, the blood group systems, compatibility testing, and antibody detection. *Credit, 4.*

306. CLINICAL HISTOLOGY.*
Lectures and supervised training in the preparation of human tissues and organs for gross and microscopic examination as practiced in the hospital histopathology laboratory.

307. CLINICAL SEROLOGY.*
Lectures and supervised training in principles and methods used in detection and measurement of antigens and antibodies important in diagnosis of infectious diseases.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. MEDICAL TECHNOLOGY SEMINAR.
Open to Medical Technology majors only; permission of instructor required. *Credit, 1.*

*Course given in affiliated hospital schools of Medical Technology during the year of clinical internship.

SPECIAL PROGRAMS

Computer and Information Science

Chairman of Program: Professor Michael A. Arbib. Professors Foster (Associate Director, University Computing Center), Kilmer, Lee, Wogrin (Director, University Computing Center); Associate Professors Ledgard, Riseman; Assistant Professors Eckhouse, Jr., Stidham, Taylor, Tenney. Adjunct Associate Professor Greene. Associated Faculty: Anderson (Education), Archer (Civil Engineering), Bobrow (Electrical and Computer Engineering), Ehrich (Electrical and Computer Engineering), Glorioso (Electical and Computer Engineering), Manes (Mathematics), Peelle (Education), Sahin (Management), Stockton (Civil Engineering).

Significant course additions, and a restructuring of existing courses, have been proposed for 1973-74. *Pleose consult the COINS deportmentol office for the lotest informotion.*

122 (I), (II). INTRODUCTION TO PROBLEM SOLVING USING THE COMPUTER.
Problem solving and FORTRAN programming for students from all disciplines. Concepts associated with problem solving valid for many types of problems. Use of FORTRAN on the UMASS time-sharing system. Laboratory included. *Credit, 4.*

132 (II). ALGORITHMIC METHODS FOR SCIENTISTS AND ENGINEERS.
Development of algorithmic techniques for solving large-scale scientific and engineering problems. Emphasis of applications, efficiency, and special interests of the students involved. Use of APL as a major programming language. Prerequisite, COINS 122 or programming experience. Laboratory included. (Not for graduate credit in COINS). Mr. Wogrin.

133 (I), (II). COMPARATIVE CONCEPTS IN PROGRAMMING LANGUAGES.
Fundamental concepts in programming languages. Topics include data structures, scope of names, parameter passing, recursion, block-structure, string and list manipulation languages (like SNOBOL or LISP) and business oriented languages (like COBOL or RPG). Projects embrace concepts discussed. Prerequisite, COINS 122 or programming experience. Laboratory included. *Credit, 4.*

210 (I). TRANSLATOR DESIGN.
A project-oriented course covering techniques of language definition and translation. Particular reference to symbolic assemblers and algebraic compilers. Prerequisites, COINS 133 and 223. Mr. Lee.

211 (II). SYNTACTIC ANALYSIS.
Introduction to the concepts and techniques of syntactical analysis with respect to context free grammars, the recognitive processes involved in the anal-

ysis and generative algorithms of computer translators. Consideration of precedence grammars and semantical implications of grammars. Prerequisites, COINS 210 and 270. Mr. Lee.

223 (I), (II). ASSEMBLY LANGUAGE PROGRAMMING.
Elementary description of computer hardware, input/output equipment, machine language, machine organization, logical design, and assembly language programming. Hands-on laboratory experience with programs, loaders and assemblers. Prerequisite, COINS 122 or programming experience. *Credit, 4.*

224 (II). ADVANCED PROGRAMMING.
Use of list processing and associative computers. Design of interpreters and higher level languages. Topics vary from year to year. Prerequisites, COINS 133, 223 and 235. Mr. Foster.

235 (I). COMPUTER ARCHITECTURE.
The various elements of computer design. The historical influence of certain real computers and the concepts behind them. Prerequisites, COINS 133, 223. Mr. Foster.

250 (I). COMPUTATIONAL MODELLING.
An introduction to probabilistic techniques such as Markov processes, Random Walk and Monte Carlo techniques. Statistical techniques, distributions, and correlation coefficients. Brief introduction to simulation languages. Simple queues, n-person zero sum games. Selected topics generated by class interest from various areas of application. Prerequisite, COINS 133. Mr. Kilmer.

252 (I). TOPICS IN NUMERICAL METHODS.
Computer-oriented numerical analysis, including linear algebra, solution of simultaneous equations, homogeneous equations, eigenvalues, solution of differential equations, solution of algebraic and transcendental equations, and functional representations. Prerequisite, COINS 122 or programming experience.

260 (II). LINGUISTICS AND AUTOMATA.
An introduction to formal language theory in relation to linguistic and psychological studies of the origins, properties and structure of natural languages; phrase structure and transformational grammars; pushdown, linear-bounded and stack automata; applications of grammatical descriptions in behavior and pattern description. Prerequisite, COINS 270. Mr. Tenney.

270 (I), (II). FUNDAMENTALS OF COMPUTATION.
Integrates application and theory by presenting the mathematical underpinning of algorithms, languages, and machines; recursion and induction; models for machines, state diagrams, switching theory, and regular sets; trees; formal grammars; syntax and semantics; basic notions of automata, pushdown automata, and Turing machines, proving properties of programs. Prerequisite, Math 167 or equivalent mathematical maturity.

285 (I). FUNDAMENTALS OF CYBERNETICS.
Integrates brain analysis and artificial intelligence for basic understanding of systems and neural networks, modelling, feedback; scene analysis and pattern recognition in brains and machines; parameter adjustment and adaptation; heuristic search; and planning of complex behavior in the brains of animals and the control computers of robots. Prerequisite, COINS 122 or background in biology or psychology.

291 (I). ECOLOGICAL CYBERNETICS.
Vectors, matrices and eigenvector problems; deterministic and random ecosystem population models; solutions of nonlinear differential equation systems arising in population biology; analytical formulations of ecosystem stability problems, species-packing models, epidemiological problems, and the evolution of altruism. Computer simulation projects will be encouraged as a means of earning a course grade. Prerequisites, Calculus; a computer programming course desirable. Mr. Kilmer.

294 (II). COMPUTERS AND SOCIETY.
The use of computers to solve social problems. Topics like data banks, security, computerized voting, automated health care, computer-aided instruction. Long-range impact of computers.

295 (I). SEMINAR ON IMPLICATIONS.
Interdepartmental studies of social and economic factors in relation to computer-based solution of large-scale problems. Topics vary from year to year. Prerequisite, permission of instructor.

385 (I), 386 (II). SPECIAL PROBLEMS.
Topics by arrangement each semester. Recent advances and current problems in a specialized field of computer and information science. Prerequisite, permission of instructor. *Credit, 1-6.*

RELATED COURSE:
Electric and Computer Engineering 233. Mini Computers.

Marine Sciences Program

Co-Choirmen of Program: Professors D. E. Carritt and C. F. Cole. *Program Faculty:* Professors D. E. Carritt and C. S. Yentsch; Assistant Professor E. A. Perry, Jr.; *Associated Faculty:* Associate Professor C. Adams (Engineering), Associate Professor S. Bemben (Engineering), Professor Cole (Forestry and Wildlife), Associate Professor J. Colonell (Engineering), Associate Professor F. Dzialo (Engineering), Assistant Professor C. Edwards (Zoology), Professor W. Heronemus (Engineering), Associate Professor R. Levin (Food Sciences), Professor W. Litsky (Environmental Science), Assistant Professor P. Mangarella (Engineering), Assistant Professor A. Niederoda (Geology), Dr. R. J. Reed (Cooperative Fishery Unit), Professor J. L. Roberts (Zoology), Associate Professor L. Roberts (Zoology), Professor D. Storey (Agricultural and Food Economics), Professor G. Webb (Geology), Professor J. Zahradnik (Engineering), Assistant Professor O. T. Zajicek (Chemistry).

The Marine Sciences Program is an interdisciplinary program administered by the Graduate School. While there is no undergraduate major in Marine Sciences, several general interest courses are offered to undergraduates who desire a general understanding of the marine environment as well as those who plan to seek an advanced degree in either Marine Biology or Oceanography. Further information can be obtained from Professor D. E. Carritt, A-305 Graduate Research Center, or Professor C. F. Cole, Fisheries Biology, Holdsworth Hall.

225. INTRODUCTORY OCEANOGRAPHY.
A survey of oceans and sea water, the substrate, marine life, and processes; oceanographic techniques. For students in engineering and others desiring a general knowledge of the sea. Prerequisites, one year each of college level physics, chemistry, and mathematics.

230. CHEMICAL OCEANOGRAPHY.
The chemical properties of the ocean that influence and are influenced by marine physical, biological and geological systems. The nutrient cycles; the carbon dioxide system; the density, chlorinity, salinity problem; a brief review of the geological history of sea water; the age of the ocean; gas solubility and gas exchange processes and problems; trace element chemistries; chemistry and man's use of the ocean. Prerequisites, one year college level chemistry, physics, and mathematics. Mr. Carritt.

250. MICROBIAL ECOLOGY OF MARINE ENVIRONMENT.
The ecology, function and importance of microorganisms in the marine environment including the underlying sediments; their role in the food chain and productivity of the seas and estuaries; and the factors influencing seasonal and geographical population dynamics. Prerequisites, general courses in biology, microbiology, and chemistry, and permission of instructor. *Credit, 2.* Mr. Litsky.

301. BIOLOGICAL OCEANOGRAPHY.
Aspects of major planktonic and benthic marine taxa, including distribution, periodicity, and dominant ecological factors.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

391, 392. SEMINAR. *Credit, 1.*

RELATED COURSE:
Geology 355. PHYSICAL OCEANOGRAPHY.

DIVISION OF MILITARY AND AIR SCIENCE

Military Science

Head of Department: Professor (Colonel, USA) George I. Connolly, Jr. Assistant Professors (Major) Faison, (Captain) Libby; Lecturers (Major) Brennan, (Major) Best.

The Department of Military Science offers courses which are open to any student of the University or other institutions in the local area. In addition, the department conducts the Reserve Officers' Training Corps program for those desiring to earn a commission as an officer in the United States Army. Students electing to be ROTC cadets must complete eight semesters or the equivalent of military science subjects. A student may receive constructive credit towards an army commission through attendance at a basic summer camp in lieu of the first two years of the ROTC program; veterans may receive appropriate constructive credit for military service. In addition to the classroom instruction and seminars, participation is required in the department's leadership laboratory comprised of drills and field exercises each semester. Students are also required to complete a six-week advanced summer camp session at the end of the junior or senior year. The summer practicum combined with the leadership laboratory permits the application of theory presented in academic subjects and also includes subjects which can best be instructed under field conditions. To be eligible to be enrolled as a cadet, student must possess the university-sponsored student health insurance or equivalent coverage.

Upon completion of University degree requirements and departmental requirements, the student is commissioned a Second Lieutenant in the U.S. Army. Students also participate in department-sponsored activities to include orientation visits and guest lecturer presentations.

FRESHMAN YEAR

111 (I). AMERICAN MILITARY HISTORY I.
American military history from the Revolutionary War to World War II. Emphasis on the social, economic and political factors which caused participation in each war. Army organization of each war and post war period; leadership techniques in the application of the principles of war; the development of tactics, weapons and equipment; fundamentals of leadership. Prerequisite, permission of instructor. 1 class hour. *Credit, 1.*

112 (II). AMERICAN MILITARY HISTORY II.
American military history from World War II to the Vietnam War with emphasis on the social, economic and political factors which have caused participation in each war; Army organization of each war and post war period; leadership techniques in the application of the principles of war; the development of tactics, weapons and equipment; fundamentals of leadership. Prerequisite: MS 111 or permission of instructor. 1 class hour. *Credit, 1.*

SOPHOMORE YEAR

135 (I). CONCEPTS AND APPLICATIONS OF MILITARY THEORY I.
Introduction to the principles and fundamentals of contemporary military tactics developed through the analysis, interpretation and usage of topographic maps and map substitutes; land navigational techniques and continued leadership development. Prerequisite, MS 112 or permission of instructor. 2 class hours. *Credit, 2.*

136 (II). MILITARY LEADERSHIP AND MANAGEMENT I.
Analysis of military leadership as a dynamic interaction involving the leader, the group and the situation. Readings and discussion of the dimensions of leader behavior; group behavior, communications systems. Motivational theory and organizational structures. Integration of the management fundamentals and principles required by the junior officer. Prerequisite, MS 135 or permission of instructor.

JUNIOR YEAR

251 (I). MILITARY LEADERSHIP AND MANAGEMENT II.
Theory of military leadership and management with applications in case studies; military instructional principles and practicum. Prerequisite, MS 136 or permission of instructor.

252 (II). CONCEPTS AND APPLICATIONS OF MILITARY THEORY II.
Principles of offensive and defensive tactics and leadership applications in units of the infantry division; military communications management, contemporary concepts and techniques in counterinsurgency operations. Six-week summer camp session. Prerequisite, MS 251, or permission of instructor.

SENIOR YEAR

378 (I). MILITARY LAW.
Constitutional basis of powers; the constitution and the individual; the basic principles of criminal law; administration of military justice; and the rules of evidence and legal methods of proving claims made to the courts. Prerequisite, permission of instructor.

379 (II). DEFENSE ORGANIZATION AND MANAGEMENT.
Discussion of the evolution of contemporary defense organization; perspective on defense and Army leadership management and organization in support of national security; fundamentals of leadership. Prerequisite, MS 378 or permission of instructor.

377 (I). ARMY FLIGHT INSTRUCTION PROGRAM.
Flight instruction, offered to eligible seniors who opt to serve as pilots in the U.S. Army. Students receive 35 hours of classroom instruction in meteorology, navigation and Federal Aviation regulations and 36½ hours of flight instruction at a Federal Aviation approved facility. Upon successful completion of the course and FAA examination, students receive a private pilot's license. Enrollment by arrangement with the Professor of Military Science. 2 class hours, 2 laboratory periods.

385 (I), 386 (II). SPECIAL PROBLEMS.
Individual study of selected problems for qualified students. *Credit, 1-3.*

Air Science

Head of Department: Professor (Colonel) Fisher. Assistant Professors (Major) Duto, (Major) Goodhue.

FRESHMAN YEAR

111 (I). THE U.S. AIR FORCE.
Introductory examination of the mission, organizational structure, and operational concepts of the U.S. Air Force with emphasis on U.S. strategic offensive and defensive forces. 1 class hour, 1 hour of corps training. *Credit, 1.*

112 (II). U.S. MILITARY FORCES.
Missile defense, U.S. general purpose forces, and Air Force support forces. The mission, resources, and operation of tactical air forces in limited war. Review of Army, Navy, and Marine general purpose forces, their concepts and organization. 1 class hour, 1 hour of corps training. *Credit, 1.*

SOPHOMORE YEAR

121 (I). DEFENSE ORGANIZATION.
The U.S. Department of Defense, the role of the military as an element of national power, and the nature and principles of war. 1 class hour, 1 hour of corps training. *Credit, 1.*

122 (II). DEFENSE POLICIES AND THE MILITARY.
The defense policies of the Soviet Union and China, the role of alliance in U.S. defense policy, and the making of U.S. defense policies. 1 class hour, 1 hour of corps training. *Credit, 1.*

JUNIOR YEAR

231 (I). GROWTH AND DEVELOPMENT OF AEROSPACE POWER I.
The development of aerospace power into a prime national security element, the development of doctrinal thought that concerns aerospace forces, and the role of technology in this growth and develop-

ment. Presented in a general historical development from the beginning of manned flight to present. 3 class hours, 1 hour of corps training.

232 (II). GROWTH AND DEVELOPMENT OF AEROSPACE POWER II.
Future aeronautical equipment, astronautics, and space operations; future manned aircraft, space vehicles and systems; problems in space exploration, and future space programs. 3 class hours, 1 hour of corps training.

233 (II). FLIGHT INSTRUCTION PROGRAM— CLASSROOM PHASE.
Aeronautics primarily for those students eligible and who elect to serve as pilots in the United States Air Force. 2 class hours. Permission of department required. *Credit*, 2.

SENIOR YEAR

341 (I). THE PROFESSIONAL OFFICER I.
Military management functions, the role of command and staff in decision-making, and the factors relating to effective leadership. 3 class hours, 1 hour of corps training.

342 (II). THE PROFESSIONAL OFFICER II.
The professional concept of military duty, and the framework of military law. 3 class hours, 1 hour of corps training.

343 (I), (II). FLIGHT INSTRUCTION PROGRAM—FLIGHT PHASE.
Aeronautics for those eligible students electing to serve as pilots in the United States Air Force. Provides a total of 36½ hours of flight instruction. Prerequisite, Air Science 233. By arrangement.
Credit, 1.

INDEX TO COURSE & FACULTY SECTION

(See Tables of Contents also.)

University of Massachusetts at Amherst

Head Count Enrollment—February, 1972

UNDERGRADUATE SCHOOL

	1972		1973		1974		1975		1976*		Totals		Grand
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Total
Arts and Sciences	825	590	1361	885	1301	934	1448	1117	172	132	5107	3658	8765
Business Administration	278	12	337	19	337	26	305	17	28	2	1285	76	1361
Education	65	317	91	352	75	291	35	234	10	29	276	1223	1499
Engineering	153	1	254	4	203	6	248	7	14	—	872	18	890
Food & Natural Resources	173	18	330	48	289	50	251	59	22	4	1065	179	1244
Home Economics	2	120	13	286	5	250	1	128	—	7	21	791	812
Nursing	1	70	3	92	3	115	1	113	—	5	8	395	403
Physical Education	66	70	180	83	139	84	94	77	6	6	485	320	805
Public Health	4	24	25	48	22	26	16	40	2	2	69	140	209
Other**	13	10	48	30	14	10	2	3	—	—	77	53	130
Total	1580	1232	2642	1847	2388	1792	2401	1795	254	187	9265	6853	16,118
	2812		4489		4180		4196		441				

GRADUATE SCHOOL

Men	Women	Total
3505	1696	5201

STOCKBRIDGE SCHOOL

Class	Men	Women	Total
1972	213	33	246
1973	281	37	18
Special	10	6	16
	504	76	580

* Mid-Year Admission - First Semester Freshman Class
** Includes students enrolled for the Bachelor's Degree in Individual Concentration

Specials	36	158	194
Non-Classified	22	74	96
Total	9323	7085	16,408

SUMMARY

Undergraduate	16,408
Stockbridge	580
Graduate	5,201
TOTAL AMHERST	22,189
Boston Campus	4,849
Worcester Medical School	40
TOTAL UNIVERSITY	27,078

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ADMINISTRATIVE OFFICERS AND FACULTY 1973

UNIVERSITY OF MASSACHUSETTS AT AMHERST

ADMINISTRATIVE OFFICER AND FACULTY LIST

UNIVERSITY OF MASSACHUSETTS AT AMHERST

NOTE: This listing is based on information available at the beginning of calendar 1973, updated to include promotions effective with the second semester of school year 1972-1973.

ADMINISTRATIVE OFFICERS

UNIVERSITY SYSTEM

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1974-75
Graduate School Bulletin
University of Massachusetts at Amherst

November 1974, Second Edition

The Graduate School Bulletin is published annually. The Graduate School Bulletin for the sessions of 1974-76 is part of the One Hundred and Tenth Annual Report of the University of Massachusetts and in conjunction with the Undergraduate Catalog of the University it constitutes Part II of Public Document 31 (Sec. 8, Chapter 75, of the General Laws of Massachusetts).

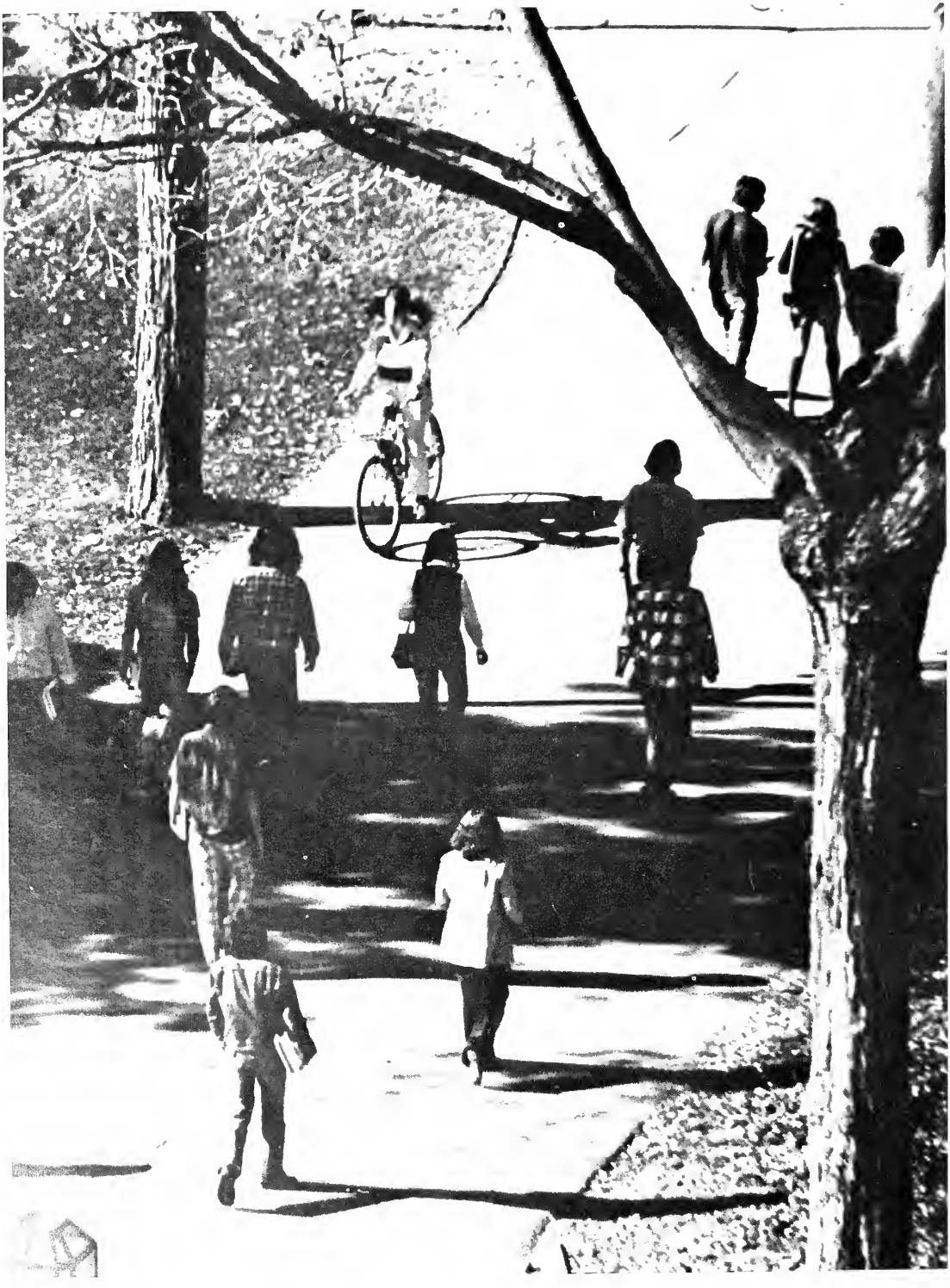
Information contained in this Bulletin is current as of August, 1973.

The University of Massachusetts symbol is a six-pointed motif made up of three units representing learning (an open book), unity (juxtaposition of the units representing campuses at Amherst, Boston, and Worcester), and mankind (conventionally represented by the Y space formed between the three units).

1974-75

GRADUATE SCHOOL

UNIVERSITY OF MASSACHUSETTS AMHERST



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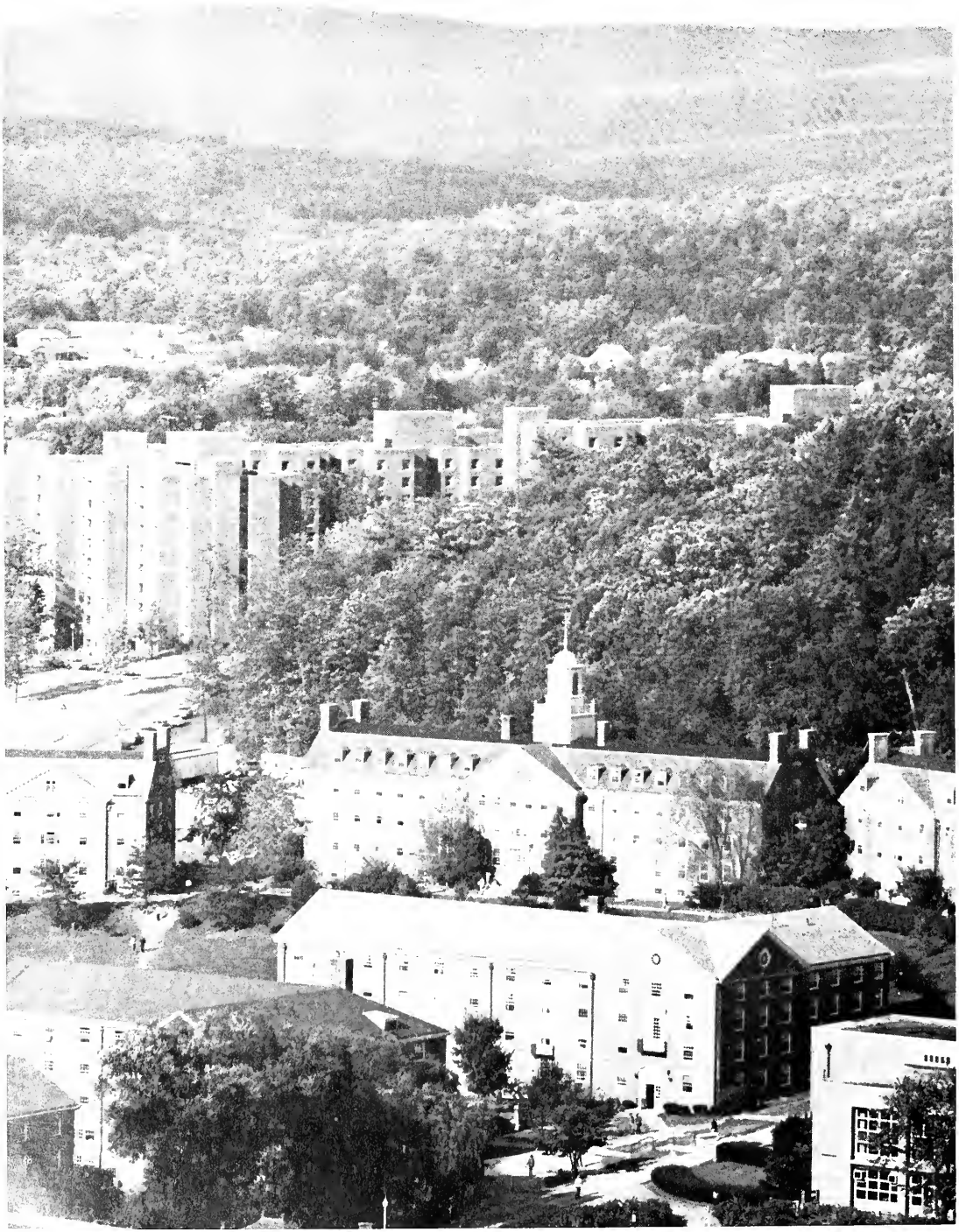
1974-75 Academic Calendar

Thursday, September 5	Registration for graduate students.
Friday, September 6	Classes begin.
Thursday, September 19	Last day to add courses.
Monday, September 30	Last day on which May 1975 doctoral degree candidates may submit an approved dissertation prospectus.
Monday, October 14	Holiday.
Thursday, October 17	Last day to drop courses with DR.
Monday, October 28	Holiday.
Monday, November 11	Spring semester preregistration begins.
Wednesday, November 27	Thanksgiving Recess begins after last class.
Monday, December 2	Thanksgiving Recess ends.
Friday, December 13	Final examinations begin.
Saturday, December 21	Final examinations end; Christmas Recess begins.
Tuesday, December 31	Degree requirements deadline for February 1, 1975 degrees; last day on which May 1975 masters' degree candidates may submit an approved thesis outline.
Wednesday, January 29	Registration for graduate students.
Thursday, January 30	Classes begin.
Friday, January 31	Last day on which September 1975 doctoral degree candidates may submit an approved dissertation prospectus.
Wednesday, February 12	Last day to add courses.
Monday, February 17	Holiday.
Wednesday, March 12	Last day to drop courses with DR.
Saturday, March 22	Spring Recess begins after last class.
Monday, March 31	Classes resume.
Monday, April 21	Holiday.
Monday, April 28	Fall semester preregistration week begins.
Wednesday, April 30	Degree requirements deadline for May 31, 1975 degrees; last day on which September 1975 masters' degree candidates may submit an approved thesis outline.
Monday, May 19	Final examinations begin.
Monday, May 26	Holiday.
Wednesday, May 28	Final examinations end.
Friday, May 30	Last day on which February 1976 doctoral degree candidates may submit an approved dissertation prospectus.
Saturday, May 31	Commencement.
Friday, August 29	Degree requirements deadline for September 1, 1975 degrees; last day on which February 1976 masters' degree candidates may submit an approved thesis outline.

1975-76 Academic Calendar

Thursday, September 4	Registration for graduate students.
Friday, September 5	Classes begin.
Thursday, September 11	Last day to register.
Thursday, September 18	Last day to add courses.
Tuesday, September 30	Last day on which May 1976 doctoral degree candidates may submit an approved dissertation prospectus.
Monday, October 13	Holiday.
Thursday, October 16	Last day to drop courses with DR.
Monday, October 27	Holiday.
Monday, November 17	Spring semester preregistration week begins.
Wednesday, November 26	Thanksgiving Recess begins after last class.
Monday, December 1	Classes resume.
Friday, December 12	Final examinations begin.
Saturday, December 20	Final examinations end; Christmas Recess begins.
Wednesday, December 31	Degree requirements deadline for February 1, 1976 degrees; last day on which May 1976 masters' degree candidates may submit an approved thesis outline.
Wednesday, January 28	Registration for graduate students.
Thursday, January 29	Classes begin.
Friday, January 30	Last day on which September 1976 doctoral degree candidates may submit an approved dissertation prospectus.
Wednesday, February 4	Last day to register.
Wednesday, February 11	Last day to add courses.
Monday, February 16	Holiday.
Wednesday, March 10	Last day to drop courses with DR.
Saturday, March 20	Spring Recess begins after last class.
Monday, March 29	Classes resume.
Monday, April 19	Holiday.
Monday, April 26	Fall semester preregistration week begins.
Friday, April 30	Degree requirements deadline for May 29, 1976 degrees; last day on which September 1976 masters' degree candidates may submit an approved thesis outline.
Monday, May 17	Final examinations begin.
Tuesday, May 25	Final examinations end.
Friday, May 28	Last day on which February 1977 doctoral degree candidates may submit an approved dissertation prospectus.
Saturday, May 29	Commencement.
Tuesday, August 31	Degree requirements deadline for September 1, 1976 degrees; last day on which February 1977 masters' degree candidates may submit an approved thesis outline.



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Organization of 1973	*Term Expires*
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Nicholas K. Apostola '74 *of Southbridge*	1974
John C. Boyden *of Yarmouth Port*	1974
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University of Massachusetts/Amherst

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University of Massachusetts/Worcester

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General Information

The University

The University of Massachusetts is the state university of the Commonwealth. It was founded in 1863 under the provisions of the Morrill Land Grant Act passed by the United States Congress one year earlier.

Situated in one of the most picturesque sections of the state, the University at Amherst joins with its academic neighbors—Amherst, Smith, Mount Holyoke, and Hampshire Colleges—in maintaining the rich tradition of education and cultural activity associated with the Connecticut Valley region. The University's Amherst campus consists of approximately 1,100 acres of land and 110 buildings. Physical growth has been carefully planned, with provisions or additional buildings and facilities to accommodate an enrollment of approximately 25,000 students by 1975.

The Associate Provost and Dean of the Graduate School, in collaboration with the University Graduate Council, exercises overall review and supervision of graduate programs conducted in the several colleges and provides guidance in the development of new programs as well as the maintenance of standards for existing programs. Each college of the University has developed its graduate programs in accordance with the highest national professional standards of the respective fields.

For information about University of Massachusetts at Boston graduate programs, consult the *University of Massachusetts at Boston Bulletin.*

Information on graduate programs in medicine is found in the *University of Massachusetts at Worcester Medical School Catalog.*

COLLEGES CONDUCTING GRADUATE PROGRAMS

Eight colleges and schools of the University are authorized to offer graduate degrees through the Graduate School: the College of Arts and Sciences, the College of Food and Natural Resources, the School of Business Administration, the School of Education, the School of Engineering, the School of Health Sciences, and the School of Physical Education.

UNIVERSITY LIBRARY

The University Library system is composed of the new 28-story University Library and several branch libraries. Present holdings include over 1,200,000 books, periodical volumes, and government documents, and over 250,000 microforms. All holdings of the University Library and its branches are listed in the public catalog, situated on the main level of the University Library. More than 10,000 periodicals are currently received and distributed, according to subject matter, in the University Library or its branch libraries. Holdings and locations are listed in both the card catalog and the *Pioneer Valley Union List of Journal and Serial Holdings,* a computer-produced book that also includes serial listings of Amherst, Smith, and Mount Holyoke Colleges and the Hampshire Inter-Library Center. A computer project to provide on-line access to all University serial holdings is currently underway. The Library is a depository for U.S. Government publications and also regularly receives many categories of publications from the United Nations and other international agencies and from the Commonwealth, cities, and towns of Massachusetts.

The University Library contains the major portion of the entire collection, including most of the holdings in the social sciences and humanities. The principal branch libraries are the Morrill Biological Sciences Library in the Morrill Science Center and the Physical Sciences Library in the Graduate Research Center.

A library handbook and information series is available at the reference desk of the University Library as well as in the branch libraries. Librarians are on duty in the University Library and the two branch libraries to assist the University community in using the Library and its collections.

HAMPSHIRE INTER-LIBRARY CENTER

The University Library is a participating member of the Hampshire Inter-Library Center, a cooperative facility for the acquisition, storage, and servicing of research materials, especially journals, documents, and scholarly sets. Incorporated in 1951 to augment library resources in the area, HILC is jointly operated by the libraries of the five Connecticut Valley colleges—Amherst, Hampshire, Mount Holyoke, Smith, and the University of Massachusetts—and the Forbes Library of Northampton, Massachusetts. The HILC collection numbers about 35,000 bound volumes, and approximately 1,000 journals are received currently. The Center is currently located in the Physical Sciences Branch Library.

THE UNIVERSITY COMPUTING CENTER

The University Computing Center provides the computing services required to support the instruction and research activities of the faculty and students of the University. Computing services include both batch and time-sharing operations. A large number of popular programming languages and an extensive library are available through the batch system. The time-sharing system allows access to the computer from over 100 terminals located around the campus. As many as 96 simultaneous users can be accommodated. The languages available are FORTRAN, BASIC, APL, and a number of special purpose languages such as COGO, MIMIC, and MIXAL. Users can maintain and share their private libraries as well as have access to a large public library.

In addition to the computing services, the University Computing Center offers many user services, including application programming, consulting, library, program assistance, and keypunching. Short courses in programming and various languages and the use of various systems are offered as needed by the community. Formal full-term courses in computing techniques are offered by the Computer and Information Science Department.

The equipment of the University Computing Center consists of a CDC 3800 and a CDC 3600 which share four 32K banks of core storage. Peripheral devices include drums, disk drives, tape drives, card readers, printers, card punch, and a PDP-8 and TEMPO I computer. Off-line equipment includes plotter, verifiers, collator, sorter, and accounting machines. An intensive study has been underway to upgrade the computing facilities with a large-scale, modern, central computing system by Summer, 1974.

LABOR RELATIONS AND RESEARCH CENTER

The Labor Relations and Research Center conducts research in the field of labor relations, provides consultation services, and supports a regular program of academic course work. A Master of Science degree in Labor Relations is described elsewhere in this Bulletin. Inquiries should be addressed to the Director of the Labor Relations and Research Center, 125 Draper Hall, University of Massachusetts, Amherst, MA 01002.

WATER RESOURCES RESEARCH CENTER

The Water Resources Research Center at the University's Amherst campus supports research in the planning and development of water and related land resources. Areas covered include engineering, economics, and hydrogeology; management and decision-making institutions; and the ecology of wetlands, rivers, lakes, and coastal waters. Through its research the Center also provides training opportunities for persons interested in master's and doctoral degrees in water resources-related fields. The Center assists the various departments in the development of new and strengthened water resources programs and courses.

THE MARINE STATION

The Marine Station of the University of Massachusetts is located about half-way between Rockport and Gloucester on the North Shore of Cape Ann. The laboratory was formerly the quarters of the Consolidated Lobster Company, which for years processed and distributed fish products for Boston and New York. The main laboratory building is located at the end of a peninsula jutting out into Ipswich Bay. Adjacent to the laboratory are 200 feet of docks and floats where deep draft vessels are easily moored. The laboratory operates a 45-foot research vessel, the R.V. Bigelow, named after the famous oceanographer, Henry B. Bigelow. The vessel is equipped with deep-sea winches and all-weather laboratory space.

The close proximity of the laboratory to the fishing activities of Gloucester and the science-industrial complex along Route 128 provides a unique opportunity for cooperative research efforts. The laboratory staff of 15 year-round employees directs research oriented toward understanding the physical and chemical processes associated with the growth of marine organisms.

The main laboratory is essentially equipped for biochemical studies, containing culturing facilities, dark rooms, instrument rooms, running seawater, research offices, and a library. Research studies include: physical and biochemical factors affecting the augmentation of growth of phytoplankton in the Gulf of Maine, biochemical cycling of plant material, influence of temperature on photosynthesis and respiration of phytoplankton, general metabolism and energetics of marine shellfish, biochemical factors influencing the penetration of solar radiation in seawater, and nitrogen metabolism of attached algae.

Opportunities exist for qualified graduate students to do research at the Station. Through the School of Continuing Education courses are offered in the environmental physiology of invertebrates and algae. For further information see the section on the Marine Sciences program.

THE SUBURBAN EXPERIMENT STATION

A part of the College of Food and Natural Resources, the University's Suburban Experiment Station is located in Waltham, about 10 miles west of Boston. It has 30 acres of land available for field experiments under urban/suburban conditions. Well-equipped greenhouses and laboratories for studying the effects of environmental stresses on plants are also available. Represented disciplines include plant physiology, plant pathology, entomology, plant breeding and plant genetics.

Faculty members regularly participate in graduate programs and are willing to cooperate in studies involving urban/suburban stresses.

DEPARTMENTS OF MILITARY AND AIR SCIENCE

Seniors and graduate students with two years of academic study remaining who are interested in becoming commissioned officers in the United States Army or United States Air Force may apply to the Department of Military Science or to the Department of Air Science, respectively, for a two-year commissioning program. Selected students receive $100 per month and are granted Selective Service deferments. Two-year scholarships are available for qualified applicants. Those interested should consult the head of either department at least six months prior to the beginning of their final two years at the University. Early application is necessary for administrative processing. Candidates must pass an aptitude test, a physical examination, and attend a six-week summer camp.

UNIVERSITY OF MASSACHUSETTS ABROAD

Freiburg Program

The Freiburg Program, begun in 1966-67, offers to graduate students and selected upper-division undergraduates an opportunity for a year of advanced studies in the humanities, social sciences, and arts at the University of Freiburg, Germany. Although a good command of German is necessary for admission, the program is not restricted to students concentrating in German language and literature. However, a superior academic record is required for admission. Accepted students may enroll in a wide variety of courses at the University of Freiburg, including political science, comparative literature, philosophy, economics, music, psychology, and German language and literature.

The program is directed in Freiburg by a member of the University of Massachusetts faculty and is headquartered in the University of Massachusetts Study Center in Freiburg. The relationship between the two universities is developing into a genuine partnership, with a yearly exchange of students and faculty from each institution.

Students from other colleges and universities are eligible to apply for admission to the Freiburg Program. Undergraduates apply through the Office of International Programs, Whitmore Administration Building. Students from other colleges and universities applying to study in the Freiburg Program at the graduate level must apply to the Graduate School of the University of Massachusetts as well as to the International Programs Office.

Basic cost of the program is estimated at about $2,500 annually, including international travel, room and board, tuition and fees. Scholarships are available to outstanding students, and Fulbright scholarships may be applied to participation in the Freiburg Program. Applications and additional information are available at the Office of International Programs.

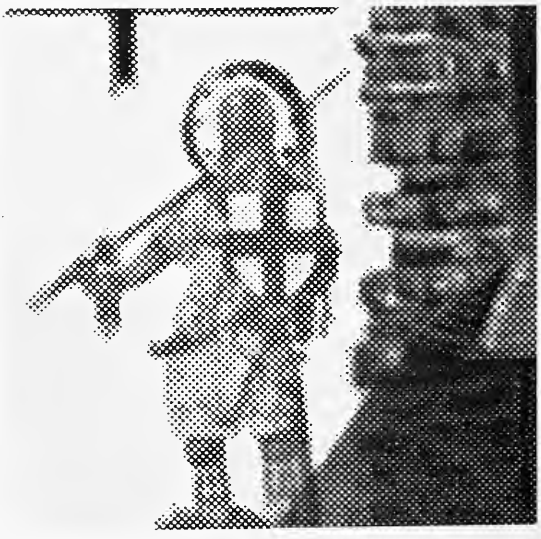
Summer Program at Freiburg

The Department of Germanic Languages and Literatures sponsors a six-week summer program in West Berlin and Freiburg, Germany. Courses in elementary, intermediate, and advanced German are offered, and students may earn up to 6 University of Massachusetts credits. There is a three-week period for independent travel in Europe between the initial week in Berlin and the five weeks spent in Freiburg.

The course fee for the program is $895. This fee covers round-trip international travel, tuition, room and board, special excursions, and lectures which supplement the basic program.

Although primarily for undergraduates, the program is open to graduate students as well. One of its aims is to offer to students enrolling in the one-year Freiburg Program the opportunity to gain greater proficiency in German prior to participation in that program.

For further information contact the Department of Germanic Languages and Literatures, Herter Hall.



Summer Program at Bologna

The Summer Program in Italy, held in Bologna from the middle of June to late August, is not geared specifically to any one discipline or to language study. Italy—its language, its history, and its people—is the focus of all courses, and each acquires an added dimension by virtue of the fact that it is taught in the country itself. The curriculum includes graduate and undergraduate courses in the fields of history, art history, Italian language and literature, cultural anthropology, and other related fields. Field trips to major cultural centers in Italy are an integral part of the program. The program is open to students from other colleges and universities as well as to University of Massachusetts students, but enrollment is limited to 60 students. Any student in good academic standing is eligible to apply. Although knowledge of Italian is not a prerequisite, prospective applicants are encouraged to take at least one year of Italian so as to derive the greatest possible benefit from their stay in Italy. Enrollment in the program costs $900; this includes international travel, tuition, field trips, housing, and partial board in Bologna. Expenses for the free travel time at the conclusion of the program are additional and should be budgeted for. For further information contact the Director, Bologna Program, Department of French and Italian, Herter Hall.

Summer Studies in French

The Department of French and Italian will sponsor a French studies Summer Program. The location is to be decided upon by October, 1973.

Summer Program at Oxford

A special group of courses in English literature is regularly offered at Trinity College, Oxford, during July and part of August. The six-week session is part of the regular Summer Session of the University of Massachusetts and awards University of Massachusetts credit. Courses are taught by Oxford, with the Bodleian Library available for extensive research. Graduate and undergraduate courses are offered, subject matter varying according to the availability of specialists at Oxford and the interests of students. Evening lectures by noted authorities supplement course offerings. Students from colleges and universities other than the University of Massachusetts are also eligible. Admission requirements include 15 hours of credit in literature and good academic standing. The overall cost to the student is $890. There is free travel time before and after the seminar. To apply, contact Dr. Ernest Hofer, Department of English, Bartlett Hall.

Field Course in Cultural Anthropology

St. Vincent, West Indies

The Anthropology Department offers an eight-week field course in cultural anthropology to graduate and selected undergraduate students in anthropology. The purpose of the course is to give students a supervised introduction to cultural anthropological field work, the foundation of a professional career in anthropology.

The course is given in June and July. The first week is devoted to orientation and familiarization with the culture of St. Vincent in the capital, Kingstown. This is followed by six weeks' residence in research sites selected on the basis of both student and government interest. Research activities in the field are closely supervised by the director of the program, and students return to Kingstown periodically for brief seminars to compare and discuss their progress and problems. The final week's work, held in Kingstown, is devoted to presentation of preliminary results, evaluation, discussions with officials of Government, and planning for publication of final reports.

Costs of the program, including round-trip air transportation from New York, tuition, room and board, and program-related transportation, is about $700 ($850 for non-residents of Massachusetts). Limited financial aid is available. Students earn 6 University of Massachusetts credits. Further information may be obtained from Professor T. M. Fraser, Department of Anthropology, Machmer Hall.

Field Program in Anthropology, Europe

The Anthropology Department offers a field program in anthropology open to graduate and advanced undergraduate students in anthropology. Lasting for a period of either four or seven months, the course is designed to provide serious students preparing for careers in anthropology with an extended period of field research in Europe under the guidance of an experienced field worker. The program is held each spring semester, with an option to extend the period of research through the summer available to selected participants.

Directorship of the program rotates among the faculty members of the Department's European Studies Committee. Location of the program in Europe in any given year depends upon who is directing the program. Each participant selects a

field site in accordance with his interests and training, but within the country or group of countries designated by the director. The first few weeks in the field each student conducts a survey of the region in which his field is located before taking up residence at the site. Supervision of all field activities is provided by the director. All participants assemble periodically in a central location for short seminars, to discuss their problems and progress. A final seminar, during the last week of the program, is devoted to the presentation and evaluation of preliminary results.

Prerequisites for participation in the program include a working-knowledge of the language required for field research, and prior course work in both field methods and in the culture area where research is to be conducted. Students interested in participation in the program should submit to the program director a proposal outlining the research they hope to accomplish. The proposal should be submitted during the fall preceding the spring in which the applicant wishes to participate in the program. A format for such a proposal, as well as additional information about the program, is available from the Chairman of the European Studies Committee, Anthropology Department, Machmer Hall.

A limited number of stipends is available to offset costs of international travel and maintenance while in the field.

Application Procedures for Admission and Readmission

Holders of bachelor's degrees, from this University or from other institutions having substantially the same requirements for the bachelor's degree, are eligible to apply for admission to a program of graduate studies. Admission is only for the semester requested and cannot be guaranteed for a later date. Application blanks may be obtained by writing to the Graduate Admissions Office, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002. Application for admission, with supporting documents, should be sent in duplicate to the Graduate Admissions Office so as to be received by March 1 (by February 15 for Master of Fine Arts programs) for September or Summer Session enrollment and by October 1 for January enrollment. Applications received after these dates can be considered only if space is available.

Admission to the Graduate School does not necessarily indicate candidacy for an advanced degree. Such candidacy is subject to specific requirements as defined by the individual departments. The student must secure the approval of the Head or Chairman of the Department in which he desires to major before he can become a candidate for a degree in that subject.

Applicants can be admitted to the Graduate School in one of the following categories:

Degree status: a student admitted as fully qualified to undertake a program toward a graduate degree.

Provisional status: a student admitted on a probationary status. At the conclusion of a semester of work—or two semesters if the department stipulates—the student is either admitted to degree status or refused readmission. If he is admitted to degree status, credits earned while in a provisional status are acceptable toward his degree if approved by his department/school.

Graduate Special Status: open to students who have a bachelor's degree or its equivalent. A student may enroll for a maximum of 12 credits or two consecutive enrollment periods (including Summer Session) whichever comes first. This status may not be renewed beyond the credit/time limitation regulation as stated above. Graduate credits earned may be applied toward a graduate degree at this institution, subject to acceptance into a degree program, and provided the credits are acceptable to the department/school. (The Art Department requires a slide portfolio from all art education and studio Special Student applicants.)

Graduate Non-Degree Status: open to students who have a bachelor's degree or its equivalent. Acceptance is for one calendar year, and credits earned under this status are not—and will not become—applicable toward a graduate degree at this University. This status may be renewed upon its expiration, provided the student is in good academic standing.

Requirements for Admission

1. A minimum cumulative grade point average of 2.75.
2. A bachelor's degree or the equivalent from any college or university of recognized standing.
3. Two official transcripts of all previous college work (undergraduate and graduate).

An applicant should request the registrar of all colleges previously attended to send two copies of the transcript directly to the Graduate Admissions Office. Transcripts should be sent as soon as the first semester grades of the final year's work have been recorded. A final transcript showing that the bachelor's degree has been awarded must be received before the applicant enters the Graduate School.

4. Two letters of recommendation from persons in the field of the applicant's academic major at the institution most recently attended. Applicants whose academic record goes back more than five years may substitute other references, subject to departmental acceptance.
5. The Graduate Record Examination (both Aptitude and Advanced Tests) should be submitted for admission to the Graduate School. The Advanced Test must be taken in the field of study in which the applicant intends to earn a degree. Each applicant should have a transcript of his scores sent to the Graduate Admissions Office. Applicants are urged to take the Graduate Record Examination at the November testing or earlier. The results of later testings are frequently not available before decisions on admission must be made. The Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540, or Box 27896, Los Angeles, California administers the test in the United States as well as abroad. Addresses of test centers can be obtained from them. On this campus the test is given by the University Guidance Office.

Applicants for admission to the School of Business Administration are required to take the Admission Test for Graduate Study in Business rather than the Graduate Record Examination. This test is also administered by the Educational Testing Service. Inquiries concerning it should be addressed to the Service.

6. For foreign student requirements see section entitled Foreign Applicants.
7. Acceptance by *both* the department *and* the Graduate School.

Foreign Applicants

A brochure entitled "Information for Prospective Students from Other Countries" giving detailed information of use to foreign students, is available from the Graduate Admissions Office. Foreign applicants must complete their applications at least nine months prior to the registration date of the first semester of study.

The Test of English as a Foreign Language (TOEFL) is required of all applicants for admission to the Graduate School from countries whose native language is not English. Information about the examination may be obtained by writing:

Test of English as a Foreign Language
Educational Testing Service
Princeton, New Jersey 08540 U.S.A.

TOEFL may be waived if the applicant has attended an American college or university for a period of at least two academic years. A score of 550 or above is required for admission. Students scoring between 500 and 549 who otherwise meet the requirements set by departments may be admitted provided they agree to attend, at their own expense in the summer prior to admission, a summer institute in English (such as the program of the Experiment in International Living at Putney, Vermont). All non-native-speakers of English who are admitted will be tested by the University on arrival before registration, whether or not they have submitted TOEFL. Students scoring below the established minimum will be required to take further work in English. The program of study of graduate students taking remedial English work is subject to limitation by the Graduate School.

Foreign applicants are normally admitted only to Degree Status and for full-time study.

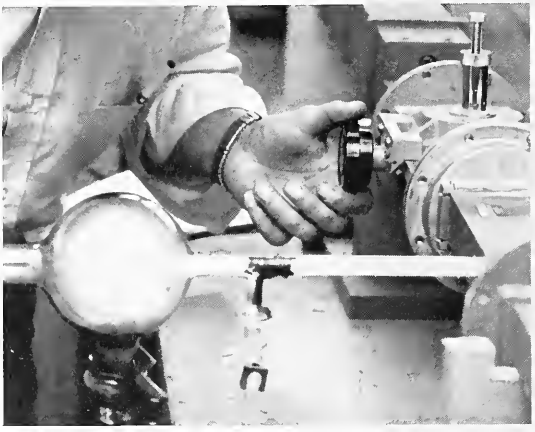
Admission of Faculty and Staff Members to Graduate Study

A member of the faculty of the University with the rank of assistant professor or higher may not earn a graduate degree from the University. He may, however, do graduate work on a non-degree basis. A full-time staff member of the University may not carry more than 4 credits per semester.

Readmission

A student or applicant who falls into one of these categories must reapply:

1. An applicant who has previously been admitted to the University but did not enroll on the entrance date stated in the acceptance letter;
2. A graduate student at this University who was accepted for one degree program and wishes to apply for another program or degree; and
3. A degree candidate who has not enrolled in courses or paid the Program Fee (see next section) must reapply and pay all associated fees.



Tuition and Fees

TUITION

All graduate students pay tuition at the following rates: Residents of Massachusetts—$22.50/credit hour up to $225 per semester; non-residents—$45/credit hour up to $450 per semester. In order to register as a Massachusetts resident, a student must have on file a Certificate of Residence properly authenticated by his Town or City Clerk.

GENERAL FEES

(also see Medical-Surgical Section)

Graduate students enrolled for 5 or more credit hours are assessed approximately $70 per semester. This General Fee includes such facilities and services as Infirmary, Fine Arts, Campus Center, I.D. Card, and Graduate Student Senate Tax. The General Fee is NOT optional.

Graduate students enrolled for fewer than 5 credit hours are assessed approximately $20 per semester. This fee includes an I.D. card, Graduate Student Senate Tax, and one-half of the Campus Center charge. Infirmary service is optional at $35 per semester if enrolled for less than 5 credit hours.

During the Summer Session tuition charges are as stated above, but fees are assessed on a weekly basis.

TUITION AND FEE CHANGE

Tuition and fees are subject to change and may be changed without prior notice.

PROGRAM FEES

Graduate students not enrolled for any course credits but who are candidates for a degree, must pay a Program Fee of $10 each semester until the degree for which the student has been accepted has been awarded. Deadline for payment of this fee is two weeks after the first day of classes. If a student does not pay this fee but later seeks readmission or applies for graduation, he shall pay the accumulated Program Fees plus a readmission fee of $50. Students seeking readmission must secure a Reapplication form from the Graduate Admissions Office and follow the procedure described under the Readmission section.

COMMENCEMENT FEE

There is a $10 Commencement Fee requisite for graduation. This fee must be paid by the time a student files for graduation.

MEDICAL-SURGICAL INSURANCE

An optional medical-surgical insurance plan supplements the care received by students at the Infirmary. It provides hospital, medical, and surgical care on a twelve-month basis for illness or injuries received during the school year as well as holidays, summer vacation, and other times when the student is off campus. Students who register for the fall semester have only one opportunity to enter or reject this program each year, at the time of payment of the fall semester bill. It is offered on the spring semester bill for new spring registrants only. The fee for medical-surgical insurance is approximately $40 per year. Married students desiring family coverage under the plan now in existence at the University are advised to contact the Student Health Services. The cost of family coverage is an additional $35 (approximate) per quarter.

STUDENT FINANCES

Students should arrive on campus with enough cash on hand to pay their tuition, fees, and insurance bills as well as room and board for at least one month after registration. Normally, this will be between $400 and $500. (Students receiving financial assistance from or through the University will not receive their first checks for approximately three to four weeks after registration.)

WAIVER OF TUITION AND FEES

Some exemptions are made for tuition and certain fees. Waiver forms must be processed prior to registration in order to take advantage of exemptions.

Waiver of Tuition

Full-Time Community College Faculty

The Trustees of the University of Massachusetts have authorized waiver of tuition, but not fees, for faculty members of the Massachusetts Regional Community Colleges taking courses at the University of Massachusetts, providing the faculty members have been serving full-time before taking such courses and return to full-time teaching in their Community College after completion of course work. When a faculty member who is eligible for such a tuition waiver desires to take a course at the University, his Community College President should write a memorandum certifying that he is a full-time faculty member. Such waivers will apply for the period from September 1 to the following August 31. Such faculty members must be accepted for admission by the Graduate School prior to any registration.

Vietnam Veterans

Tuition may be waived for any Vietnam veteran, as defined in the General Laws, whose service was credited to the Commonwealth. Any veteran eligible for this waiver is advised to contact the Veterans Coordinator, Whitmore Administration Building for further information.

TUITION AND FEE REFUNDS

A student who leaves the University for any reason before a semester is completed, except as specified below, will be granted a pro rata refund of tuition and fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given full refund of tuition and fees. A student who is involuntarily called into military service before the completion of a semester will be given pro rata refund of tuition and fees provided he receives no academic credit for work done in that semester. If academic credit is given, there will be no refund. A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

Refunds are first applied to reimburse scholarships or loan funds (up to the full amount), and any remaining amount is refunded to the student.

REFUND SCHEDULE

Regular Term

a. Within the first two weeks from the beginning of semester or term—(Registration Day)—80%
b. During the third week—60%
c. During the fourth week—40%
d. During the fifth week—20%
e. After the fifth week—No refund

Summer Session

a. During the first week—60%
b. During the second week—20%
c. After the second week—No refund

ROOM RENT

The charge varies from $307.50 to $350 per semester, depending upon the residential area. The telephone charge, where applicable, is $20 per semester and is not optional. A deposit of $100 is required before any assignment can be made.

ROOM RENT REFUNDS

Room rent refunds are granted on a pro rata basis which applies for the first five weeks of the semester only. No rent refunds are granted after five weeks.

BOARD

The cost for each semester is $321.75 for 15 meals per week or $284.75 for 10 meals per week. Food service will be available weekends on an individual purchase basis. Students under 21 years of age who reside in a dormitory are required to pay University board. Other students may purchase individual meals on a cash basis.

BOARD REFUNDS

Authorized refunds will be made on a pro rata basis. A student who is suspended or expelled from the University for disciplinary reasons forfeits all right to a refund.

Housing

The University provides a limited amount of housing on campus for married and single graduate students. Information relating to off-campus housing should be requested from the Housing Office, Room 235, Whitmore Administration Building.

At present, one of the residence halls in the Southwest Residential College is reserved for use by unmarried graduate students. Prince House is a four-story building containing three large social-lounge areas, a recreation room, a television room, vending machines, and a snack lounge. Student bedrooms are for double occupancy only. Terms of occupancy are indicated below:

1. Space in the building will be assigned on a full-semester basis only.

2. Both American and foreign single graduate students, male or female, are admitted to the limits of available space. Each individual assignment states the amount of board and room charged. The University reserves the right to alter fees whenever necessary.

3. Residence-hall rules and regulations require that occupants assume the responsibility for damage in and to their rooms; hot plates or any other equipment for preparing hot food are expressly prohibited.

4. No assignment will be made until the $100 Room Security Deposit has been paid. This deposit is required of all students who live in University residence halls. It is not deductible from the semester bill and can be refunded only upon notification of withdrawal or of the student's plans to move off campus, *provided* such notification is given to the Housing Office no later than forty-five days prior to registration day of each semester.

5. Upon acceptance to the Graduate School, the entering student will receive housing information and an application form. While every effort is made to comply with requests, the University reserves the right to make room assignments in accord with existing vacancies. Early applications receive preference.

APARTMENTS FOR MARRIED STUDENTS

The University owns and manages 395 unfurnished apartment units of various sizes at three convenient locations on or near campus. A waiting list is established for entrance into University-owned housing and is maintained according to the date of application. Apartments are allocated as follows: 75% married graduate students, 20% married undergraduates, and 5% for University use. Information on assignment procedures, apartment descriptions, and application forms may be obtained from the Married Student Housing Office, Room 235, Whitmore Administration Building.

OFF-CAMPUS HOUSING

A listing of off-campus apartments, houses, and rooms is maintained at the Housing Office for use by any person connected with the University. Due to daily changes in these rental listings and the fact that all off-campus arrangements must be made directly by the parties involved, these listings cannot be secured except by a personal visit. Information concerning off-campus housing may be obtained from the Housing Office, Room 235, Whitmore Administration Building.

Fellowships, Assistantships, and Teaching Associateships

UNIVERSITY FELLOWSHIPS

A limited number of unrestricted University fellowships are awarded to graduate students on a University-wide basis by competition. They are intended to encourage and assist superior students in pursuing graduate study and in completing the requirements for graduate degrees in the minimum possible time.

The stipend is $2,800 for the academic year, payable in weekly installments from September through May. Fellowships provide for waiver of tuition, but not of fees and are not renewable beyond the third year. A recipient of a University fellowship must enroll as a full-time student.

Application can be made on forms supplied as part of the regular admissions material by the Graduate School of the University of Massachusetts. Completed applications must be submitted to the Graduate School for major department review before February 1 for the following September. Awards are announced by April 15. Applicants not currently enrolled in graduate study at the University must also have filed an application for admission to the Graduate School.

FEDERAL FELLOWSHIPS

The University participates in the various Federal fellowship programs sponsored by the National Defense Education Act (NDEA), the National Science Foundation, and the National Institutes of Health. Suitable applicants are recommended by the academic departments.

OTHER FELLOWSHIPS

Direct fellowship awards are available from a number of foundations. Students may obtain information concerning these fellowships from the Graduate School.

GRADUATE ASSISTANTSHIPS AND ASSOCIATESHIPS

The University offers a number of graduate assistantships and associateships in the research and instructional programs of the various departments. Graduate assistants and associates are not required to pay tuition if their stipend is $625 or more for the semester. A stipend of $1,250 or more over two semesters entitles the assistant to a waiver of tuition during the following summer session. Application for a graduate assistantship is made to the Graduate Program Director in the department involved.

Research Assistantships

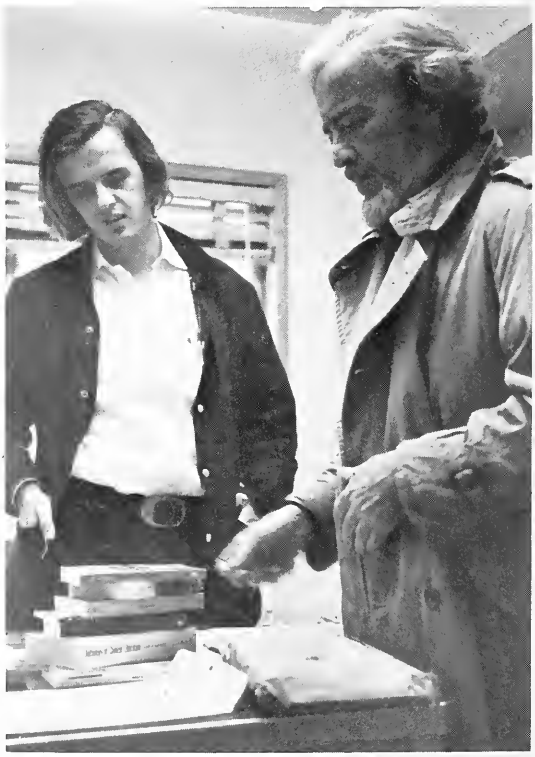
A number of research assistantships are available to qualified graduate students. These are made possible through funds provided by various industries, the Experiment Station, and research grants awarded to members of the Graduate Faculty either from sources outside the University or from funds provided by the University and administered by the Research Council. Stipends vary with the type of work and the amount of time involved.

Teaching Assistantships

Many departments are able to offer teaching assistantships to qualified, regularly enrolled graduate students. A teaching assistant is normally required to devote 20 hours per week in preparation and teaching. The stipend varies from $3,400 to $4,000 per academic year.

Teaching Associateships

Superior achievement and ability among teaching assistants is recognized and rewarded by promotion to the position of Teaching Associate. The stipend for teaching associates ranges from $3,800 to $4,500 per academic year.



NATIONAL DEFENSE LOANS AND THE COLLEGE WORK-STUDY PROGRAM

Graduate students may be eligible for National Defense Loans and employment under the College Work-Study Program. Loans are awarded on the basis of need and funds available; however, no student may borrow in excess of $10,000. The repayment period and the interest do not begin until nine months after the student ends his studies. The loans bear interest at the rate of three percent per year, and repayment of principal may be extended over a ten-year period. If a borrower becomes a teacher in an elementary or secondary school or in an institution of higher education, as much as half of the loan may be forgiven at the rate of 10 percent for each year of teaching service. Borrowers who elect to teach in certain eligible schools located in areas of primarily low-income families may qualify for cancellation of their entire obligation at the rate of 15 percent per year. Repayment may be deferred up to a total of three years while a borrower is serving in the Armed Forces, with the Peace Corps, or as a Volunteer in Service to America (VISTA). Repayment also is deferred for as long as a borrower is enrolled at an institution of higher education.

Information concerning these programs may be obtained from the Financial Aid Office, Whitmore Administration Building.

The deadline for filing an application is March 1. Applications received after this date may not receive consideration.

Programs Offered

Major fields in which courses are offered leading to the degree of Doctor of Philosophy:

Agricultural and Food Economics
Animal Science
Anthropology
Astronomy
Biochemistry
Botany
Business Administration
Chemical Engineering
Chemistry
Civil Engineering
Communication Studies
Comparative Literature
Computer and Information Science
Economics
Electrical and Computer Engineering
English
Entomology
Environmental Engineering
Food and Agricultural Engineering
Food Science and Technology
Forestry and Wood Technology
French
Geology
Germanic Languages and Literatures
Hispanic Languages and Literatures
History
Human Movement
Industrial Engineering and Operations Research
Linguistics
Mathematics
Mechanical Engineering
Microbiology
Nutrition and Food
Ocean Engineering
Philosophy
Physics
Plant Pathology
Plant Science
Political Science
Polymer Science and Engineering
Psychology
Sociology
Soil Science
Wildlife and Fisheries Biology
Zoology

An Interdisciplinary Ph.D. with individual concentration may be awarded in exceptional circumstances. The candidate must first be admitted into a specific Ph.D. program and complete one year of residence and study in that program before petitioning for admission into the Interdisciplinary Ph.D. program. For detailed information apply to the Graduate Dean's Office.

In several fields, degrees are awarded under the Five-College Cooperative Ph.D. Program: All departments in the biological sciences; chemistry, French, geology, Germanic languages and literatures, philosophy, physics, and Hispanic languages and literatures.

Doctor of Education

Major fields in which courses are offered leading to the Master's degree:

Agricultural and Food Economics
Animal Science
Anthropology
Art History
Astronomy
Biochemistry
Botany
Business Administration
Chemical Engineering
Chemistry
Civil Engineering
Communication Studies
Comparative Literature
Computer and Information Science
Economics
Education
Electrical and Computer Engineering
English
Entomology
Environmental Engineering
Fine Arts (Art, English, Theatre)
Fisheries Biology
Food and Agricultural Engineering
Food Science and Nutrition
Forestry
French
Geology
Germanic Languages and Literatures
Hispanic Languages and Literatures
History
Home Economics
Industrial Engineering and Operations Research
Labor Relations
Landscape Architecture
Linguistics
Marine Sciences
Mathematics
Mechanical Engineering
Microbiology
Music
Nursing
Ocean Engineering
Philosophy
Physical Education
Physics
Plant and Soil Sciences
Plant Pathology
Political Science
Polymer Science and Engineering
Psychology
Public Administration
Public Health
Regional Planning
Slavic Languages and Literatures
Sociology
Theatre
Wildlife
Zoology

DIVISION OF CONTINUING EDUCATION

The Division of Continuing Education serves part-time students for whom traditional or formal programs of study are not necessary or feasible. Such students' needs are met through two basic channels: Academic Extension (graduate- and undergraduate-level credit programs) and Conference Services (a flexible noncredit schedule of conferences, institutes, workshops, and seminars). The Division's main offices are located in the Murray D. Lincoln Campus Center.

Academic Extension includes the Evening Division and special programs for off-campus credit courses. At Westover Air Force Base, for example, servicemen are enrolled in a master's program in Education Management. Geographically, programs range from Martha's Vineyard to Africa and include such offerings as Project: SELF, a women's program that is expanding beyond the Pioneer Valley in an attempt to provide continuing education to a vital sector of the Commonwealth's population.

The Division, through its Conference Services, assists on- and off-campus groups to arrange conferences, institutes, short courses, and workshops to be held in the Campus Center or elsewhere on the Amherst campus or, if circumstances require, off campus as well. Arrangements include budgeting, publicity, housing, meals, meeting rooms, registration, transportation, audio-visual material, and bookkeeping.

Doctoral Degree Requirements

All requirements for any advanced degrees to be awarded at a given degree-granting period (February, May, September) must be completed by the appropriate deadline which will be announced at least two months beforehand. The completed Eligibility for Degree forms must be submitted to the Graduate School by the specified deadline so that all the candidate's credentials can be certified before the degree is actually awarded. Refer to the *Graduate School Handbook* (copies available at the Graduate School) for further detailed guidance in the preparation through the completion of a program of study.

DOCTOR OF PHILOSOPHY AND DOCTOR OF EDUCATION

The departmental/school Graduate Program Director is responsible for the following, all within the guidelines of the Graduate School *and* the candidate's school/department graduate studies program:

a. Approving the candidate's program of courses.
b. Approving the procedure for satisfying the language requirements, if any.
c. Arranging for the candidate's preliminary comprehensive examination.
d. Reporting fulfillment of the above requirements to the Head/Chairman of the Department.

As soon as the student has passed his preliminary comprehensive examination, the Department Head/Chairman or Graduate Program Director of the candidate's major department* shall recommend to the Dean of the Graduate School the names of at least three members of the Graduate Faculty to serve as a Dissertation Committee. At least two of the Graduate Faculty so nominated shall be from the candidate's major department.* One member shall be appointed from outside the candidate's department.* The outside member shall without exception be a voting member of the Dissertation Committee.

When, in exceptional cases, it is not appropriate or feasible to appoint an outside member at the time the Dissertation Committee is formed, the Dean of the Graduate School shall appoint such a Graduate Faculty member as the representative of the Graduate Council prior to the candidate's final oral examination. This member will read the dissertation and participate as a voting member in the final oral examination.

It shall be the responsibility of the Dissertation Committee to approve the dissertation project, to supervise its execution, and to arrange for the final examination of the student. All members of the Dissertation Committee must tentatively approve the dissertation before the final oral examination is scheduled and agree that it is time for this examination to be held. Attendance at the final oral examination is open to all members of the candidate's major department and any member of the Graduate Faculty. However, only members of the Dissertation Committee may cast votes. A unanimous vote of the Dissertation Committee is required for the student to pass the final oral examination. If, at the final examination, two members of the Dissertation Committee cast negative votes, the candidate will be informed that he has not passed the examination. If there is but one negative vote, the degree will be held up pending action of the Graduate Council.

The doctoral degree is conferred upon graduate students who have met the following requirements:

1. Successful completion of all courses and projects specified by the advisor/guidance committee within the guidelines of the candidate's school/department graduate studies program.
2. Satisfactory completion of foreign language requirements under Graduate Council policy. (These requirements are listed in the departmental sections of this Catalog.)
3. Passing a preliminary comprehensive examination conducted by the major department. If the student fails the comprehensive examination he may, at the discretion of the examining committee, be permitted a second and final examination.

*Refers to administrative entity for which degree has been authorized (i.e., department, program, school, etc.).

4. Submission of an approved dissertation prospectus to the Graduate School (at least seven months prior to the Final Oral Examination (defense of dissertation).

5. Preparation of a dissertation satisfactory to the Dissertation Committee and the Department Head/Chairman.

6. Passing a final (at least partly oral) examination conducted by the Dissertation Committee. This examination shall be primarily upon, but not limited to, the candidate's dissertation. This examination cannot be scheduled until all members of the Committee and the candidate's Department Chairman or Head (or his designee) have approved the dissertation.

7. Satisfactory completion of the residence requirement. The equivalent of at least one academic year of full-time graduate work must be taken at this University. This requirement must be satisfied by the candidate's physical presence on campus for two consecutive semesters, either a fall-spring or a spring-fall sequence. It cannot be satisfied by a summer session and an adjoining semester of the regular academic year. The candidate need not reside in Amherst, and should not hold a full-time job during this period. If the candidate is a teacher in a school system in the area he may teach no more than one course while satisfying the residence requirement. This requirement is not stated in terms of credit hours because the candidate may satisfy the requirement while working on his dissertation without being registered for a specific number of credits. The intent is that the candidate should be on campus so that the faculty can become acquainted with him and be able to recommend him in connection with his future career.

8. Credits for each graduate course become invalid nine years following the date of completion of the course. However, graduate credits previously earned at another institution and officially accepted by the Graduate School toward the degree requirements shall become invalid nine years from the date of first registration in the doctoral degree program. The candidate must take a minimum of one half of his course work for the degree at the University.

FIVE-COLLEGE COOPERATIVE PH.D. PROGRAM

A cooperative Ph.D. program is offered by Amherst, Hampshire, Mount Holyoke, and Smith Colleges, and the University of Massachusetts. The degree is awarded by this University, but

in exceptional cases much of the work leading to it may be taken at one or another of the sister institutions. Departments authorized to offer the cooperative Ph.D. degree are: all departments in the biological sciences, Chemistry, French, Geology, German, Philosophy, Physics, and Hispanic Languages.

An applicant must apply for the Five-College Cooperative Ph.D. Program through the Graduate School of the University of Massachusetts. The applicant must then secure the approval of the appropriate academic department at the University. The application then will be forwarded to the appropriate Five-College institution for its evaluation. The letter of acceptance to the applicant is sent only by the Dean of the Graduate School of the University of Massachusetts, not by the other cooperating institution.

Registration for the Five-College Cooperative Ph.D. students is handled only through the Graduate School of the University of Massachusetts.

Degrees awarded in this program will be appropriately indicated on the diploma, the permanent record card, all transcripts, and the Commencement Program.

All requirements for the Five-College Cooperative Ph.D. degree are similar to those for the Ph.D. degree at the University except for the residency requirement. Residence in this program will apply to the institution where the dissertation work is done.

The names of the Graduate Faculty at cooperating institutions are listed at the end of this *Bulletin*.

Doctoral Dissertation

The dissertation shall pertain to a topic in the field of the candidate's major subject, and must demonstrate that the candidate possesses the ability and imagination necessary to do independent thinking and to present his ideas in organized form.

The dissertation in its completed form will be judged largely upon the ability of the candidate to review literature and reach definite deductions; to formulate a problem, plan a method of attack, and work systematically toward a solution; to summarize his material and draw conclusions. Scholastic attainment in writing and presenting the results of the study will be crucial. The goal of the dissertation is to make a contribution to knowledge. It should be of publishable quality. The following rules shall be adhered to in the preparation and presentation of a dissertation:

1. The professor responsible for the direction of the student's research shall be the chairman of the student's Dissertation Committee. Only members of the Graduate Faculty may be appointed to this committee.
2. It is the responsibility of the Chairman of the Dissertation Committee to arrange a conference with other members of the Committee and the candidate to discuss the research problem before approving the dissertation prospectus.
3. A copy of the candidate's dissertation prospectus must be signed by each member of the Dissertation Committee to indicate that the prospectus has been approved and that a conference with the candidate has been held. The signed copy of the prospectus shall then be sent to the Dean of the Graduate School.
4. The Dissertation Committee shall have complete charge of all matters pertaining to the dissertation. The dissertation must have the unanimous approval of this Committee and the approval of the Department Head or Chairman before arrangements are made for the final examination for the degree.
5. Because of the time required to give adequate consideration to the research conducted by the student, it is important that the dissertation be submitted to the Dissertation Committee not later than one month before the Graduate School degree granting deadlines.
6. Although uniformity of style in dissertations is desirable, different disciplines have distinctive research and presentation styles. The following recommendations should help achieve maximum uniformity:

a. The MLA Style Sheet (revised edition) is the Graduate School standard. However, any school, college, or department may specify substitute standards agreed upon in that discipline.

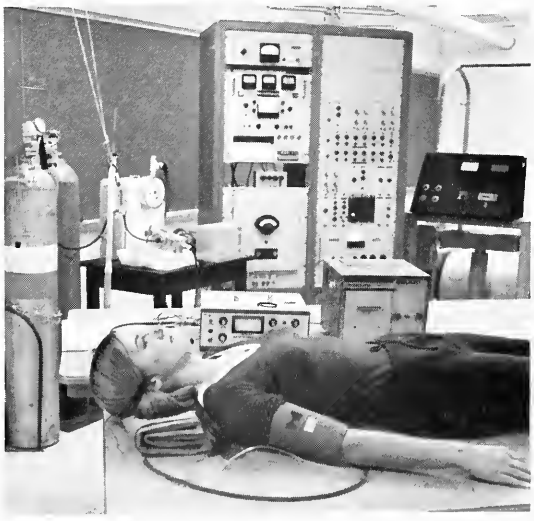
b. All typed copies of theses or dissertations must be on plain, white, quality rag paper, not less than 20-pound weight and 8½ x 11″ in size. This paper is available at the University Store; no substitutions may be made. All copies should be of this same weight and quality paper. (This can be arranged by supplying your copy service with the correct paper in sufficient quantity.) Margins to the left shall be 1½ inches; margins to the right, one inch.

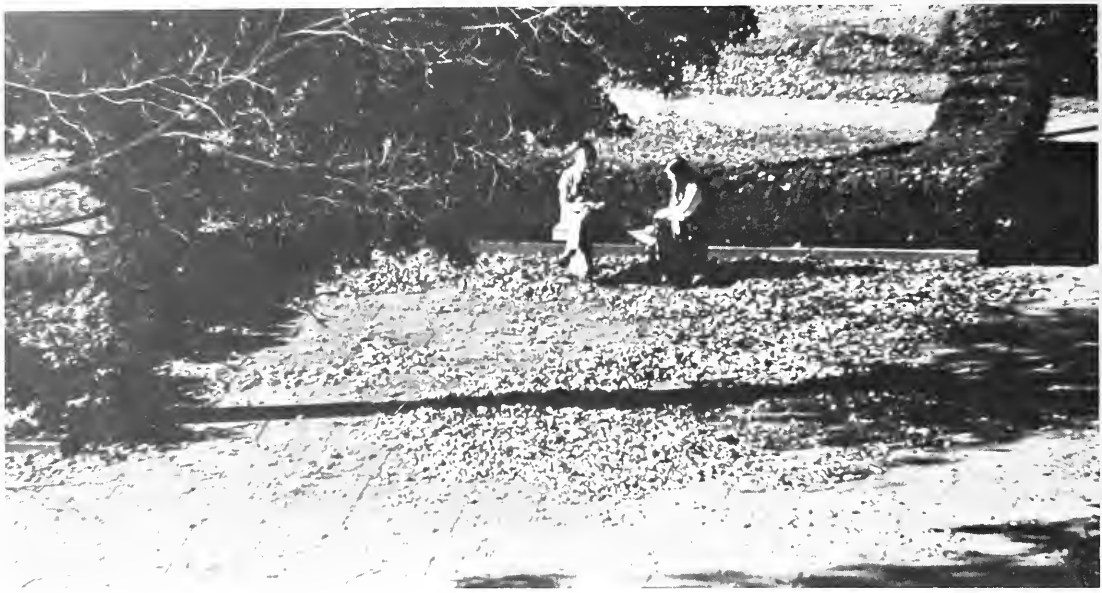
c. Any method of reproducing duplicate copies that produces the required number of clear, neat, and permanent copies is acceptable.

d. The form of doctoral dissertations must conform to the "Instructions for Typing Theses and Dissertations" which may be found in the *Graduate School Handbook.* This booklet may be obtained in the Graduate School.

e. Since the Graduate School has every dissertation microfilmed, much attention must be paid to the finished form. Both the Dissertation Committee and the Graduate School must approve the final format and appearance.

The candidate shall submit to the Graduate School the *original* and one copy of the dissertation. Both the original (after being microfilmed) and the copy will be sent to the Library for binding. The candidate shall submit a money order or





a certified bank check made out to the Library Binding Trust Fund to cover binding costs. The original will be deposited in the central library as an archival copy. The copy will be located in either the central library or branch library, as appropriate, for circulation. Some departments require an additional bound copy for their own file. The candidate wishing to have other copies of his dissertation bound for departmental requirements or for his own purposes, is referred to the *Graduate School Handbook* which gives binding guidelines and recommends local binderies. The candidate must also provide an abstract of fewer than 600 words.

The microfilm fee of $35 covers microfilm publication of the dissertation by University Microfilms Library Services and the publication of the abstract by them in Dissertation Abstracts.

The microfilm fee covers the cost of copyright in the author's name. If the author does not wish to have the dissertation copyrighted the microfilm fee is $20. The dissertation will be cataloged in the Library of Congress and in the University of Massachusetts Library. Microfilm copies may be purchased from University Microfilms Library Services, Xerox Corporation, Ann Arbor, Michigan 48106. Publication by microfilm does not preclude the printing of the dissertation in whole or in part in a journal or as a monograph.

Master's Degree Requirements

In addition to the Master of Arts (M.A.) and Master of Science (M.S.) degrees, the University also offers the following master's degrees: *Master of Arts in Teaching (M.A.T.), Master of Business Administration (M.B.A.), Master of Science in Business Administration (M.S.B.A.), *Master of Education (M.Ed.), *Master of Fine Arts (M.F.A.), *Master of Landscape Architecture (M.L.A.), Master of Music (M.M.), *Master of Regional Planning (M.R.P.), Master of Science in Chemical Engineering (M.S.Ch.E.), Master of Science in Civil Engineering (M.S.C.E.), Master of Science in Electrical and Computer Engineering (M.S.E.C.E.), *Master of Science in Environmental Engineering (M.S.Envr.E.), Master of Science in Industrial Engineering and Operations Research (M.S.I.E.O.R.), Master of Science in Ocean Engineering (M.S.O.E.), Master of Science in Mechanical Engineering (M.S.M.E.), and Master of Public Administration (M.P.A.).

The basic requirements for the master's degrees are given below. Programs marked by asterisk above have additional requirements. These are listed under headings below. Also consult the departmental sections for more detailed information. Refer to the *Graduate School Hand-*

book (copies available at the Graduate School) for further detailed guidance in pursuing and completing a program of study.

1. Thirty graduate credits, of which not more than six of grade B or better may be transferred from other institutions with the consent of the candidate's major department and approval by the Graduate School. Twenty-one of the 30 credits must be in the major field. If a thesis is offered, at least six credits must be earned in 700-900 series courses (at this University); if a thesis is not offered, at least 12 credits must be earned in 700-900 series courses (at this University). A minimum of half the required credits for a Master's degree in each department must be on a graded basis; some or all of the remaining number of credit hours toward the degree may be on a pass/fail basis, subject to the approval of the student's department. The option as to which courses may be taken on a pass/fail basis rests with the department/school rather than with the individual candidate. Transfer credits cannot be used as part of the required component of one-half credits of letter grades. No more than 10 credits may be earned by means of a thesis. No credits remain valid after six years.

2. The thesis is optional with the school or department; if one is required, however, it shall be under the supervision of a Thesis Committee. This Committee shall consist of one or more members of the Graduate Faculty appointed by the Dean of the Graduate School upon recommendation of the Head or Chairman of the Department. As soon as practicable after the student arrives on campus, an Adviser or Guidance Committee shall be appointed from the members of the Graduate Faculty. Once the candidate has selected his thesis topic, the Guidance Committee may be appointed as the Thesis Committee; these two committees are not necessarily the same, however. The thesis must be approved by the Thesis Committee and the Department Chairman or Head.

The candidate must also pass a general examination, not necessarily limited to the thesis topic, to be conducted by an examining committee of at least three members of the Graduate Faculty. This examination must be taken whether the student writes a thesis or not. The recommendation of two of the three members of the Examining Committee shall be requisite to receiving the degree. If the candidate prepares a thesis, Special Problems courses shall be limited to six credits.

3. Candidates for the Ph.D. degree may apply for the master's degree when they have fulfilled the residence and course requirements for the doctorate and the master's degree, have passed any applicable language examinations and have successfully completed the preliminary comprehensive examination for the Ph.D. They must also fulfill the course requirements listed under 1.—Master's Degree Requirements.

4. Foreign language requirements for the master's degree are optional with the school or department.

5. Course credits used for fulfilling the requirements for a master's degree may not be used for fulfilling requirements for any other master's degree at this University.

MASTER OF ARTS IN TEACHING

This program is primarily for those who do not have adequate academic preparation nor appropriate teaching experience—but who do hold a bachelor's degree—to become effective teachers either at the secondary school or community/junior college level. The M.A.T. program leads to a terminal degree combining professional aspects of the M.Ed. degree with the academic tradition of the M.S./M.A. degree. Thirty-nine credits are required for the secondary school option, and 45 credits for the community/junior college option. A maximum of nine graduate credits of grade B or better from another accredited institution may be applied toward the degree, upon recommendation by one of the participating departments (Anthropology, Art, Classics, French, and Public Health) and approval by the Graduate School.

MASTER OF EDUCATION

This is a 33-credit program in which a maximum of nine credits of grade B or better from another accredited institution may be applied toward the degree with the consent of the School of Education and approval by the Graduate School.

MASTER OF FINE ARTS

The Master of Fine Arts degree program is administered by an interdisciplinary committee appointed jointly by the Dean of the Graduate School and the Dean of the Faculty of Humanities and Fine Arts. The degree is particularly designed for those interested in the creative aspects of the arts and may be obtained in the Department of Art for work in the visual arts, the Department of English for work in creative writing, or the Department of Theatre for work in

dramatic art. The basic requirements for the degree are:

1. Sixty credits at the graduate level. Not more than 12 credits may be transferred from other institutions where the department considers it appropriate. While an interdisciplinary course of study may be arranged, the Art Department does not require that 12 credits be earned in courses outside the Art Department. No more than 18 credits may be earned for the thesis project. No credit is valid after eight years.

2. The exact nature of the thesis project will be determined by the student's major adviser in conference with the student. It is to be understood that the student will produce a work in the creative arts. A written analysis of the work itself and of the procedures used in producing it will be required. The candidate will be asked to pass an examination in his major field in addition to presenting his thesis project publicly. Applicants to the Department of Art (Studio) must submit a portfolio of slides directly to the Director of the Graduate Program.

MASTER OF FINE ARTS IN ART

This degree program is designed for students who are committed to becoming professional artists and who want an intensive two-year, 60-hour, in-residence preparation for careers in art. There are four principal areas of study: painting, printmaking, ceramics, and sculpture. An applicant must select and qualify in one of these areas. The thesis (required) consists of a one-person exhibition supported by a written statement and other documentation, including a slide of each work in the exhibition. The candidate must also make an oral defense of the thesis.

Thirty-three to 36 credit hours are required in the major; 12-18 of these are thesis credits. Any credits over the 36 limit cannot be counted toward the M.F.A. degree in Art. The remaining 24 to 27 hours, taken in other studio areas and art history constitute the minor. In some instances, if the department chairman approves, an interdisciplinary course of study may be arranged, providing that it is consistent with the student's background and goals. Up to 18 hours of work may be taken as special problems.

Fall enrollment is necessary to assure continuity in the program. The number of graduate students that can be accepted into the studio-art program each fall is limited. Often places are filled by March 1. Therefore, application should be made early. Only those applicants who can clearly demonstrate their ability to work at a professional level need apply. There are a few openings for qualified special students, but admission to courses is on a space available basis, as degree candidates are given preference.

The normal requirements for admission to the Graduate School apply except that applicants to the M.F.A. Art program must also submit a portfolio of slides of their work, and the Graduate Record Examination is not required.

Application forms should be obtained from and returned to the Graduate Admissions Office by February 15. Slides should be submitted separately to the Director of the Graduate Program, Art Department, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002. Space is provided on the regular application form to apply for financial aid, but note that the deadline for University Fellowship applicants is February 1.

35 mm color transparencies should be submitted in 9″ X 11″ clear plastic viewing sheets. There must be at least 10 slides of work from the major area. In addition, slides of drawings and work closely allied to the major direction should be included. Each slide must be labeled with name of artist, date, size, and medium. Slides of rejected candidates will be returned by April 15. Slides of accepted candidates, including those on waiting list status, will be retained by the department until admission procedures have been completed.

MASTER OF FINE ARTS IN ENGLISH

This degree, based upon a two- to three-year program of 54 hours, is designed for qualified graduate students who are determined to become reputable writers of fiction, poetry or drama, and who wish to prepare themselves for the variety of positions related to the profession of writer, including the college teaching of English.

The normal standards for admission to graduate study in English apply, except that applicants for the M.F.A. must also submit supplementary original writing in fiction, poetry or drama: two short stories, or twenty pages of fiction; from eight to twelve pages of poetry; or one full act of a play. Manuscripts should be mailed separately to the Director of the M.F.A. Program in English, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002.

The candidate must either pass one foreign language examination or translate a body of work from another language. He must pass an oral examination including a defense of his thesis, which should constitute a book-length manuscript of fiction, poetry or drama, of publishable quality.

The 54 hours of work are apportioned as follows: 12 hours of courses in imaginative writing; 18 hours of thesis credit, incorporated into the course structure of the credits in imaginative writing, beginning with the second semester of such studies; six hours in another appropriately related field of study; 24 hours in American and English literature and language, including at least two courses in the modern and contemporary genre of his specialty (fiction, poetry or drama), and one each in either modern or contemporary courses in the other two genres.

Application forms should be obtained from and returned to the Graduate School. Deadline for applications is February 15. Candidates will be notified by April 1.

MASTER OF FINE ARTS IN THEATRE

A three-year, 60-hour, in-residence program offers specialized training in acting, directing, scenography, playwriting, and dramaturgy. Courses of study are individually established. For detailed information on admissions and on specific degree requirements, write the Graduate Program Director in Theatre.

MASTER OF SCIENCE IN LABOR RELATIONS

The graduate curriculum leading to the Master of Science in Labor Relations is an interdepartmental one, with responsibility for coordinating students' programs vested in the interdisciplinary committee recommended by the Advisory Council of the Labor Center and approved by the Dean of the Graduate School.

Students in this program will be individually advised by members of the Interdisciplinary Committee.

Two years is considered the normal period for completing this degree.

Students who successfully complete the graduate curriculum in Labor Relations will be prepared primarily for academic work, labor union employment, and government service.

The basic requirements for the degree are:

1. Forty-two graduate credits of which no more than nine may be transferred from other accredited institutions.

2. A research project (in the first year), an internship (in the summer), and an administrative assignment in the worker's education extension teaching area (in the second year) will be expected of each candidate.

3. A thesis is optional.

MASTER OF LANDSCAPE ARCHITECTURE AND MASTER OF REGIONAL PLANNING

The degrees are conferred upon graduate students who have satisfactorily met the following requirements:

1. Work covering at least two years in residence, and a minimum internship in a public or private office of at least three months. Specific requirements concerning the nature of such practice are determined by the department.

2. The earning of not fewer than 46 credits, of which 28 shall consist of graduate level courses within the department, with specific exceptions at the discretion of the department.

3. Preparation of a satisfactory thesis or terminal project.

4. The passing of a final examination, written and/or oral.

5. Recommendation by the Department of Landscape Architecture to the Graduate School for the awarding of the degree and approval of the recommendation by the Dean of the Graduate School.

MASTER OF SCIENCE IN ENVIRONMENTAL ENGINEERING

All candidates with non-engineering backgrounds must present satisfactory evidence of proficiency in the following: elementary differential equations, general chemistry, introductory physics, statics, fluid mechanics, and engineering hydraulics.

Each candidate must take a common core of fundamentals intended to provide a technical foundation for more advanced environmental engineering courses and an understanding of the institutions and policies common to control of water and air quality and land usage. Beyond this core, environmental engineering elective courses have been conveniently grouped into three descriptive areas—systems, design, and science—each of which includes offerings in water, air, and land resources. A total of 31 credits must be earned, six of which may be for a thesis.

Master's Thesis

The requirements for the master's thesis are the same as those for the doctoral dissertation, listed above, with the following exceptions:

1. The Chairman or Head of the Department shall submit nominations to the Graduate Dean for a Thesis Committee. This Committee may consist of one, two, or three members, all of whom must be members of the University of Massachusetts Graduate Faculty. After the Thesis Committee has been appointed by the Graduate Dean, it shall review the candidate's proposed thesis outline. When accepted, all members shall sign a cover sheet indicating approval. The thesis outline, with the cover sheet bearing the signatures of the Committee members and the date of the Thesis Committee's meeting with the candidate, will be forwarded to the Graduate School by the Graduate Program Director at least four months prior to the general Master's examination (or defense of thesis).

2. The *original* and one copy (both unbound) of the thesis are required. The candidate shall submit a money order or a certified bank check made out to the Library Binding Trust Fund to cover binding costs. The original will be deposited in the central library as an archival copy; the copy will be placed in either the central library or branch library, as appropriate for circulation. Some departments require an additional copy of the thesis for their own files. Refer to the *Graduate School Handbook* for guidelines as to having additional copies bound for either the department's requirement or for the candidate's own purposes.

3. The two unbound copies required by the Graduate School must be submitted along with the Eligibility for Degree form to the Graduate School by the deadline for the appropriate degree granting period.

Foreign Language Examinations

Under Graduate Council policy, each academic department establishes foreign language requirements for its own advanced degree candidates. The department determines both the number of foreign languages and the level of competency required. A foreign language is defined for this requirement as a language other than the candidate's native tongue, in which there is a significant body of literature relevant to his academic discipline.

The levels of competency which a department may select are:

1. Advanced level.
2. Intermediate level.
3. Journal level: reading knowledge sufficient to understand journals in the language of the student's academic disciplines.
4. No foreign language competency.

A department may select any of these levels or any combination of them for as many languages as it wishes. When a department selects levels one or two, the student's competency will be judged by the score on the Graduate School Foreign Language Examination: The passing grade for advanced and intermediate levels will be specified by the Graduate Council. Current passing levels are 600 and 450, respectively. The results will be recorded on the student's transcript. When a department selects level three, the student's competency will be decided by a departmental committee, but not by his Thesis or Dissertation Committee, and no entry will be made on his transcript.

General Regulations

1. *Course numbering system at the University of Massachusetts:*

001-099 Noncredit courses, nonquality point courses, entrance deficiencies, etc.
100-199 Undergraduate credit only: lower division.
200-399 Undergraduate credit only: upper division.
400-499 Professional courses which presume a bachelor's degree.
500-699 Graduate credit only: parallel to 200-399.
700-999 For graduate students only.
700 Special Problems.
800 Master's Thesis.
900 Doctoral Dissertation.

2. *Academic average for regular standing:*
A graduate student must maintain a 2.80 overall cumulative average in all graduate courses in the field of his major. A student cannot repeat such courses to raise his grade point average. He may repeat them to improve his knowledge of the subject matter. A student whose cumulative grade point average in the field of his major falls below 2.80 is placed on academic probation. If, at the end of the ensuing semester, the cumulative average remains below 2.80, he is subject to academic dismissal upon the recommendation of his major department.

3. *Academic average for graduate degrees:*
In the grades which a student is offering to satisfy degree requirements, a minimum standard for satisfactory work is a B average. No degree will be awarded to a student whose cumulative average for course work earned for the degree at the University of Massachusetts is below 3.0.

4. *Maximum Credit Load:*
A graduate student may register for up to 15 credits during the fall and spring semesters and nine credits during the Summer Session. Any student who wishes to register for more than the maximum credit load must secure written permission from the graduate program director in his major department and secure Graduate School approval.

5. *Full-time students register* for eight credits or more per semester. Part-time students register for seven credits or less per semester. Ph.D. candidates may be considered full-time students regardless of the number of dissertation credits for which they register, if the major department certifies that they are working full-time on research.

6. *Withdrawal regulations:*

a.) To add, drop, or change a course, the student must obtain the written approval of the instructor concerned and his faculty adviser. Signed cards are to be filed with the Graduate Records Office.

b.) Up to and including 10 academic days from the beginning of a semester a student may

add, drop, or change courses without penalty; that is, no entry will be made to the student's permanent record. No courses may be added after this date. Signed cards are to be filed with the Graduate Records Office.

c.) After period (b) but within six calendar weeks after the beginning of a semester a student may drop courses with a grade of DR provided approval is obtained from the instructor and the student's major adviser.

d.) During periods (b) and (c) a student may withdraw from the University without academic penalty. Grades of DR will be noted on his record. After six weeks, grades of WF or WP will be entered unless special permission is obtained from the Dean of the Graduate School. No student may withdraw from courses after final examinations begin.

7. *Incompletes:*
A student can obtain credit for an "incomplete" only by finishing the work of the course before the end of one calendar year from the time of enrollment in the course. At the end of that period, if a grade is not submitted, an IF (Incomplete F) will be recorded. The initiative in arranging for the removal of an "incomplete" rests with the student.

8. *Candidates registering for thesis* or dissertation credits (Thesis 800 and Dissertation 900) will register for credits recommended by the Thesis or Dissertation Committees. These credits will remain "incomplete" except for the semester in which the thesis or dissertation is completed, when the grade will be either S (Satisfactory) or NS (Not Satisfactory) as recommended by the Thesis or Dissertation Committee.

9. *Five-college library use:*
The libraries at Amherst, Smith, Hampshire and Mount Holyoke Colleges are normally available to students from the University of Massachusetts, subject to the rules and procedures set by each library.

UNDERGRADUATES TAKING GRADUATE-LEVEL COURSES

Registration of an undergraduate in a graduate course numbered in the 400, 700, or 800 series is subject only to the permission of the course instructor. An undergraduate student who wishes to register in a graduate course numbered in the 500 or 600 series must file a specific authorization, issued by the head of the department offering the course, with the undergraduate registrar.

TRANSFER OF COURSES AND CREDITS TAKEN OVER AND ABOVE CREDITS EARNED FOR A BACHELOR'S DEGREE

An undergraduate student in his senior year at any of the five-college institutions who will earn during this year more credits than he will need for his bachelor's degree, may register concurrently for graduate credits at the University of Massachusetts if he has the permission of his major adviser and of the graduate course instructor. He registers for these credits with the undergraduate registrar. After he has completed the courses, if he wishes to transfer them to a graduate program, the undergraduate Records Office should send to the Graduate School an official statement listing the courses, credits, and grades, and certifying that they were over and above those needed by the student for his bachelor's degree. The Graduate School will then record this information on a permanent record card and supply the student with transcripts bearing this legend:

Approval given (date) to transfer the following course(s) and credits, earned over and above credits required for the bachelor's degree, toward the master's degree.

Special Services Available to Graduate Students

GRADUATE COURSES DURING THE SUMMER

The University offers opportunity to pursue graduate studies during the summer. Details regarding courses offered, facilities for study, tuition and fees, etc., may be found in the Summer Session Bulletin, a copy of which may be obtained upon request to the Graduate Admissions Office, Graduate Research Center, around April 1.

HEALTH SERVICES

All students who have paid the Health Fee are eligible to receive care through the University Health Services. The provision of direct personal services to students is financed entirely by the student Health Fee. Therefore, any professional services rendered on campus by a member of the

Health Services' staff is provided without additional charge. Off-campus hospitalization and surgical services can be arranged by the Health Services' staff, but the cost of this care is the responsibility of the individual student. A supplemental insurance program is available to students on an optional basis to provide coverage for most medical and surgical services not available at the Health Center. This plan also provides coverage for dependents of students. The purpose of the Health Services is to help each student realize optimum physical, emotional, and social well-being so he may most benefit from his University experience. Services available at the Health Center include unlimited outpatient consultation with staff physicians and nurse practitioners backed by supporting diagnostic x-ray, laboratory, pharmacy, and physical therapy facilities. In addition, the Health Center contains 65 beds for the care of students who require hospitalization.

The outpatient clinic hours are weekdays, 8:00 a.m.-12 noon and 1:00-5:00 p.m., and for urgent problems only, Saturdays, 8:00-11:30 a.m. Appointments made with the physician of choice are encouraged, but care may be obtained on a walk-in basis if the student's needs so require. Emergency care is available 24-hours-a-day, seven days a week. Should a student need to stay in the infirmary, an attempt will be made to provide an opportunity to study if he feels able. Student visitors are allowed during specific hours; parents may visit at any reasonable hour.

The Mental Health Division is available to assist students with specific emotional problems and includes diagnostic and short-term treatment services. Appointments may be made by calling the Mental Health Division directly. In addition to direct-care services, the health program includes an active Health Education Division which attempts to involve students in programs that develop awareness of personal and community health needs. The Health Services is also concerned with matters of environmental health and safety that affect students, faculty, employees, and visitors on campus.

Each graduate student who has paid the Health Fee must fill out and submit a pre-entrance medical history and health evaluation form prior to registration. Information contained on this form will in no way affect the student's admission to the Graduate School. Students who have been under medical care prior to admission are encouraged to have their physician contact the Health Services and provide detailed reports and instructions. In brief, the Health Services attempts to provide all students with a coordinated and comprehensive program of health supervision.

It is important to note that all health-service program records are strictly *confidential.* No information will be released without the express written permission of the student. Students with questions concerning their health are encouraged to speak with a member of the staff upon arrival on campus.

TEACHING IMPROVEMENT SERVICES

The Provost's Office of Teaching Evaluation and Improvement provides these coordinated services on the Amherst campus. Course evaluation services include questionnaire design and processing, computer display and data interpretation assistance. Teaching improvement strategies are matched to evaluation results. A wide array of teaching improvement support services are available, including videotaping, microteaching, skills training and others. Evaluation and improvement services are available to Teaching Assistants and faculty on an individual or departmental basis.

CAREER PLANNING & PLACEMENT SERVICE

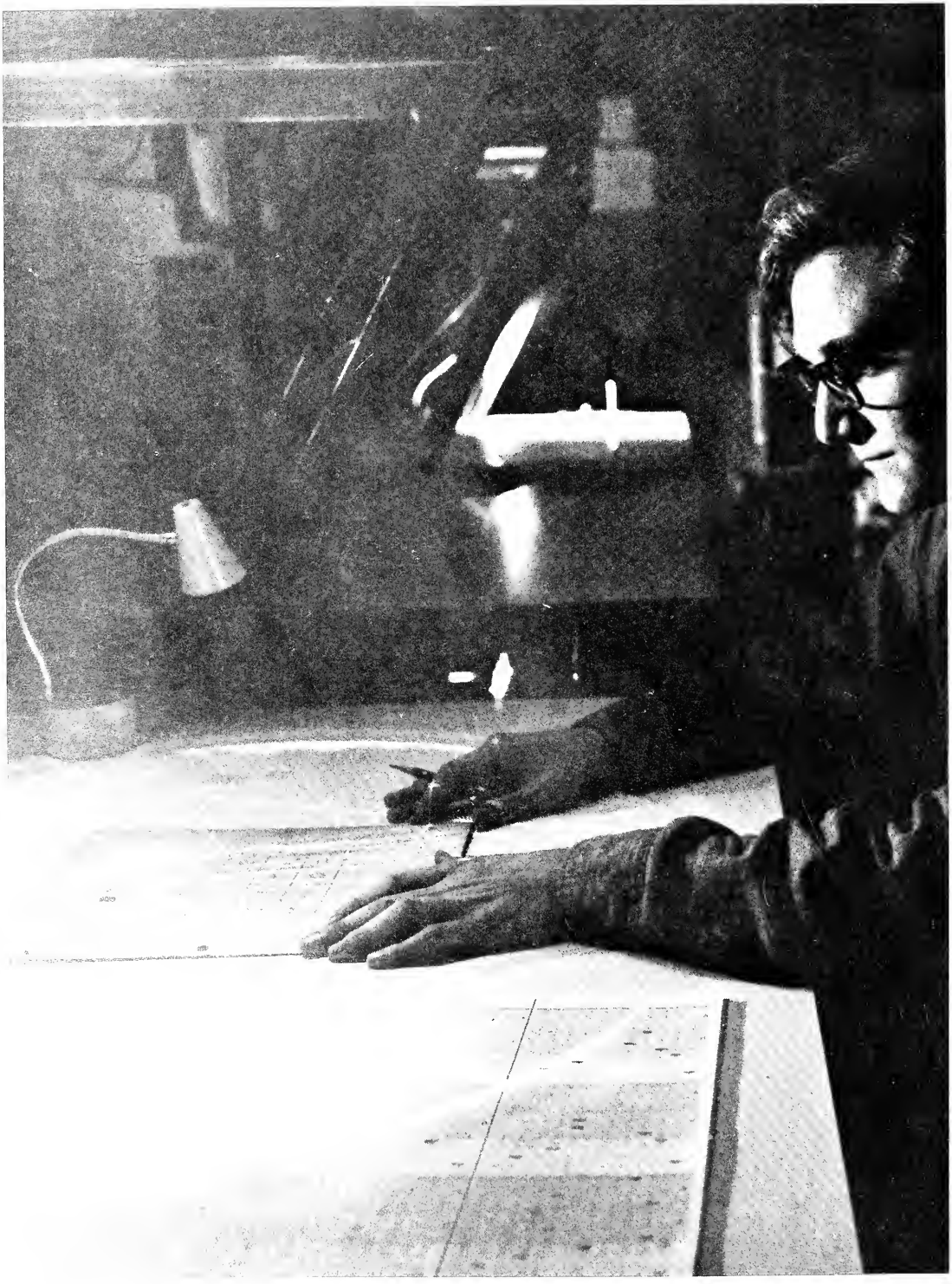
Vocational counseling with assistance in finding employment through career and occupational information, on-campus interviews, the preparation of credentials, personal resumes and recommendations is offered to aid graduate students to attain their career objectives.

POST-DOCTORAL FELLOWS, RESEARCH ASSOCIATES AND VISITING FELLOWS

Post-Doctoral Fellows and Research Associates will be entitled to faculty privileges for the duration of their appointments at the University. Qualified scholars who may desire temporarily the privileges of the library and research facilities of the University, and who are not candidates for a degree may be appointed as Visiting Fellows (without stipend) upon petition to the Dean of the Graduate School. Such Fellows will be entitled to faculty privileges. However, use of research facilities will have to be arranged on an individual basis with the chairman or head of the department in whose area the facilities are located.

GRADUATE STUDENT SENATE

The Graduate Student Senate serves as the representative body of graduate students at the University. It pursues policies and objectives that serve to advance the material and academic needs of the graduate community.



Description of Graduate Programs

Before consulting the course descriptions listed in this section, students should become thoroughly familiar with the General Regulations governing registration for courses in the Graduate School. The regulations cover such matters as graduate credit, course numbering system, changing or dropping of courses, and requirements regarding incomplete work in a course. Students should also acquaint themselves with the requirements governing the particular degree which they wish to earn.

For description of courses numbered from 100 to 399, refer to the current Undergraduate Course and Faculty Directory of the University.

Agricultural and Food Economics

GRADUATE FACULTY

N. Eugene Engel, *Professor and Head of the Department of Agricultural and Food Economics*, B.S., Nebraska, 1954; M.S., Connecticut, 1959; Ph.D. 1967.

Robert L. Christensen, *Associate Professor and Graduate Program Director*, B.S., Michigan State, 1958; M.S., Delaware, 1960; Ph.D., North Carolina State, 1967.

Robert S. Bond, *Associate Professor of Forestry;* Forestry and Wood Technology.

Jon M. Conrad, *Assistant Professor*, B.S., Wisconsin, 1968; M.A., Washington, 1970; Ph.D., Wisconsin, 1973.

Bradford D. Crossmon, *Professor*, B.S., Connecticut, 1937; M.S., 1943; M.P.A., Harvard, 1949; D.P.A., 1963.

Barry C. Field, *Assistant Professor*, B.S., Cornell, 1956; M.S., 1959; Ph.D., California, 1967.

John H. Foster, *Professor*, B.S., Cornell, 1950; M.S., Purdue, 1951; Ph.D., Cornell, 1957.

Elmar Jarvesoo, *Associate Professor*, M.S., Tartu University, Estonia, 1937; Dr. Agri. Sci., University of Berlin, 1939.

Edward K. Knapp, *Associate Professor*, B.S., Cornell, 1950; M.S. (Ed.), 1951; Ph.D., Michigan State, 1969.

Theodore W. Leed, *Professor*, B.S., Ohio State, 1950; M.S., 1951; Ph.D. 1957.

Donald R. Marion, *Associate Professor*, B.S., Cornell, 1954; M.S., 1955; Ph.D., Massachusetts, 1971.

Brian R. Payne, *Adjunct Assistant Professor of Forestry and Adjunct Professor of Agricultural Economics.*

David A. Storey, *Professor*, B.S., Massachusetts, 1954; M.S., Purdue, 1958; Ph.D., Purdue, 1960.

Cleve E. Willis, *Assistant Professor*, B.A., Chico State, 1965; M.S., California, 1967; Ph.D., 1972.

The Department offers both the Ph.D. and the M.S. degrees. The primary objective of the graduate program in Agricultural and Food Economics is the education of applied economists to meet the needs of contemporary society in the United States and other countries. Fields of interest included in the Department's program are: 1) Natural Resource Economics (Environmental Economics), 2) International Agricultural Development Economics, and 3) Food Production and Marketing Economics.

The doctoral degree requirements of the Graduate School apply to the Ph.D. program. The student's program of study will be developed in accordance with his individual objectives and the required level of competence in economic theory and quantitative analytical methods established by the Department. The Ph.D. student is required to demonstrate research competency by completing an acceptable Ph.D. dissertation. No foreign language competency is required.

The general requirements established by the Graduate School also apply to the M.S. degree program. The M.S. degree candidate will earn from 6 to 9 credits in "experience activities" which include the alternatives of a 9-credit thesis or a 6- to 9-credit special problem in research, teaching, extension, or administration. No foreign language competency is required. A written qualifying examination normally is taken after the student completes his coursework.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. PROBLEMS IN AGRICULTURAL, FOOD, AND RESOURCE ECONOMICS.
Independent study and research on selected problems in agricultural, food, and resource economics.

702. AGRICULTURE IN THE NATIONAL ECONOMY.
The application of economic theory, particularly welfare economics, to the determination of agricultural prices and income. The interdependency of agriculture and other sectors of the economy. Effects on agriculture of national fiscal and monetary policy. Mr. Engel.

704. ADVANCED ANALYSIS OF FOOD MARKETING SYSTEMS.
Conceptual and normative analysis at both micro- and macro-levels of food and commodity marketing systems. Firm and group behavior, market structure, public policy implications. Mr. Storey.

705. RESEARCH METHODS IN AGRICULTURAL, FOOD, AND RESOURCE ECONOMICS.
Scientific method and its application. Selection, planning, and conduct of research. Formulation of models and hypotheses. Interdisciplinary considerations. Techniques commonly used and promising new approaches. Research administration.

721. NATURAL RESOURCE DEVELOPMENT ECONOMICS.
Welfare economics in relation to resource development goals; use of economic models for resource development planning and decision making; problems of evaluating development plans.

740. QUANTITATIVE METHODS.
Applications of micro-econometric techniques in agricultural, food and resource economics. Emphasis on practical applications of modern methods of quantitative analysis to problems of the firm.

775. ADVANCED AGRICULTURAL AND FOOD ECONOMICS.
Intensive study of the theory of the firm as it applies to agricultural and food production, including: production functions, cost functions, programming, and decision-making principles; the nature of the aggregate supply function in agriculture; applications of these principles to the agricultural firm and regional resource allocation, and to the distribution of income to and within agriculture.
Prerequisite, permission of instructor.

799. SEMINAR. *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, 3-9.*

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

535. AGRICULTURAL BUSINESS MANAGEMENT.
Basic decision-making principles, management tools, analytical methods and their application to management problems of commercial farms and other agricultural firms. Mr. Lee.

546. ADVANCED MANAGEMENT OF AGRICULTURAL FIRMS.
Application of the theory of the firm and modern decision theory to management of typical agricultural businesses. Plans for alternative firm adjustments will be analyzed using budgeting and other methods. Mr. Crossmon.

561. FOOD MARKETING SYSTEMS.
Structure of food marketing systems. Operating principles, significant product characteristics, role of specialized marketing firms, government programs and policies.
Mr. Fitzpatrick.

565. FOOD MERCHANDISING.
Principles of merchandising food products; the nature of consumer demand for food; developing a competitive strategy including product line decisions, pricing, and retail merchandising practices; budgeting and controlling sales, expenses, and profit. Mr. Leed.

582. WATER QUALITY ECONOMICS.
Principles for selection of welfare maximizing plans from among alternative pollution control policies and measures. Market and administrative decision making processes for pollution control.

641. PRICE THEORY AND ANALYSIS.
Elements of food and agricultural price making; demand and supply theory and methods or price analysis and forecasting; introduction to econometrics. Mr. Willis.

646. REGIONAL COMPETITION AND MARKET INTERDEPENDENCY.
Interregional competition and interdependency in agricultural factor and product markets, in the context of aggregate demand and supply by regions as affected by spatial considerations. Mr. Christensen.

652. AGRICULTURAL POLICY.
Analysis of farm price support programs, programs for alleviation of rural poverty, food trade and aid policies, other topical issues. Mr. Storey.

668. FOOD DISTRIBUTION ECONOMICS.
Economic analysis of factors, internal and external to the firm, influencing sales of food firms. Emphasis on consumer concerns, public policy, and legislation in food marketing.
Mr. Marion.

673. RESOURCE AND CONSERVATION ECONOMICS.
Economic and institutional factors controlling land and water use. Land values, private property, social control of land use, and conservation economics. Mr. Foster.

676. MARINE RESOURCE DEVELOPMENT ECONOMICS.
Economic analysis of alternative plans for attainment of social goals in the development of coastal and offshore marine resources. Mr. Storey.

681. INTERNATIONAL AGRICULTURAL DEVELOPMENT.
Economic development of low income rural economies. Relation of agriculture to national economies. Exogenous and endogenous factors in development. Mr. Foster.

Animal Science

GRADUATE FACULTY

Thomas W. Fox, *Professor and Head of the Department of Veterinary and Animal Sciences*, B.S., Massachusetts, 1949; M.S., 1950; Ph.D., Purdue, 1952.

J. Robert Smyth, Jr., *Professor and Graduate Program Director*, B.S., Maine, 1945; M.S., Purdue, 1947; Ph.D., 1949.

Donald L. Anderson, *Professor*, B.S., Massachusetts, 1950; M.S., Connecticut, 1952; Ph.D., Cornell, 1955.

Donald L. Black, *Professor*, B.S., Maine, 1954; M.S., Cornell, 1957; Ph.D., 1959.

Wallace G. Black, *Professor*, B.S., Wisconsin, 1948; M.S., 1949; Ph.D., 1952.

Anthony Borton, *Associate Professor*, A.B., Haverford, 1955; M.S., Michigan State, 1961; Ph.D., 1964.

Richard A. Damon, Jr., *Professor*, B.S., Massachusetts, 1947; M.S., Minnesota, 1949; Ph.D., 1951.

Robert T. Duby, *Assistant Professor*, B.S., Massachusetts, 1962; M.S., 1965; Ph.D., 1967.

Heinrich Fenner, *Associate Professor*, B.S., Agricultural College of Stuttgart-Hohenheim, 1951; Ph.D., 1956.

Stanley N. Gaunt, *Professor*, B.S., Rutgers, 1938; Ph.D., North Carolina State, 1955.

George R. Howe, *Associate Professor*, B.S., Vermont, 1957; M.S., Pennsylvania State, 1959; Ph.D., Massachusetts, 1961.

Sidney J. Lyford, *Assistant Professor*, B.S., New Hampshire, 1958; M.S., North Carolina State, 1960; Ph.D., 1964.

James B. Marcum, *Assistant Professor*, B.S., Missouri, 1960; M.S., Cornell, 1961; M.Div., Midwestern Baptist Theological Seminary, 1965; Ph.D., Missouri, 1969.

William J. Mellen, *Professor*, B.S., Massachusetts, 1949; M.S., Cornell, 1951; Ph.D., 1953.

Martin Sevoian, *Professor*, B.S., Massachusetts, 1949; V.M.D., Pennsylvania, 1953; M.S., Cornell, 1954.

Russell E. Smith, *Professor*, B.S., Massachusetts, 1938; V.M.D., Pennsylvania, 1942.

Glenn H. Snoeyenbos, *Professor*, D.V.M., Michigan State, 1945.

Olga M. Weinack, *Associate Professor*, B.A., Mount Holyoke, 1946; M.S., Massachusetts, 1950.

The graduate program in the animal sciences includes studies in mammalian and avian biology, with options in (a) genetics, (b) physiology, (c) nutrition, and (d) animal diseases. Students planning to major in any one of these fields must have a strong background in biology and chemistry or mathematics, or must be prepared to remedy undergraduate deficiencies without graduate credit. The option in animal diseases is designed primarily for veterinarians but is open to others with appropriate academic training. Requirements for both the M.S. and Ph.D. degrees include courses in the animal sciences offered by the department and courses in supporting areas offered by such departments as Zoology, Chemistry, Biochemistry, Microbiology, and Statistics. Available research material includes a number of domestic species. The department requires no foreign language reading competency for the doctoral degree.

COURSES OFFERED BY THE DEPARTMENT

(Note: 500 and 600 series courses are open to both graduate and undergraduate students; 700 and 800 series are open to graduate students only. Where prerequisites are stated, equivalent courses taken at other institutions or permission of instructor may be substituted.)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Genetics

608. COMPARATIVE ANIMAL GENETICS.
The mechanisms of heredity and variation in livestock and poultry; the role of selection and breeding systems in genetic improvement and their evalnation.
Prerequisite, Zool 540. Mr. Fox.

704. AVIAN GENETICS.
The classical and physiological genetics of morphological traits of avian species. Emphasis on melanogenesis and characteristics involving epidermal structures.
Prerequisites, one year's training in biology and Zool 540. Mr. Smyth.

705. GENETICS OF PRODUCTIVE TRAITS IN POULTRY.
Lectures and reports on the genetics of meat production and reproduction. Emphasis on the physiological genetics of fertility and embryogenesis.
Prerequisites, one year's training in biology and Zool 540. Mr. Smyth.

706. QUANTITATIVE INHERITANCE AND SELECTION.
The principles of population genetics and quantitative inheritance as applied to selection for traits of economic importance in poultry; theoretical and practical considerations of breeding systems.
Prerequisites, Zool 540; An Sci 661. Mr. Fox.

707. ADVANCED ANIMAL GENETICS.
Modern research in animal breeding with emphasis on the statistical approach. Includes development of selection indexes for various farm animals, sire indexes, and breeding plans based on systems of mating and selection.
Prerequisite, An Sci 608. Mr. Gaunt.

Physiology

519. INTRODUCTORY ANIMAL PHYSIOLOGY.
Foundations for systemic organ physiology through the presentation of homeostatic circuits available to the living body, such as fluid, gaseous, neural, muscular, and specialized integrated mechanisms.
Two 1-hour lectures and one 2-hour laboratory period. Mr. Howe.

520. ANIMAL PHYSIOLOGY.
An in-depth study of the different systemic organ systems of the body. Emphasis on their applied regulation in animals and man.
Prerequisite, An Sci 519 or permission of instructor.
Credit, 4. Mr. Howe.

621. PHYSIOLOGY OF REPRODUCTION.
Comparative aspects of anatomy, embryology, endocrinology, and physiology of reproduction and lactation.
Credit, 4. Mr. W. G. Black.

724. ADVANCED AVIAN PHYSIOLOGY.
Lectures and reports on specific problems in avian physiology.
Prerequisites, An Sci 519, 520. Mr. Anderson, Mr. Smyth.

725. MAMMALIAN REPRODUCTION.
An advanced course emphasizing the comparative approach to problems of reproductive anatomy and endocrinology. Lectures, laboratory and seminar reports with theoretical and practical consideration of current research findings in laboratory and domestic animals and in primates. Mr. D. L. Black.

726. FERTILITY AND FECUNDITY.
The role of heredity, nutrition, pathology, and environment in the determination of fertility and fecundity in mammalian forms. Current research directed toward control of reproductive function through experimental means is emphasized.
Prerequisites, An Sci 621 or 725. Mr. W. G. Black.

Nutrition

630. PRINCIPLES OF NUTRITION.
Scientific principles of nutrition, emphasizing the basic biochemical and physiological concepts underlying the specific functions and interrelationships of the nutrients required for maintenance, production, and reproduction in both ruminants and nonruminants. Mr. Anderson.

734. ADVANCED AVIAN NUTRITION.
Lectures, reports, and discussions of significant research developments and theories in avian nutrition.
Prerequisites, Chem 562, Biochem 524, An Sci 630. Mr. Anderson.

735. RUMINANT NUTRITION.
An advanced course in ruminant digestion and metabolism. Special topics selected and discussed in the light of recent and current research.
Prerequisites, An Sci 630, Biochem 524. Mr. Fenner, Mr. Lyford.

Animal Diseases

(Students holding a medical degree will not be given credit for the following Animal Science courses; 670, Animal Pathology; 772, Mammalian Diseases; 773, Avian Diseases; and 774, Histopathology.)

670. ANIMAL PATHOLOGY.
Introduction to the study of animal diseases; causes, development, transmission, and control. Lectures and demonstrations.
Prerequisite, permission of instructor.
Credit, 3. Mr. Smith.

771. DIAGNOSTIC LABORATORY TECHNIQUES.
Microbiological, histopathological, immunological, hematological techniques applicable to the diagnostic laboratory. *Credit, 2.* Graduate Staff.

772. MAMMALIAN DISEASES.
A survey of diseases of mammals, including laboratory animals.

Emphasis on infectious diseases and their control. Lectures and demonstrations.
Prerequisite, permission of instructor. Mr. Harris.

773. AVIAN DISEASES.
A survey of avian diseases. Emphasis on infectious diseases and their control. Lectures and demonstrations.
Prerequisite, permission of instructor. Mr. Snoeyenbos.

774. HISTOPATHOLOGY.
Histological study of basic pathological processes.
Prerequisite, permission of instructor. Mr. Sevoian.

Miscellaneous

661. (I). INTERMEDIATE BIOMETRY.
Design of experiments in the biological sciences. Methods of analysis of such designs, including expectations of mean squares, selection of appropriate error terms, individual and multiple comparisons, and trend analyses.
Prerequisite, introductory course in biometrics or statistics, such as Stat 121. Mr. Damon.

662. (II). ADVANCED BIOMETRY.
Analysis of data with disproportionate subclass numbers, including the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses.
Prerequisite, An Sci 661. Mr. Damon.

700. SPECIAL PROBLEMS.
A specific problem in some aspect of animal science not related to the candidate's thesis. *Credit, 3-6.*

751, 752. SEMINAR. *Credit, 1 each semester.*

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

Anthropology

GRADUATE FACULTY

THOMAS M. FRASER, JR., *Professor and Chairman of the Department of Anthropology*, A.B., Harvard, 1949; M.A., Columbia, 1958; Ph.D., 1963.

ZDENEK SALZMANN, *Associate Professor and Graduate Program Director*, M.A., Indiana, 1949; Ph.D., 1963.

GEORGE J. AREMELAGOS, *Associate Professor*, B.A., Michigan, 1958; M.A., Colorado, 1963; Ph.D., 1968.

JOAN M. CHANDLER, *Assistant Professor*, B.A., Cambridge (England), 1958; M.A., 1962; Bryn Mawr, 1959; Ph.D., University of Texas at Austin, 1972.

JOHN W. COLE, *Associate Professor*, B.A., Michigan, 1957; M.A., 1963; Ph.D., 1969.

JOHNNETTA B. COLE, *Assistant Professor*, B.A., Oberlin College at Ohio, 1957; M.A., Northwestern Univ., 1959; Ph.D., 1967.

DENA F. DINCAUZE, *Assistant Professor*, B.A., Barnard, 1956; Ph.D., Harvard, 1967.

RALPH H. FAULKINGHAM, *Assistant Professor*, B.A., Wheaton College, 1965; M.A., Michigan State, 1969; Ph.D., 1970.

SYLVIA HELEN FORMAN, *Assistant Professor*, B.A., Univ. of California at Berkeley, 1968; M.A., 1969; Ph.D., 1972.

DAVID H. FORTIER, *Assistant Professor*, B.A., Columbia, 1949; M.A., 1953; Ph.D., 1964.

JOEL M. HALPERN, *Professor*, B.A., Michigan, 1950; Ph.D., Columbia, 1956.

ALFRED BACON HUDSON, *Associate Professor*, B.A., California at Berkeley, 1958; Ph.D., 1967.

MARY ELLEN MORBECK, *Assistant Professor*, B.A., Univ. of Colorado, 1967; M.A., California at Berkeley, 1970; Ph.D., 1972.

NANCY D. MUNN, *Associate Professor*, B.A., Oklahoma Univ., 1951; M.A., Indiana, 1955; Ph.D., Australian National Univ., 1961.

ORIOL PI-SUNYER, *Associate Professor*, B.A., Mexico City College, 1954; M.A., Harvard, 1957; Ph.D., 1962.

DONALD A. PROULX, *Associate Professor*, B.S., Wisconsin at Milwaukee, 1961; Ph.D., California at Berkeley, 1965.

H. MARTIN WOBST, *Assistant Professor*, B.A., Michigan, 1966; M.A., 1968; Ph.D., 1971.

RICHARD B. WOODBURY, *Professor*, B.S., Harvard, 1939; M.A., 1942; Ph.D., 1949.

PETER L. WORKMAN, *Associate Professor*, B.A., California at Davis, 1957; Ph.D., 1962.

Students beginning graduate work in anthropology are expected to be conversant with the field of anthropology as evidenced by successful undergraduate completion of introductory course work in at least three of the four subfields of anthropology, plus at least two advanced courses. With respect to this requirement, an entering student will be expected to remove any deficiencies before being granted full graduate standing.

Students working toward the Master of Arts degree in anthropology, in addition to fulfilling the general requirements of the Graduate School for the degree, must achieve a mastery of general theory in cultural and social anthropology and begin developing an area or subfield of specialization. They should also attain familiarity with descriptive linguistics, physical anthropology, and archaeology.

In addition, students must pass an examination in a foreign language (or "tool of research") and a master's-level comprehensive examination in anthropology.

In addition to fulfilling general requirements of the Graduate School for the Ph.D. degree, students will be expected to pass with a grade of B or better thirty hours of course work beyond the master's degree. There are no specific requirements. Fieldwork will be required of all candidates. It should normally be undertaken under the supervision of the candidate's major adviser. This fieldwork is expected to provide the material for the candidate's doctoral dissertation.

Ph.D. candidates are required to demonstrate their proficiency in two "tools of research." Ordinarily, one of these will be a foreign language. However, each student's specific fulfillment of this requirement will be determined by consultation with his guidance committee.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN ANTHROPOLOGY.
Directed individual research or reading in anthropology.
Credit, 1-9.

701, 702. SEMINAR.
Each semester a topic is selected from one or more of the four fields of anthropology, or pertaining to anthropology as a whole. Guest speakers present their research findings to graduate students and faculty in the seminar's context.
Credit, 1 each semester.

722. ARCHAEOLOGY OF THE SOUTHWEST.
Examination of selected problems in methodology and interpretation of the prehistory of the American Southwest. May be repeated once for credit. Mr. Woodbury.

725. ANDEAN ARCHAEOLOGY.
Selected problems in excavation, analysis, and interpretation of Andean prehistory. Emphasis on the later stages of development of native American civilizations. Mr. Proulx.

760. SEMINAR IN EUROPEAN ANTHROPOLOGY.
Particular attention to problems resulting from students' field investigations in Europe.

765. PROBLEMS IN FAR EASTERN ANTHROPOLOGY.
Detailed consideration of selected, important anthropological problems and controversies in dealing with cultural and anthropological data from the Far East. China is emphasized.
Mr. Fortier.

767. SOUTHEAST ASIAN ANTHROPOLOGY.
Selected problems in Southeast Asian anthropology, such as relations between hill and valley cultures, education, economic development, and minority group problems. Major attention to the mainland. Mr. Fraser, Mr. Halpern.

770. PROBLEMS IN NORTH AMERICAN ARCHAEOLOGY.
Selected problems in North American archaeology, emphasizing the anthropological interpretation of prehistoric data.

802. RESEARCH IN ARCHAEOLOGY.
Directed individual research in archaeology.
Credit, 1-12.

803. RESEARCH IN PHYSICAL ANTHROPOLOGY.
Directed individual research in physical anthropology.
Credit, 1-12.

804. RESEARCH IN CULTURAL ANTHROPOLOGY.
Directed individual research in cultural anthropology.
Credit, 1-12.

805. RESEARCH IN LINGUISTIC ANTHROPOLOGY.
Directed individual research in linguistic anthropology.
Credit, 1-12.

812. SEMINAR IN SOCIAL BIOLOGY.
The interaction of the social, biological, and ecological factors involved in various aspects of human biological and cultural diversity. Mr. Workman.

836. INDIVIDUAL AND SOCIETY.
A cross-cultural consideration of the relationship between the individual and his society with attention to theories, methods, and empirical findings as reported in the literature of the behavorial sciences.

837. THE HISTORY OF ANTHROPOLOGICAL THEORY.
The origin and development of anthropological theory, cultural evolution, culture history, and cultural dynamics with a primary focus on trends in American anthropology up to mid-twentieth century. Mr. Fortier.

840. ANTHROPOLOGY AND DEVELOPMENT.
Tribal and traditional economic systems and the process of economic technological change. Emphasis on current problems of modernizing nations. Mr. Pi-Sunyer.

841, 842. THEORY AND METHOD IN SOCIAL ANTHROPOLOGY.
A two-semester sequence devoted to structural functional analysis as developed in British social anthropology. Emphasis on method in the analysis of social and political theoretical issues.
Credit, 6 (3 each). Miss Munn, Mr. Faulkingham.

845. REVOLUTION AND SOCIAL CHANGE.
Drastic social and cultural change. Emphasis on the historical background and social contexts of political revolutions and their role in modernizing nations. Mr. Halpern.

850. SEMINAR IN COMPARATIVE SYMBOL SYSTEMS.
Current theory and analytic method in the symbolic analysis of socio-cultural systems. Miss Munn.

860. LANGUAGE AND CULTURE.
Linguistic prehistory and classification; methods and interpretations of comparative linguistic analysis; linguistic methodology and "ethnoscientific" approaches; the "Whorf hypothesis" and linguistic relativity. Mr. Hudson.

861. ANTHROPOLOGY OF COMMUNICATION.
Various communicative codes, from a biological and sociocultural viewpoint. Mr. Salzmann.

875. METHOD IN CULTURAL ANTHROPOLOGY.
Methods of studying cultures of homogeneous and heterogeneous societies among primitive and modern peoples, with emphasis on the various techniques of field work; observation, interviewing, use of technical devices, content analysis, and projective and verbal materials.

880. PHYSICAL ANTHROPOLOGY: THE SKELETON.
The human skeleton considered in its functional aspects and with reference to evolution, age, and sex. Methods of osteological investigation and osteometrics. Mr. Armelagos.

882. PHYSICAL ANTHROPOLOGY OF THE LIVING.
Techniques and applications of physical anthropology among living persons. Anthropometry, somatotyping, serology, and other descriptive methods; elements of statistical analysis. Body form and function in relation to individual constitution and racial variation. Mr. Armelagos.

900. DOCTORAL DISSERTATION. *Credit, 30.*

ANTHROPOLOGY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS.
(For either major or minor credit)

555. PRE-INDUSTRIAL TECHNOLOGY.
Analysis of selected aspects of the material culture of simpler societies, past and present, in relation to social and economic aspects of culture. Mr. Woodbury.

560. PEOPLES OF EUROPE: EASTERN EUROPE AND THE U.S.S.R.
A survey of the peoples and cultures of Eastern Europe; emphasis on the Slavic peoples as well as upon those cultures transitional between Europe, the Middle East, and Asia from their prehistoric origins to the period of their modernization, stressing the role of peasantries and nomads with their changing ecological adaptations. Mr. Halpern.

563. URBAN ANTHROPOLOGY.
Using as a point of departure the current urban condition, the origins and evolution of cities are explored in a cross-cultural framework. Emphasis on rural-urban relationships and how these have changed over time. Mr. Halpern.

565. PEOPLES OF EUROPE: CENTRAL EUROPE.
Anthropologically oriented examination of the culture of Central Europe, with emphasis on Czech culture.
Mr. Salzmann.

567. PEOPLES OF EUROPE: ALPINE EUROPE.
Analysis of Alpine cultures from prehistoric through contemporary times. Cultural adaptation to environmental variations in mountainous zones and the interrelationship of mountain and lowland communities is emphasized. Mr. Cole.

569. CULTURES OF AUSTRALIA AND NEW GUINEA.
The ethnography of aboriginal Australia and New Guinea with emphasis on the particular problems of theory and analysis encountered in these areas. Miss Munn.

615. PRIMATE ANATOMY.
Structure and phylogeny of primates (prosimian, monkey, and ape) with emphasis on evolutionary trends leading to man. Laboratory work provides experience in dissection.
Miss Morbeck.

620. ECONOMIC ANTHROPOLOGY.
A survey of patterns of production, distribution, and consumption in nonindustrial societies as well as of the social and political matrices of these patterns. Alternative theoretical approaches to selected problems in economic anthropology. Mr. Cole.

621. PREHISTORIC CULTURAL ECOLOGY.
Analysis of cultural ecology approaches to the interpretation of the prehistoric record. Prerequisite, permission of instructor. Mr. Wobst.

630. SOCIAL ORGANIZATION OF IMPERIALISM.
Analysis of the varieties of social relations between industrial societies and non-industrial areas of the world. The development of Western imperialism in Africa, Asia and the Western Hemisphere, and the patterns of resistance, accommodation, and rebellion that have developed in response. Mr. Cole.

635. NATIVE AMERICAN LANGUAGES.
A survey of American Indian languages primarily north of Mexico. Genetic classifications and Sapir's classification based on structural resemblances between language families. Types of linguistic structure and structural restatements. Comparative work and reconstructions. Mr. Salzmann.

640. ANTHROPOLOGICAL PERSPECTIVES ON RELIGION, RITUAL, AND MYTH.
An introductory course stressing the relationship between symbolic forms and social order, and the analysis of meaning in ritual and myth. Selected theorists from Durkheim to Victor Turner and Levi-Strauss. Miss Munn.

662. ORAL FOLKLORE IN NONLITERATE SOCIETIES.
Introduction to the ethnography of oral folklore. Topical emphasis on the analysis and function of tales; geographic emphasis on Africa and North America. Mr. Salzmann.

663. LINGUISTIC ANTHROPOLOGY: THE COMPARATIVE DIMENSION.
The methods and interpretation of comparative linguistic analysis in the field of anthropology.
Prerequisite, Anthro 105 or permission of instructor.
Mr. Hudson.

664. PROBLEMS IN ANTHROPOLOGY.
Current anthropological thought in regard to specific problems chosen from physical anthropology, archaeology, and cultural anthropology.
Prerequisite, permission of instructor. Mr. Fraser.

667. ETHNOLOGY OF AFRICA.
An intensive consideration of several representative peoples of Africa; comparison of their traditional institutions, their appearance in evolutionary and historical perspectives, and adaptations to colonialism and neo-colonialism.
Prerequisite, permission of instructor. Mr. Faulkingham.

668. OLD WORLD PREHISTORY.
The Old World prehistoric record discussed in terms of general cultural processes, and with the help of hypotheses, models, and theories developed by anthropologists and scientists.
Prerequisite, Anthro 102 or permission of instructor.
Mr. Wobst.

669. NORTH AMERICAN ARCHAEOLOGY.
An intensive survey of American Indian prehistory north of Mexico. Emphasizes the historical developmental processes in selected geographical regions.
Prerequisite, Anthro 102 or permission of instructor.
Mr. Woodbury.

670. NORTH AMERICAN INDIANS.
Indian tribes with various levels of technological development and social complexity, from areas north of Mexico, in terms of their environmental context and the impact of non-Indian societies on their cultures.
Prerequisite, Anthro 104. Mr. Woodbury.

672. HUMAN VARIATION.
Description and analysis of qualitative and quantitative biological variation and variation between human populations.
Mr. Workman.

673. PEOPLES OF SOUTHEAST ASIA.
An introduction to the history and ethnography of the cultures of Southeast Asia; the peasant populations and their expanding role in the development of modern Southeast Asian states.
Prerequisite, Anthro 104. Mr. Fraser.

674. CULTURES OF THE FAR EAST.
A survey of the culture-history and ethnography of representative peoples of East Asia; peasant subcultures of traditional and contemporary China, Japan, and Korea.
Prerequisite, permission of instructor. Mr. Fortier.

675. SOUTH AMERICAN ARCHAEOLOGY.
A survey of the pre-Columbian cultures of South America and their development. Emphasis on the Andean areas.
Prerequisite, Anthro 102 or permission of instructor.
Mr. Proulx.

676. THE ETHNOLOGY OF SOUTH AMERICA.
Analysis of the prehistoric, colonial, and contemporary cultures of South America; the Indian, European, and Negro peoples and how they have related to each other over the past three centuries.
Prerequisite, Anthro 104 or permission of instructor.
Mr. Proulx.

677. SUMMER FIELD SCHOOL IN ARCHAEOLOGY.
Practical training in archaeology. Prehistoric and Colonial sites will be excavated and instruction given in archaeological methods and techniques.
Prerequisite, Anthro 102 or equivalent.
Credit, 6. Mrs. Dincauze.

679. CULTURAL DYNAMICS AND APPLIED ANTHROPOLOGY.
Theories of cultural process and their application to practical cross-cultural situations in administration, technical assistance, and community development.
Prerequisite, Anthro 102 or permission of instructor.
Mr. Fraser.

680. FIELD COURSE IN CULTURAL ANTHROPOLOGY.
A summer field course for advanced undergraduates or graduates. Supervised training in cultural anthropological research. Location varies from year to year. *Credit, 6.*

Art

GRADUATE FACULTY

GEORGE WARDLAW—Painter—*Professor and Chairman of the Department of Art*, B.F.A., Memphis Academy of Arts, 1951; M.F.A., University of Mississippi, 1954.

FREDERICK BECKER—Printmaker—*Professor*, Otis Art Institute, Los Angeles; Diploma, Beaux Arts Institute of Design, N.Y.C., 1936. Guggenheim Fellowship, 1957.

Jack L. Benson—Archaeologist, Art Historian—*Professor*, B.A., University of Missouri, 1941; M.A., University of Indiana, 1947; Ph.D., University of Basel, 1952.

Paul E. Berube—Ceramist—*Associate Professor*, B.A., Bowdoin College, 1959; B.F.A., Rhode Island School of Design, 1961; M.F.A., University of Southern California, 1962.

Iris H. Cheney—Art Historian—*Associate Professor*, B.A., Wellesley, 1950; M.A., 1951; Ph.D., Institute of Fine Arts, N.Y.U., 1963.

John J. Coughlin—Printmaker—*Associate Professor*, B.F.A., Rhode Island School of Design, 1954; M.S., 1961.

Hanlyn Davies—Painter—*Associate Professor*, N.D.D., Swansea College of Art and University of Wales, 1963; A.T.D., 1964; M.F.A., Yale University, 1966.

Walter B. Denny—Art Historian—*Assistant Professor*, B.A., Oberlin College, 1964; M.A., Harvard University, 1964; Ph.D., 1970.

Eleanor Dube—Painter—*Assistant Professor*, B.F.A., School of Art Institute, Chicago, 1968; M.F.A., Yale University, 1970.

Arnold Friedman, *Professor*, B.F.A., Pratt Institute, 1953; M.S., Pratt Institute and New York University, 1960.

Leonel Gongora—Painter—*Assistant Professor*, Diploma in Art, Washington University, 1956.

John Grillo—Painter—*Associate Professor*, Hartford School of Fine Arts, 1935-38; Studied with Hans Hoffman, 1948-51.

James P. Hendricks—Painter—*Associate Professor*, B.A., University of Arkansas, 1962; M.F.A., State University of Iowa, 1964.

Walter Kamys—Painter—*Professor and Director, Art Acquisition Program*, Diploma in Art, Chicago Art Institute, 1943.

Jerry Kearns—Sculptor—*Assistant Professor*, B.A., University of California, Santa Barbara, 1966; M.F.A., 1968.

Robert W. Mallary—Sculptor—*Professor*, Guggenheim Fellowship, 1964-65.

Donald R. Matheson—Printmaker—*Professor and Associate Chairman of Department*, B.S., United States Military Academy, 1938; M.A., University of Michigan, 1951.

Paul F. Norton—Art Historian—*Professor*, B.A., Oberlin College, 1938; M.F.A., Princeton University, 1947; Ph.D., 1952.

Susan E. Parks—Ceramist—*Assistant Professor*, B.A., Mount Holyoke College, 1964; M.F.A., University of Massachusetts, 1968.

Herbert S. Paston, *Associate Professor*, B.F.A., Philadelphia College of Arts, 1952; M.A., Columbia, 1956; Ph.D., 1970.

William J. Patterson—Printmaker—*Assistant Professor*, B.F.A., Hartford Art School of the University of Hartford, 1964; M.F.A., Syracuse University School of Art, 1969.

Lyle N. Perkins—Ceramist—*Professor*, B.F.A., Alfred University, 1939; M.F.A., 1947; Ph.D., Ohio State University, 1956.

Carleton L. Reed—Art Educator—*Professor*, B.S., New York University, 1941; M.A., Columbia University, 1954; D.Ed., New York University, 1964.

Mark W. Roskill—Art Historian—*Professor*, B.A., Trinity College, Cambridge, 1956; M.A., Harvard University, 1957; M.F.A., Princeton University; Ph.D., 1961.

John A. Roy—Painter—*Professor*, B.F.A., Yale University, 1957; M.F.A., 1959.

Dale D. Schleappi—Sculptor—*Associate Professor*, B.A., Pratt Institute, 1959; M.S., 1960.

Nancy Smith—Art Educator—*Assistant Professor*, B.A., Bennington College, 1951; M.A., 1958; D.Ed., Harvard Graduate School in Education, 1972.

Gary Tarr—Art Historian—*Assistant Professor*, B.A., University of California at Los Angeles, 1963; M.A., 1966; Ph.D., 1969.

John F. Townsend—Sculptor—*Associate Professor*, B.S., Carroll College, 1951; M.F.A., University of Minnesota, 1959.

Hui-Ming Wang—Painter—*Associate Professor*, B.S., University of Missouri, 1949; M.A., New York University, 1953.

Ronald V. Wiedenhoeft—Art Historian—*Assistant Professor*, B.C.E., Cornell University, 1959; M.A., University of Wisconsin, 1964; Ph.D., Columbia University, 1970.

James L. Wozniak—Ceramist—*Associate Professor*, B.S., University of Wisconsin, 1954; M.S., 1955; M.F.A., 1958.

The degree of Master of Fine Arts is offered for those interested in the creative aspects of the arts. Requirements for the degree are listed under Master's Degree Requirements. The degree of Master of Arts in Art History is offered upon the successful completion of 30 credits and a written examination. Some courses may be taken for graduate credit at Amherst, Hampshire, Mount Holyoke, and Smith Colleges. Most students require two years to complete the degree. For further information write to Graduate Program Director in Art History, Art Department, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

Creative Art

700. SPECIAL PROBLEMS. *Credit, 3-12.*

701. SPECIAL PROBLEMS: PAINTING. *Credit, 3-12.*

702. SPECIAL PROBLEMS: PRINTMAKING. *Credit, 3-12.*

703. SPECIAL PROBLEMS: SCULPTURE. *Credit, 3-12.*

704. SPECIAL PROBLEMS: CERAMICS. *Credit, 3-12.*

705. SPECIAL PROBLEMS: DRAWING. *Credit, 3-12.*

711. PAINTING. *Credit, 3-12.* Mr. Wang.

721. PRINTMAKING. *Credit, 3-12.* Mr. Matheson.

731. SCULPTURE. *Credit, 3-12.* Mr. Mallary.

741. CERAMICS. *Credit, 3-12.* Mr. Berube.

800. MASTER'S THESIS. *Credit, up to 18.*

History of Art

706. SPECIAL PROBLEMS: ART HISTORY. *Credit, 3-12.*

714. GREEK PAINTING. Mr. Benson.

715. ROMAN PAINTING. Mr. Benson.

724. PROBLEMS IN ART OF THE ITALIAN EARLY RENAISSANCE AND THE NORTH EUROPEAN LATE MIDDLE AGES. Mrs. Cheney.

725. PROBLEMS IN ART OF THE HIGH RENAISSANCE TO THE EARLY BAROQUE.

727. STUDIES IN MEDIEVAL ICONOGRAPHY.

734. NINETEENTH-CENTURY PAINTING & SCULPTURE. Mr. Roskill.

735. ART SINCE 1880. Mr. Roskill.

736. NINETEENTH-CENTURY AMERICAN ARCHITECTURE. Mr. Norton.

793. SEMINAR IN TWENTIETH-CENTURY ARCHITECTURE. Mr. Wiedenhoeft.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

Creative Art

520. PAINTING I.
Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitations of sound composition.
Six studio hours. Mr. Hendricks, Mr. Grillo.

522. PAINTING II.
Initial concentration on transparent water color, emphasizing control of techniques and mastery of color relationships. Further experience with opaque water color, such as gouache, casein.
Six studio hours. Miss Dube, Mr. Wang.

524. PAINTING III.
Continuation of Art 520.
Six studio hours. Mr. Kamys.

526. PAINTING IV.
Advanced work in traditional and contemporary painting techniques and media. Includes encaustic, tempera, oil, oil-resin, acrylic polymer, synthetic media, grounds and supports.
Six studio hours. Prerequisites, Art 522, 524.

530. ADVANCED DRAWING.
Investigation and development of various techniques and media. Emphasis on figure drawing.
Six studio hours. Mr. Grillo, Mr. Gongora, Mr. Kamys.

532. ADVANCED DRAWING PROBLEMS.
Advanced work in traditional and contemporary drawing media. Independent exploration of graphic problems. Solutions to problems sought in relation to student's personal objectives.
Six studio hours. Mr. Grillo.

540. PRINTMAKING: RELIEF I.
Techniques and aesthetic considerations of the woodblock print and related media. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Becker.

542. PRINTMAKING: INTAGLIO I.
Techniques and aesthetic considerations of etching, engraving, aquatint, and related media. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Patterson.

544. PRINTMAKING: LITHOGRAPHY I.
Techniques and aesthetic considerations of making lithographs. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Matheson.

546. PRINTMAKING: RELIEF II.
Advanced study of materials, techniques, and esthetic considerations relevant to relief printmaking.
Six studio hours. Mr. Becker.

548. ART EDUCATION: METHODS AND MATERIALS I.
Methods, tools, and materials used in the public school art program, with special emphasis on the elementary school level. Required for art education majors and a prerequisite for student teaching.
Six studio hours. Miss Smith.

550. ART EDUCATION: METHODS AND MATERIALS II.
The literature, philosophies, procedures, and methods used in the teaching of art. Emphasis on the secondary school program. Required for art education majors and a prerequisite for student teaching. Mr. Reed.

554. TYPOGRAPHY I.
A studio course in typography and book design. The student selects a text, sets it in type, prints and binds at least one copy of the finished book.
Six studio hours.

560. SCULPTURE I.
Experimentation with materials. Investigation into the nature of three-dimensional order. Individual projects.
Six studio hours. Mr. Townsend, Mr. Schleappi.

562. SCULPTURE II.
Continuation of Art 560.
Six studio hours. Mr. Kearns.

564. SCULPTURE III.
A sequence of problems in direct and cast-metal sculpture, using a variety of metals, techniques, and processes. Emphasizes traditional and modern foundry methods, and includes gas and electric welding.
Prerequisite, Art 562 (previously or concurrently).
Six studio hours.

566. SCULPTURE IV.
Encourages development of a personal approach to sculpture and creative decisions. The student selects projects and materials of interest to himself and completes them within a classroom situation.
Prerequisite, Art 564 (previously or concurrently).
Six studio hours.

580. CERAMICS I.
The designing and making of pottery with the potter's wheel and related tools. One or more basic courses in creative art should be taken previously.
Six studio hours. Mr. Berube, Miss Parks, Mr. Wozniak.

582. CERAMICS II.
Continuation of Art 580.
Prerequisite, Art 580.
Six studio hours. Miss Parks, Mr. Wozniak.

584. CERAMICS III.
Creation of ceramic forms with stress on aesthetic principles rather than utility. Introduction to ceramic glaze technology and coloring media. Related ceramic history.
Prerequisite, Art 582.
Six studio hours.

586. CERAMICS IV.
Continuation of Art 584. Emphasis on expressive potential of clay and glazes. Advanced techniques in glaze technology. Introduction to kiln design.
Prerequisite, Art 584.
Six studio hours.

588. GLASS BLOWING I.
An introduction to the principles and techniques of glass blowing from molten mixes, emphasizing experimental form.
Six studio hours. Mr. Perkins.

590. LIGHT WORKSHOP.
Introduction to the use of light as a medium of aesthetic expression. Emphasis on individual investigation into the techniques of modifying the quality of illumination.
Six studio hours.

640. PRINTMAKING: Intaglio II.
Advanced study of materials, techniques, and aesthetic considerations relevant to etching, engraving and aquatint.
Six studio hours. Mr. Patterson.

642. PRINTMAKING: Lithography II.
Advanced study of lithography. Emphasis on the concepts and techniques of color lithography.
Six studio hours. Mr. Matheson.

History of Art

505. GREEK ART.
The sculpture, painting, and architecture of ancient Greece from Protogeometric beginnings through the Hellenistic period. Mr. Benson.

525. EARLY MEDIEVAL ART.
Early Christian art and the beginnings of Byzantine art in East and West; Coptic art, Barbarian and Celtic influences in northern Europe; Carolingian, Ottonian, and Anglo-Saxon art.

527. ART OF THE ROMANESQUE AND GOTHIC PERIODS.
Art of the High Middle Ages; Romanesque and Gothic art. Emphasis on architecture, monumental sculpture, and painting in western Europe.

533. ISLAMIC ART AND ARCHITECTURE I.
Art and architecture of Islamic peoples from their origins up to the Mongol invasions in the 13th century.
Mr. Denny.

535. ISLAMIC ART AND ARCHITECTURE II.
Art and architecture of Islamic peoples from the 14th century to our time. Mr. Denny.

545. ITALIAN ART OF THE EARLY AND HIGH RENAISSANCE (1400-1520).
The development of Italian art and architecture of the 15th and early 16th centuries in historical context.
Mrs. Cheney.

547. ITALIAN ART OF THE LATE RENAISSANCE AND MANNERISM.
The dissolution of the High Renaissance; proto-Baroque and early Mannerist art; the courtly Mannerism of the revived feudal class after 1530; the artistic response to the Counter-Reformation.
Prerequisite, Art 545 or permission of instructor.
Mrs. Cheney.

561. THE ARTS OF AFRICA, OCEANIA, AND PRE-COLUMBIAN AMERICAS.
An introduction to the so-called "primitive arts" of traditional peoples of Africa, Oceania, and pre-Columbian Americas.

563. AFRICAN ART.
A survey of ancient, traditional, and contemporary art and architecture of Western and Central Africa. Emphasis on art in its cultural context.

565. BAROQUE ART AND ARCHITECTURE IN NORTHERN EUROPE.
Art and architecture in France, Flanders, Holland, Germany, and Austria from 1600 to 1750. Students are encouraged to take Art 113 or 115 before taking this course.
Mr. Wiedenhoeft.

571. ART OF INDIA.
The effect of the great Eastern religious movement on art in India and surrounding territories. Some attention to secular art and architecture in modern times. Mr. Tarr.

573. THE HINDU TEMPLE.
The conception and development of the Hindu temple in South and Southeast Asia. Emphasis on the structural traditions of the regions covered. Mr. Tarr.

575. CHINESE PAINTING.
Shang tomb paintings; Han, Sung, Yuan, Ming, and Ch'ing Dynasty art; and the interplay between the art of Japan and the West. Mr. Tarr.

577. ART OF BUDDHISM.
The development of Buddhist arts as they spread through Central Asia into East Asia and through Southeast Asia. The influence of the changing religion on the arts.
Mr. Tarr.

585. EUROPEAN ART, 1780-1880.
Major developments in painting from David to Post-Impressionism in France, England, and Germany. Mr. Roskill.

587. MODERN ART, 1880 TO THE PRESENT.
Emphasis on major artists such as late Cezanne and Gauguin, Picasso, Matisse, Klee, Jackson Pollock, Optical and Pop artists. Main developments of style in relation to these artists.
Mr. Roskill.

591. MODERN ARCHITECTURE, NINETEENTH CENTURY.
Developments in the late 18th century and the history of the changes in style, technical advances, and aesthetic principles during the 19th century in Europe and America.
Mr. Norton.

593. MODERN ARCHITECTURE, TWENTIETH CENTURY.
Developments in Europe and America, including influential personalities, social and political influences, structural innovations, and aspects of city planning.
Mr. Wiedenhoeft.

595. AMERICAN ART.
The earliest colonial art, the impact of later European influences, regional art of the 19th and 20th centuries, and contemporary developments.

605. ART OF EARLY MEDITERRANEAN CULTURES.
The art of high cultures of the Bronze Age: Egyptian, Mesopotamian, Aegian, Hittite, and related cultures.
Mr. Benson.

625. MEDIEVAL PAINTING.
Early Christian to later medieval painting in Eastern and Western Europe.

627. SUMPTUARY ARTS OF THE MIDDLE AGES.
The technique, style, function, and symbolism of liturgical and secular objects in precious materials from Early Christian through Gothic periods.
Prerequisite, Art 225 or 227 or permission of instructor.

663. SEMINAR ON AFRICAN ART.
Methodology, authentication, and in-depth stylistic analysis of traditional African art.
Prerequisite, Art 263 or permission of instructor.

671, 673. GREAT THEMES IN ART HISTORY.
Central themes, issues, and problems of an important area in the history of art.

675, 677. MASTERS OF WESTERN ART.
An intensive study of the work of a master in the field of art. 1 or 2 class hours.
Prerequisite, permission of instructor. *Credit, 1-2.*

681, 683. METHODS OF ART HISTORY.
An introduction to methods of study in this field emphasizing differing approaches to the work of art.

691. SEMINAR IN ROMAN ART.
Origins and development of Roman architecture, portraiture, historical relief, painting, and mosaics.
Prerequisite, Art 115 or 505, or Ancient History, or permission of instructor. Mr. Benson.

693. CRITICISM OF MODERN ART—SEMINAR.
Practical exercises in the evaluation of modern paintings. Discussion of the results. *Credit,* 2. Mr. Roskill.

697. ASPECTS OF AMERICAN ARCHITECTURE.
Changes in style, technique, and aesthetic principles of architecture in the United States.

Astronomy

(Five-College Cooperative Program)

GRADUATE FACULTY

WILLIAM M. IRVINE, *Professor and Head of the Astronomy Program,* B.A., Pomona College, 1957; M.A., Harvard, 1958; Ph.D., 1961.

FRANCIS PICHANICK, *Associate Professor of Physics and Graduate Program Director in Physics and Astronomy.*

THOMAS T. ARNY, *Associate Professor,* B.A., Haverford, 1961; Ph.D., Arizona, 1965.

TOM R. DENNIS, *Assistant Professor* (Mount Holyoke College).

WILLIAM A. DENT, *Associate Professor,* B.S., Case Institute of Technology, 1960; M.S., University of Michigan, 1962; Ph.D., 1965.

H. MARK GOLDENBERG, *Associate Professor of Physics.*

COURTNEY P. GORDON, *Assistant Professor* (Hampshire College).

KURTISS J. GORDON, *Assistant Professor* (Hampshire College).

GEORGE S. GREENSTEIN, *Assistant Professor* (Amherst College).

EDWARD R. HARRISON, *Professor,* Graduate, Institute of Physics, England, 1949; Associate, 1956; Fellow, 1963.

G. RICHARD HUGUENIN, *Professor,* B.S., Massachusetts Institute of Technology, 1959; Ph.D., Harvard, 1964.

ROBERT V. KROTKOV, *Professor of Physics.*

RICHARD N. MANCHESTER, *Associate Professor,* B.S., University of Canterbury, New Zealand, 1964; Ph.D., University of Newcastle, Australia, 1969.

BRIAN T. O'LEARY, *Assistant Professor* (Hampshire College).

WALTRAUT C. SEITTER, *Professor* (Smith College).

JOHN D. STRONG, *Professor,* B.A., Kansas, 1926; Ph.D., Michigan, 1930.

EUGENE TADEMARU, *Assistant Professor,* B.S., University of Illinois, 1964; Ph.D., University of Chicago, 1969.

JOSEPH H. TAYLOR, JR., *Associate Professor,* B.A., Haverford, 1963; Ph.D., Harvard, 1968.

DAVID J. VAN BLERKOM, *Assistant Professor,* B.S., City College of New York, 1963; Ph.D., Colorado, 1969.

Students entering the master's and doctor's programs in astronomy are expected to have a sound background in undergraduate physics. Previous training in astronomy is helpful but not required.

The candidate for a master's degree generally takes a normal course load during the first year. The second year is devoted principally to either research directed toward a thesis or advanced course work. Physics courses are included with astronomy courses for determination of the total graduate credits in the major field. If a thesis is offered, at least six credits must be earned in 700-900 series astronomy courses; if a thesis is not offered, 12 credits must be earned in 700-900 series astronomy courses. A general examination must be passed before the degree is awarded.

The general requirements for the Ph.D. in astronomy are those of the Graduate School. A student takes a normal load of basic courses during the first two years. After passing the qualifying examination, the student is expected to devote his major effort to research. Research problems may be in either theoretical or observational areas. There is no foreign language requirement for the Ph.D. in astronomy. The basic courses of the program are 643, 644, 730, 740, 741, and 743. In addition, students will normally take several courses from Physics 701, 702, 703, 704, 705, 706, 707, and 718.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. INDEPENDENT STUDY.
Special study in some branch of astronomy or astrophysics, either theoretical or experimental, under direction of a faculty member. May be repeated for credit. Prerequisites, permission of the Head of the Astronomy program and the directing faculty member. *Credit, 1-6.*

730. RADIO ASTROPHYSICS.
The physical theory fundamental to radio astronomy: propagation of electromagnetic waves in isotropic and anisotropic media with emphasis on plasmas, Faraday rotation, the emission and absorption of synchrotron radiation and bremsstrahlung emission, spectral lines at radio frequencies; nonthermal radio source models. Prerequisites, Physics 552 and 586. Mr. Dent.

731. RADIO ASTRONOMY.
An introduction to observational radio astronomy. Topics include: a brief survey of areas to which radio observations have made important contributions; antenna systems, inter-

ferometers, radiometric systems, and other instrumentation; observing methods and techniques.
Prerequisites, Physics 552 and Math 641 or equivalent.
Mr. Huguenin.

740. GALACTIC AND EXTRA-GALACTIC ASTRONOMY.
The stellar density and luminosity functions as applied to the problem of galactic structure. Determination of the galactic force field from stellar motions. Spiral structure, star clusters and their stability.
Prerequisite, Physics 556. Mr. Huguenin.

741. THE INTERSTELLAR MEDIUM.
Observed properties of the interstellar medium from optical and radio data: composition, distribution, and motions. Transfer of dilute radiation and its production in a rarefied gas. The dynamics of the gas as influenced by radiation and gravity.
Prerequisite, Astron 644 or permission of instructor.
Mr. Arny.

743. STELLAR ATMOSPHERES.
Theory of stellar atmospheres. Observational methods and observational data, formation of the continuous spectrum, line formation and curve of growth techniques in normal stars, stars with envelopes, variable stars, novae, magnetic fields in stars. Departure from local thermo-dynamic equilibrium.
Prerequisite, Astron 644. Mr. Van Blerkom.

744. STELLAR STRUCTURE.
Stellar structure and evolution: energy generation and transfer in the interior of stars, convective and radiative equilibrium, the computation of stellar models and evolution of young and old stars, red giants, pulsating stars, novae, and white dwarfs.
Prerequisites, Astron 643, COINS 409, or equivalent.
Mr. Harrison.

745. THE SUN.
The determination of physical conditions in the solar atmosphere using the various observational data. The features of both the quiet and the active sun: granulation, limb darkening, plages, sunspots, etc. Solar-terrestrial relationships.
Prerequisite, Astron 644.

746. SOLAR SYSTEM PHYSICS.
The physics and chemistry of planetary atmospheres, surfaces, and interiors. Comets, meteors, and asteroids. The solar wind, solar terrestrial relations, and the interplanetary medium. Advanced topics in mechanics applicable to astronomical problems.
Prerequisites, Physics 552 and 556 and Astron 644, or permission of instructor. Mr. Irvine.

748. COSMOLOGY AND GENERAL RELATIVITY.
Observational cosmology and cosmological Principles. Background radiation and Olbers' paradox. Newtonian cosmology. General relativity, gravitational waves, relativistic cosmology, and gravitational collapse. Theories of the universe and the origin of celestial structure.
Prerequisite, Physics 585. Mr. Harrison.

797, 798. SEMINAR—REVIEW OF CURRENT LITERATURE.
Discussion and review of current articles in the astronomical literature. May be repeated for credit. Required of graduate students. *Credit, 1 each semester.*

850. ADVANCED TOPICS IN ASTRONOMY.
Topics of special interest not covered in regular courses. Prerequisite, permission of instructor.

860. SEMINAR ON RESEARCH TOPICS IN ASTRONOMY.
Topics of current interest not covered in regular courses. Instruction via reading assignments and seminars. May be repeated for credit.
Prerequisite, permission of instructor. *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, variable.*

900. DOCTORAL DISSERTATION *Credit, variable.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

538. TECHNIQUES OF MODERN ASTRONOMY.
An introduction to modern methods of astronomical observation and data reduction. Specific techniques of optical astronomy, radio astronomy, and space astronomy discussed and analyzed. Laboratory experiments and field observations.
Prerequisites, Physics 113 or 107. Mr. Huguenin.

643. ASTROPHYSICS I.
Basic topics in astronomy and astrophysics. Gravitational equilibrium configurations, virial theorem, polytropes, hydrodynamics, thermodynamics, radiation transfer, convective and radiative equilibrium, stellar and planetary atmospheres, the equations of stellar structure. Miscellaneous topics on the physics of stellar and galactic structure.
Prerequisite, permission of instructor.
Credit, 4. Mr. Harrison.

644. ASTROPHYSICS II.
Atomic physics and opacity. Nuclear physics and nucleosynthesis in stars. Gravitational instability and star formation. Stellar evolution and electron-degenerate configurations. Gravitational collapse. Topics in plasma physics and the propagation of electromagnetic waves. Topics in magnetohydrodynamics and Alfven waves. Dynamic and kinematic principles of cosmology and a review of the underlying physical processes.
Prerequisite, Astron 643. *Credit, 4.* Mr. Harrison.

RELATED COURSES

Physics

701. CLASSICAL MECHANICS.

702. STATISTICAL PHYSICS.

703. INTRODUCTORY QUANTUM MECHANICS I.

704. INTRODUCTORY QUANTUM MECHANICS II.

705. METHODS OF MATHEMATICAL PHYSICS.

706. CLASSICAL ELECTRODYNAMICS I.

707. CLASSICAL ELECTRODYNAMICS II.

718. BASIC PHYSICS OF ATOMS AND MOLECULES.

Biochemistry

GRADUATE FACULTY

R. C. Fuller, *Professor and Head of the Department of Biochemistry*, B.A., Brown, 1947; M.A., Amherst College, 1948; Ph.D., Stanford, 1952.

Henry N. Little, *Professor and Graduate Program Director*, B.S., Cornell, 1942; M.S., Wisconsin, 1946; Ph.D., 1948.

John F. Brandts, *Professor of Chemistry.*

Pat W. Camerino, *Associate Professor and Associate Graduate Dean for Research*, B.S., Kent State University, 1957; Ph.D., Cornell, 1961.

Mark S. Fischer, *Assistant Professor*, A.B., Brandeis, 1965; Ph.D., University of California, Berkeley, 1969.

Maurille J. Fournier, *Assistant Professor*, B.A., Vermont, 1962; Ph.D., Dartmouth, 1967.

ANTHONY M. GAWIENOWSKI, *Associate Professor*, B.A., Villanova, 1948; M.A., Missouri, 1953; Ph.D., 1956.

THOMAS L. MASON, *Assistant Professor*, B.S., Wisconsin, 1962; M.S., Louisiana, 1965; Ph.D., Minnesota, 1970.

JOHN H. NORDIN, *Associate Professor*, B.S., Illinois, 1956; Ph.D., Michigan State, 1961.

PETER PARSONS, *Assistant Professor*, B.A., Colby, 1955; Ph.D., Pittsburgh, 1963.

TREVOR ROBINSON, *Associate Professor*, B.A., Harvard, 1950; M.A., 1951; M.S., Massachusetts, 1953; Ph.D., Cornell, 1956.

DONALD L. SCHNEIDER, *Assistant Professor*, B.A., Kalamazoo, 1963; Ph.D., Michigan State, 1969.

LINDA L. SLAKEY, *Assistant Professor*, B.S., Siena Heights, 1962; Ph.D., University of Michigan, 1967.

EDWARD W. WESTHEAD, *Professor*, B.S., Haverford, 1951; M.S., 1952; Ph.D., Brooklyn Polytechnic, 1955.

GENERAL INFORMATION

Candidates for the degrees of Master of Science and Doctor of Philosophy in Biochemistry are accepted for admission under the general regulations of the Graduate School. Students normally must complete the following undergraduate courses before admission to either degree program: two semesters each of organic chemistry, physical chemistry; a year of calculus, physics and biology. As part of these requirements, all students prior to their first registration must take achievement or placement exams in the areas of organic chemistry, analytical chemistry, and physical chemistry. Satisfactory completion of the admission requirements will be judged by the Graduate Study Committee of the Department on evidence of the student's undergraduate transcript and his scores on these examinations. Those students with deficiencies must remove them at the earliest possible date by taking the appropriate courses. Students may register for graduate credit courses while doing this remedial work, but no graduate credit is given for such remedial courses.

SUMMARY OF REQUIREMENTS FOR THE PH.D. DEGREE

Upon entrance a student is assigned an adviser who will work out the first-year courses, seminar and research programs with the entering student. At the end of the first two semesters the student must have remedied his deficiencies, if any; have taken the equivalent of one year's graduate study in biochemistry (including laboratory work); and participated in the biochemistry seminar specially designed to familiarize entering students with the research work of the faculty and the pertinent literature.

All students must attend regular departmental seminars. A comprehensive examination (of the research-proposal and written-comprehensive type) is required of all Ph.D. students. The Department currently requires one foreign language to be passed under departmental supervision. In addition to the comprehensive examination, all Ph.D. students must complete the preparation of a dissertation satisfactory to their Dissertation Committees and pass a final oral examination on that dissertation.

SUMMARY OF REQUIREMENTS FOR THE M.S. DEGREE

Entrance requirements for the master's degree are similar to those for the Ph.D. degree. They may be fulfilled by remedial work during the first year. All students are expected to participate in the biochemistry seminar during their first year and to complete 30 graduate credits, no more than 10 of which may be earned by means of a thesis. A thesis presentation and an oral examination on the thesis are required.

GENERAL REQUIREMENTS FOR ALL GRADUATE STUDENTS

All entering candidates for either the M.S. or Ph.D. degree must participate in a special in-depth seminar, which will cover the research work of the members of the Biochemistry Department, and in one or more research projects before the end of the first year of studies. It is expected that the master's degree will take two years to complete, and the Ph.D. degree two years after the award of a master's degree from this or another institution.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

724. SPECIAL TOPICS IN BIOCHEMISTRY.
Topics of current interest which may include hormones, lipids, carbohydrates, control mechanisms, and protein synthesis.
Prerequisite, Biochem 524.

725. ADVANCED BIOCHEMICAL TECHNIQUES.
A laboratory course to provide experience in isolation, identification and analysis of biochemical compounds.
Prerequisites, Biochem 524, and either 525, 526, 527 or equivalent. *Credit*, 2-5. Mr. Parsons.

726. EXPERIMENTAL ENZYMOLOGY.
A laboratory course. Experience in the preparation, assay, and physical characterization of enzymes.
Prerequisite, Biochem 525, 526.
Credit, 2. Mr. Westhead.

728. PROTEIN PHYSICAL CHEMISTRY.
The chemical, physical, and biological properties of proteins.
Prerequisites, Biochem 524 and Chem 586. Mr. Brandts.

729. ENZYMES.
Basic aspects of enzyme assay, preparation, kinetics, and properties. Topics of current importance such as studies on active sites, mechanisms, and controls of enzyme action.
Prerequisite, Biochem 524. Mr. Westhead.

731. PLANT BIOCHEMISTRY.
The chemistry and metabolism of plants with particular emphasis on higher plants. Topics such as nitrogen metabolism, photosynthesis, and the chemistry of compounds peculiar to plants.
Prerequisite, Biochem 524. Mr. Robinson.

891. SEMINAR.
Required of all students. Oral report on a topic of current interest and preparation of a research proposal based on the seminar topic. *Credit, 1 each semester.*

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

523, 524. GENERAL BIOCHEMISTRY.
Introductory course for students majoring in chemistry or in

the biological sciences. A background for more advanced or specialized study.
Prerequisites, Chem 166 or equivalent; second semester requires Chem 281 or equivalent.
Credit, 3 each semester. Mr. Little.

525, 526. BIOCHEMISTRY LABORATORY.
First semester: biochemical materials and standard biochemical techniques; second semester: more sophisticated experiments, with increased opportunity for initiative in experimental design. Density gradient ultracentrifugation, amino acid and peptide analysis, and separation and study of subcellular components.
Prerequisite, Chem 127 or equivalent.
Credit, 1 each semester. Mr. Parsons.

527 (I). BIOCHEMISTRY LABORATORY FOR MAJORS.
Similar to 525, 526 but concentrated into one semester and taught at a more advanced level.
Credit, 2. Mr. Parsons.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in biochemistry.)

520. ELEMENTARY BIOCHEMISTRY.
The more important facts relating to biological materials and processes. Primarily for students not eligible for courses 523 or 524.
Not open to chemistry or biochemistry majors.
Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Robinson.

Botany

GRADUATE FACULTY

Otto L. Stein, *Professor and Head of the Department of Botany,* B.S., Minnesota, 1949; M.S., 1952; Ph.D., 1954.

Bernard Rubinstein, *Assistant Professor and Graduate Program Director,* B.S., Michigan State University, 1960; M.S., Purdue University, 1962; Ph.D., University of California at Berkeley, 1968.

Paul E. Barrett, *Assistant Professor,* B.S., University of New Hampshire, 1964; M.S., 1966; Ph.D., British Columbia, 1972.

David W. Bierhorst, *Professor,* B.S., Tulane University, 1947; M.S., 1949; Ph.D., University of Minnesota, 1952.

Howard E. Bigelow *Professor,* B.A., Oberlin, 1949; M.A., 1951; Ph.D., Michigan, 1956.

Margaret E. Barr Bigelow, *Associate Professor,* B.A., University of British Columbia, 1950; M.A., 1952; Ph.D., Michigan, 1956.

Edward L. Davis, *Associate Professor,* B.A., Harvard, 1951; M.S., Massachusetts, 1953; Ph.D., Washington University, 1956.

Sara A. Fultz, *Assistant Professor,* B.S., Purdue, 1951; M.S., Michigan, 1953; Ph.D., 1965.

Paul J. Godfrey, *Assistant Professor,* B.S., University of Connecticut, 1962; Ph.D., Duke University, 1969.

Edward J. Klekowski, Jr., *Associate Professor,* B.S., 1962; M.S., N.C. State University, 1964; Ph.D., University of California, Berkeley, 1968.

Robert B. Livingston, *Professor,* B.A., Colorado College, 1938; M.A., Duke, 1941; Ph.D., 1947.

James A. Lockhart, *Professor,* B.S., Michigan State, 1949; M.S., 1952; Ph.D., University of California at Los Angeles, 1954.

David L. Mulcahy, *Associate Professor,* B.A., Dartmouth College, 1959; Ph.D., Vanderbilt University, 1963.

Livija Raudzens, *Assistant Professor,* B.A., Barnard College, 1961; M.A., Columbia University, 1964; Ph.D., 1967.

Rudolf M. Schuster, *Professor,* B.S., Cornell, 1945; M.S., 1946; Ph.D., Minnesota, 1948.

Seymour Shapiro, *Professor,* B.S., Michigan, 1947; Ph.D., 1953.

Albert C. Smith, *Ray Ethan Torrey Professor,* B.A., Columbia University, 1926; Ph.D., 1933.

Arthur I. Stern, *Associate Professor,* B.S., City College of New York, 1953; Ph.D., Brandeis University, 1962.

Carl P. Swanson, *Professor,* B.S., Massachusetts State College, 1937; M.A., Harvard University, 1939; Ph.D., 1941.

William F. Thompson, *Assistant Professor,* B.A., Princeton University, 1966; Ph.D., University of Washington, 1970.

Oswald Tippo, *Commonwealth Professor,* B.S., Massachusetts, 1932; M.A., Harvard, 1933; Ph.D., 1937.

James W. Walker, *Assistant Professor,* B.A., University of Texas, 1964; Ph.D., Harvard University, 1970.

Peter L. Webster, *Assistant Professor,* B.S., University of St. Andrews, 1964; Ph.D., Western Reserve University, 1968.

Robert T. Wilce, *Associate Professor,* B.S., University of Scranton, 1950; M.S., Vermont, 1952; Ph.D., Michigan, 1957.

Candidates for the degrees of Master of Arts, Master of Science, and Doctor of Philosophy are accepted for admission under the general regulations of the Graduate School. Admission to advanced courses does not imply admission to candidacy for an advanced degree. Only students whose knowledge of botany and related chemical and physical sciences is considered by the Department to be adequate will be accepted as candidates for advanced degrees. Research work leading to the thesis may be selected from the fields of anatomy, cytology, ecology, morphology, morphogenesis, physiology, and taxonomy.

The Botany Department normally requires candidates for the Ph.D. degree to demonstrate on the intermediate level reading knowledge of two foreign languages, one of which must be German. Choice of the second language will be made after consultation between the student and his guidance committee. Waiving of the requirement for the second language requirement may be made by consultation of the student with his guidance committee and must be approved by the departmental Degree Requirements Committee.

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

700. SPECIAL PROBLEMS.
Research not expected to terminate in a thesis; advanced study in special subjects. *Credit, 1-5 each semester.*

711, 712. ADVANCED PLANT PHYSIOLOGY.
Selected topics in plant physiology. Lectures, laboratory, and individual conferences.
Prerequisites, Botany 511 and permission of instructor.
Credit, 2-4 each semester.
Miss Fulz, Mr. Lockhart, Mr. Rubinstein, Mr. Stern.

715. PLANT GROWTH REGULATORS.
Recent advances in the field of plant growth regulators, including phytochrome, auxins, gibberellins, kinins, and herbicides. The mechanisms whereby these materials control plant growth and development. Possible experimental approaches.
Prerequisites, Botany 511 and one semester of biochemistry. Mr. Rubinstein, Mr. Marsh.

721. ADVANCED PLANT ECOLOGY.
Lectures, conferences, critical reading, and reports on advanced considerations of synecology and autecology.
Prerequisite, Botany 521.
Mr. Godfrey, Mr. Livingston, Mr. Mulcahy.

731. ADVANCED MYCOLOGY.
Systematics and ecology of the higher ascomycetes and basidiomycetes; problems in growth and nutrition of fungi.
Prerequisite, Botany 531 or equivalent. *Credit, 4.*
Mr. H. E. Bigelow, Mrs. M. E. B. Bigelow.

741. ADVANCED PHYCOLOGY.
Detailed study of marine and fresh-water algae. Emphasis on phylogeny, life histories, and ecology.
Prerequisite, Botany 541 or equivalent. Mr. Wilce.

750. PLANT PHOTOSYNTHESIS.
Lectures and discussions of the literature on the mechanisms and requirements of photosynthesis, including the light and dark reactions and the process of photorespiration.
Prerequisite, Botany 512 or Chem 524 or equivalent.
Mr. Baker, Mr. Stern.

761. BIOLOGY OF LOWER PLANTS.
The use of fungi and algae as experimental organisms for investigations in physiology and genetics.
Prerequisite, Botany 511, Zool 660, or Chem 524.
Credit, 4. Miss Fulz.

781. ADVANCED ANGIOSPERM SYSTEMATICS.
Consideration of angiosperm systematics and evolution at an advanced level. Topics may vary from year to year. May be repeated with permission of instructor.
Three class hours, one 3-hour laboratory-discussion period.
Prerequisite, Botany 528 and Botany 581, or permission of instructor. *Credit, 4.* Mr. Walker.

800. MASTER'S THESIS.
Maximum credit, 10.

801. PLANT MORPHOGENESIS.
Lectures, discussions, and reading on the development of the plant body.
Prerequisites, Botany 591, Botany 511 or equivalent.
Mr. Shapiro, Mr. Stein.

825. PALYNOLOGY.
Comparative morphology of modern and fossil pollen grains and spores, including development of the pollen wall. Emphasis on the taxonomic use of pollen characters for angiosperm systematics. Mr. Walker.

850. SEMINAR.
Credit, 1 each semester; maximum credit, 6.

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

511. INTRODUCTORY PLANT PHYSIOLOGY.
How the plant grows and feeds itself. Methods of communication among cells and organs, and between plant and environment.
Prerequisite, 1 semester organic chemistry. *Credit, 4.*
Miss Fultz, Mr. Lockhart, Mr. Rubinstein, Mr. Stern.

512. PLANT METABOLISM.
The basic metabolic processes in plants including carbohydrate metabolism, glycolysis, respiration, photosynthesis, lipid metabolism and protein synthesis. Biological as well as chemical approach. Emphasis on free energy changes and the enzymatic reactions and pathways involved.
Credit, 4. Mr. Jennings, Mr. Marsh, Mr. Stern.

515. PLANT GROWTH.
Description and analysis of the physiology, kinetics, and energetics of plant growth; the methods used to study growth. Cells, tissues, whole plants, and assemblages of plants.
Prerequisites, Botany 511 and College Physics.
Mr. Lockhart.

519. ECOLOGICAL PLANT PHYSIOLOGY.
Physiology of plants in relation to the classes of problems they face and the various strategies evolved for survival and growth.
Prerequisites, Botany 211 and one semester of differential calculus. Mr. Lockhart.

521. PLANT ECOLOGY.
Interrelationships between plants and their environment; the structure and development of plant communities.
Mr. Barrett, Mr. Godfrey, Mr. Mulcahy.

522. AUTECOLOGY.
Plant behavior in relation to the physical and biological environment. Emphasis on the ecology of individual plants.
Prerequisites, Botany 511 and 521. Mr. Godfrey.

526. PLANT GEOGRAPHY.
Principles governing the development and natural distribution of plants and plant communities. Special consideration of the vegetation of North America.
Prerequisite, Botany 521. Mr. Godfrey, Mr. Livingston.

528. PRINCIPLES OF EVOLUTION.
Ecological phenomena through the application of genetic concepts. The adaptation of individuals, populations, and communities as functional units.
Prerequisite, introductory botany or zoology.
Mr. Mulcahy.

531. GENERAL MYCOLOGY.
Survey of the various fungi, their life history and distribution, their significance in disease, their utilization by man.
Mr. Bigelow.

541. PHYCOLOGY.
The phylogeny, taxonomy, morphology, and ecology of the major groups of marine and fresh water algae. Includes field work in both marine and fresh water environments.
Mr. Wilce.

551. THE ARCHEGONIATES.
The morphology, evolution, and systematics of primitive land plants. Emphasis on evolution and systematics of Bryophyta.
Mr. Schuster.

555. EXPERIMENTAL PTERIDOLOGY.
An integrated view of physiological and genetical parameters of the pteridophyte life cycle. The research potential of these organisms.
Prerequisites, Botany 240 or Zool 240, and Botany 211.
Mr. Klekowski.

570. CYTOGENETICS.
The correlation of genetic data with chromosome behavior, including an analysis of the mechanism of crossing over. Evolutionary considerations of changes in chromosome structure and number.
Prerequisites, Zool 540 and a cytology course preferred.
Mr. Swanson.

580. ORIGIN, EVOLUTION, AND DISTRIBUTION OF FLOWERING PLANTS.
Survey of evolutionary history of primitive flowering plants and the significance of their geographic distribution.
Prerequisite, Botany 125 or equivalent. Recommended, Botany 581, 591. *Credit, 4.* Mr. Smith.

581. INTRODUCTORY ANGIOSPERM SYSTEMATICS.
The evolution and systematics of flowering plants, emphasizing families and their relationships.
Credit, 4. Mr. Walker.

591. PLANT ANATOMY AND HISTOLOGICAL METHODS.
Origin and structure of vegetative and reproductive organs of seed plants coordinated with exercises in preparation of stained slides for microscopic studies.
Credit, 4. Mr. Bierhorst.

601. MORPHOGENESIS.
Lectures and laboratory exercises demonstrating the development of plant form utilizing examples from throughout the plant kingdom. Mr. Davis.

603. PLANT MORPHOLOGY.
The life cycles of various non-vascular plant taxa, the dynamics of their evolution and the interpretation of various morphological structures.
Prerequisite, Botany 100 or permission of instructor.
Credit, 4. Mrs. Bigelow, Mr. Schuster, Mr. Wilce.

604. PLANT MORPHOLOGY.
As 603, but vascular plant taxa.
Credit, 4. Mr. Bierhorst, Mr. Schuster.

611. CYTOLOGY.
Development, structure, and function of cell organelles; cell reproduction and differentiation, with reference to the behavior and role of the nucleus.
Mr. Stein, Mr. Swanson, Mr. Webster.

COURSES NOT FOR MAJOR CREDIT

635. AQUATIC VASCULAR PLANTS.
Systematics, ecology, and fundamental importance of aquatic plants. For majors in Wildlife.
Two 3-hour class-laboratory periods.
Prerequisites, Botany 100 and 126. Mr. Ahles.

Business Administration

GRADUATE FACULTY

Wendell R. Smith, *Professor and Dean of the School of Business Administration*, B.S., State University of Iowa, 1932; M.A., 1935; Ph.D., 1941.

John T. Conlon, *Professor of Management and Associate Dean*, B.B.A., Massachusetts, 1949; M.A., Connecticut, 1951; Ph.D., Michigan State, 1960.

Wynn A. Abranovic, *Assistant Professor of General Business and Finance*, B.E.E., Rensselaer Polytechnic Institute, 1963; M.S., 1965; Ph.D., 1969.

John W. Anderson, *Professor of Accounting*, B.S., Indiana University, 1949; M.B.A., 1953; C.P.A., Maine, 1952.

Stephen Arons, *Assistant Professor of General Business and Finance*, B.A., University of Pennsylvania, 1965; J.D., Harvard, 1969.

Morton Backer, *Professor of Accounting*, B.B.A., Boston University, 1939; M.Lt., University of Pittsburgh, 1950; Ph.D., 1958; C.P.A., New York and West Virginia, 1941.

Joseph L. Balintfy, *Professor of General Business and Finance*, Dipl.Eng., University of Technical Sciences, 1947; Dipl.Ec., 1948; D.Eng., The Johns Hopkins University, 1962.

Mary K. Barber, *Assistant Professor of Marketing*, B.S., Massachusetts State College, 1944; M.A., New York University, 1948; Ph.D., 1969.

Alexander Barges, *Professor of General Business and Finance*, B.S., University of California, 1956; M.B.A., Northwestern University, 1956; Ph.D., 1962.

Kathryn M. Bartol, *Assistant Professor of Management*, B.A., Marygrove College, 1963; M.A., University of Michigan, 1966; Ph.D., Michigan State, 1972.

Meyer W. Belovicz, *Associate Professor of General Business and Finance*, B.S., Illinois Institute of Technology, 1961; M.B.A., Northwestern University, 1963; Ph.D., 1967.

John J. Bonsignore, *Associate Professor of General Business and Finance*, B.A., Trinity College, 1957; J.D., University of Chicago Law School, 1969.

Tim Bornstein, *Associate Professor of Management*, B.A., University of Louisville, 1954; J.D., Harvard University, 1957.

Victor P. Buell, *Associate Professor of Marketing*, B.A., Pennsylvania State University, 1938.

John G. Burch, Jr., *Assistant Professor of Accounting*, B.S., Louisiana Polytechnic Institute, 1965; M.A., University of Alabama, 1967; Ph.D., 1968.

D. Anthony Butterfield, *Assistant Professor of Management*, B.S., Yale, 1961; M.A., Michigan, 1963; Ph.D., 1968.

Arthur E. Carlisle, *Associate Professor of Management*, B.A., McGill, 1948; M.B.A., Michigan, 1963; Ph.D., 1966.

Gordon K. C. Chen, *Associate Professor of Management*, B.S., Great China University, 1945; M.A., University of Iowa, 1950; Ph.D., 1956.

Pao L. Cheng, *Professor of General Business and Finance*, B.S., National Chiotung China, 1944; M.A., Missouri, 1949; Ph.D., Wisconsin, 1956.

C. Marc Choate, *Assistant Professor of Finance*, B.A., University of Washington, 1964; M.B.A., 1967; D.B.A., 1970.

Sidney J. Claunch, *Associate Professor of Management*, B.A., Ohio, 1949; M.B.A., Wisconsin, 1951; Ph.D., 1958.

Robert W. Cooper, *Assistant Professor of General Business and Finance*, B.S., University of Connecticut, 1965; M.A., University of Pennsylvania, 1967; Ph.D., 1972.

A. Wayne Corcoran, *Professor*. B.S.. Cornell. 1954: M.S., University of Rochester, 1960; C.P.A., State University of New York, 1960; Ph.D., 1966.

M. King Deets, *Associate Professor of General Business and Finance*, B.A., University of Iowa, 1961; M.A., 1963; Ph.D., 1968.

Carl Dennler, Jr., *Professor of Accounting and Acting Associate Dean*, B.S., University of Missouri, 1948; M.A., 1950; Ph.D., Wisconsin, 1962.

Arthur Elkins, *Associate Professor of Management*, B.B.A., Massachusetts, 1957; M.S., Columbia, 1958; D.B.A., Indiana, 1967.

Richard D. Evans, *Assistant Professor of General Business and Finance*, B.S., University of Missouri, 1966; M.P.A., Syracuse University, 1967; Ph.D., 1972.

Frederick E. Finch, *Professor of Management*, B.S., Kent State University, 1961; M.B.A., 1963; D.B.A., University of Washington, 1966.

Donald G. Frederick, *Associate Professor of Marketing*, B.S., Indiana University, 1957; M.B.A., 1958; D.B.A., Washington University, 1964.

Martin L. Gosman, *Assistant Professor of Accounting*, B.B.A., Wisconsin, 1965; M.B.A., 1966; Ph.D., 1971; C.P.A., Wisconsin, 1972.

Joseph P. Guiltinan, *Assistant Professor of Marketing*, B.B.A., University of Notre Dame, 1966; M.B.A., Indiana University, 1968; D.B.A., 1969.

Van Court Hare, Jr., *Professor of Management*, B.S., Massachusetts Institute of Technology, 1950; M.A., Columbia, 1953; Ph.D., 1961.

H. Richard Hartzler, *Professor and Chairman of the Department of General Business and Finance*, B.A., Indiana University, 1950; J.D., 1955.

Lawrence A. Johnson, *Associate Professor and Assistant Dean*, B.S.B.A., Boston University, 1955; M.B.A., 1958; Ph.D., Stanford University, 1970.

Eugene E. Kaczka, *Professor of General Business and Finance*, B.S., Rensselaer Polytechnic Institute, 1960; M.S., 1961; Ph.D., 1966.

Anthony T. Krzystofik, *Associate Professor and Chairman of the Department of Accounting*, B.S., American International College, 1952; M.A., University of Connecticut, 1961; C.P.A., Massachusetts, 1956.

Prem Kumar, *Assistant Professor of Finance*, B.S., University of Delhi, India, 1965; M.S., University of Wisconsin, 1967; Ph.D., 1970.

Robert W. Lentilhon, *Professor of Accounting*, B.S., University of Rhode Island, 1949; M.B.A., Boston University, 1963; C.P.A., Massachusetts.

Bertil Liander, *Associate Professor of Marketing*, Undergraduate, Schartau College, 1948; M.B.A., Stockholm School of Economics, 1954; Ph.D., University of Massachusetts, 1972.

Joseph A. Litterer, *Professor of Management*, B.S., Drexel Institute of Technology, 1950; M.B.A., 1955; Ph.D., University of Illinois, 1959.

James B. Ludtke, *Professor of General Business and Finance*, B.A., State University of Iowa, 1947; M.A., 1948; Ph.D., 1951.

Robert E. McGarrah, *Professor of Management*, B.S., Lafayette College, 1943; M.S., Princeton University, 1948; Ph.D., Cornell University, 1951.

Walter McKibben, *Assistant Professor*, A.B., University of California, 1949; Ph.D., 1971.

Stephen R. Michael, *Associate Professor of Management*, B.A., Rutgers University, 1948; M.A., Harvard University, 1949; Ph.D., Columbia University, 1967.

Kent B. Monroe, *Associate Professor of Marketing*, B.A., Kalamazoo College, 1960; M.B.A., Indiana University, 1961; D.B.A., University of Illinois, 1968.

Craig L. Moore, *Assistant Professor of General Business and Finance*, B.S., West Virginia University, 1967; M.A., Syracuse University, 1972; Ph.D., 1972.

Ula K. Motekat, *Assistant Professor of Accounting*, B.S., University of Denver, 1964; M.B.A., 1966; D.B.A., University of Colorado, 1972.

Grant M. Osborn, *Professor of General Business and Finance*, B.S., Brigham Young University, 1948; M.B.A., Stanford University, 1950; Ph.D., University of Pennsylvania, 1955.

Gordon W. Paul, *Professor of Marketing*, B.S., University of Tulsa, 1955; M.B.A., University of Texas, 1962; Ph.D., Michigan State University, 1966.

Robert H. Plattner, *Associate Professor of General Business and Finance*, B.S., University of Missouri, 1950; M.B.A., Ohio State University, 1962; Ph.D., University of Michigan, 1968.

Robert L. Rivers, *Professor of General Business and Finance*, B.A., Clark University, 1943; M.S., Illinois, 1947; Ph.D., 1957.

Kenen Sahin, *Associate Professor of Management*, B.S., Massachusetts Institute of Technology, 1963; Ph.D., 1969.

Alan G. Sawyer, *Assistant Professor of Marketing*, B.S., University of Maine, 1965; M.B.A., Northeastern University, 1967; Ph.D., Stanford University, 1970.

Charles D. Schewe, *Assistant Professor of Marketing*, B.A., University of Michigan, 1965; M.B.A., 1965; Ph.D., Northwestern University, 1971.

George Schwartz, *Associate Professor of Marketing*, B.A., Brooklyn College, 1943; Ph.D., Pennsylvania, 1960.

George B. Simmons, *Professor and Chairman of the Department of Management*, B.A., University of Louisville, 1953; M.B.A., Indiana University, 1957; D.B.A., 1961.

Richard H. Simpson, *Associate Professor of Accounting*, B.B.A., University of Massachusetts, 1958; M.B.A., University of North Carolina, 1961; Ph.D., 1967; C.P.A., North Carolina, 1964.

Frank A. Singer, *Professor of Accounting*, B.S., Indiana, 1948; M.B.A., 1949; D.B.A., 1955.

Donald E. Stone, *Associate Professor of Accounting*, B.S., Lehigh University, 1961; M.B.A., University of Wisconsin, 1952; Ph.D., 1965; C.P.A., Wisconsin, 1965.

William T. Tucker, *Professor*, A.B., DePauw University, 1941; M.S., University of Illinois, 1950; Ph.D., 1955.

William B. Whiston, *Associate Professor of General Business and Finance and Director of the Center for Business and Economic Research*, B.A., Amherst College, 1943; B.D., Yale University, 1947; B.S., Massachusetts Institute of Technology, 1949; M.S., University of Cincinnati, 1964; M.A., Harvard University, 1967; Ph.D., 1972.

James L. Wiek, *Assistant Professor of Marketing*, B.B.A., University of Washington, 1963; M.B.A., 1964; Ph.D., Michigan State University, 1969.

Jack S. Wolf, *Professor and Chairman of the Department of Marketing*, B.A., Coe College, 1949; M.B.A., Wharton, 1950; Ph.D., State University of Iowa, 1957.

Parker M. Worthing, *Associate Professor of Marketing,* B.S., University of Maine, 1962; M.B.A., Michigan State University, 1964; Ph.D., 1968.

Max S. Wortman, Jr., *Professor of Management,* B.S., Iowa, 1956; Ph.D., Minnesota, 1962.

Stanley Young, *Professor of Management,* B.A., Washington University, 1949; M.B.A., Pennsylvania, 1951; Ph.D., 1956.

Gerald Zeisel, *Assistant Professor of Accounting,* B.B.A., City College of New York, 1959; M.B.A., City University of New York, 1967; Ph.D., Ohio State University, 1972; C.P.A., New York, 1963.

Andris Zoltners, *Assistant Professor,* B.S., University of Miami, 1967; M.S., Purdue University, 1969; Ph.D., Carnegie-Mellon University, 1973.

The School of Business Administration is a fully accredited member of the American Association of Collegiate Schools of Business (AACSB). The Ph.D. and two different master's degree programs are offered.

The program of graduate courses in business administration is designed to prepare students for positions of responsibility in business, in organizations that serve business, in government, and in related fields of teaching.

THE DOCTOR OF PHILOSOPHY DEGREE

The graduate program leading to the degree of Doctor of Philosophy in Business Administration is designed primarily for students interested in a career in college teaching, service, and research. A minimum of three years is normal for the degree. Application requirements are described below.

A minimum ATGSB score of 550 is required, but a higher score may be necessary depending upon the applicant's previous record. A summary of the requirements for the degree follows:

1. At least two years of formal resident course study involving not less than 48 hours nor more than 72 credit-hours are required.

2. Prerequisites or foundation course work may be required depending upon the student's previous preparation at time of admission. Evaluation of this preparation will be based upon the requirements of a minimum of: 12 credits in business administration; six credits in micro- and macroeconomic theory beyond a six-credit introductory economics requirement; nine credits in mathematics, including finite mathematics, differential and integral calculus; six credits of statistics; and six credits in the behavioral sciences. Individual requirements shall be determined by the Graduate Program Director and the student's adviser.

3. Core requirements for the program include proficiency in the behavioral sciences, research methodology and statistics, and micro- and macroeconomic theory. In addition, until the dissertation proposal has been accepted, the student is required to participate in an ongoing research seminar in business administration.

4. When the student feels that he or she is prepared, but not later than the completion of 24 doctoral level credits, the student is required to take a written qualifying examination measuring ability in the core areas. A common examination is administered three times a year by the graduate faculty. Eligibility for further study is considered at this point.

5. The student selects a field of concentration from among the following alternatives:

a. Functional Fields.
   i. Accounting.
   ii. Finance.
   iii. Industrial and Personnel Relations.
   iv. Marketing.
   v. Operations Management.
b. General Fields.
   i. Business and its Environment.
   ii. Information and Control Systems.
   iii. Organizational and Administrative Behavior.
   iv. Quantitative Management Science.

In conjunction with his adviser and the Graduate Program Director, a course plan is developed to achieve the concentration desired. In addition to the selection of a major area of concentration from the alternatives listed above, the student must also designate a minor area consisting of a minimum of nine semester hours. The minor may be selected from graduate courses offered anywhere in the University.

6. Upon completion of at least 30 credits of graduate study beyond the Core requirements, the student shall take a written and oral Preliminary Comprehensive Examination, administered by the Doctoral Adviser and Doctoral Committee.

7. In conjunction with his adviser and committee, the student will develop a doctoral dissertation.

8. A Final Oral Examination, upon completion of the dissertation, is administered by the adviser and the Doctoral Committee.

9. Teaching, or the equivalent experiences, is required of all candidates for the Ph.D. in Business Administration.

Fellowships, assistantships, and other financial aid from the School of Business Administration are not available to foreign students during their first year on this campus. An application from a foreign student must be accompanied by a statement of financial sufficiency.

MASTER'S DEGREE PROGRAMS

In accordance with the accreditation guidelines of the AACSB, the foundation for master's study within the School consists of basic course work in economics, mathematics, statistics, computer methods, organizational behavior, accounting, finance, marketing, and the social and legal environment. Any baccalaureate degree holder may apply for admission to the master's degree program of the School. Applicants holding the baccalaureate degree in business typically satisfy most of the foundation requirements. Admittees having deficiencies in any of these areas are required to complete appropriate Foundation Courses prescribed from among the following: BA400, 406, 411, 422, 440, 447, 451, 456, and 457.

All master's degree candidates are required to demonstrate proficiency in written English. To this end one faculty member devotes his time. Noncredit course work and writing counseling is available to the student. The writing requirement is aligned with the student's regular course work writing requirements.

Students seeking entry into any graduate course may be required to demonstrate eligibility for such advanced study through a qualifying examination or by other means. Graduate and 400-level courses are open only to students meeting the usual admission requirements for graduate study.

A comprehensive examination is required of all students enrolled in master's degree programs of the School. This may be oral or written, depending upon the program involved.

Permission to present a thesis may be granted to qualified candidates enrolled in any of the masters programs. The thesis proposal must be approved by the end of the first semester of full-time graduate study. Up to nine credit hours in lieu of course credit may be allowed for a thesis. An oral comprehensive examination is required upon completion of the thesis.

Description of the requirements for the various master's degree program of the School are set forth below.

The Master of Business Administration Degree

The M.B.A. Program is oriented toward the development of general management knowledge and skills. The requirements for this degree follow:

1. Over and above the Foundation requirements noted above, candidates for the M.B.A. degree shall satisfactorily complete 30 semester hours of approved graduate study, 24 of which must be in courses designated as exclusively for graduate students.

2. All candidates shall complete the following courses: BA 711, 756, 722, 751, 706, 742, and 752.

3. At least three electives from among the 500-, 600-, and 700-level offerings of the School are required. Other electives may be chosen with the consent of the student's adviser.

The Master of Science in Business Administration Degree

This is a specialized degree program having several fields of concentration. The degree requirements in the various concentrations follow:

1. **The M.S.B.A./Accounting Program**

This program prepares students for careers in public accounting, industry, government, and teaching. It is expected that students completing the program will possess the following attributes:

a. Ability to intelligently evaluate contemporary research.
   1. Familiarity with sources.
   2. Familiarity with research tools.
b. Facility for correct written and oral expression.
c. Professional level of competence in accounting theory.
   1. Appreciation of historical development of accounting thought to serve as a foundation for understanding current and developing accounting theory and practice.
   2. An intimate appreciation of income theory including economic theories of income and alternative accounting valuation models.
   3. An intimate appreciation of the relationship between accounting measurements and management decision models and processes.
d. An awareness of current accounting practices and the forces that act as influences on them.

In addition to the foundation requirements described above, students not holding an undergraduate degree with a major in accounting shall take courses as prescribed by the School to provide a foundation in accounting appropriate to the student's career interests.

Candidates shall satisfactorily complete 30 semester hours of approved graduate study, 18 of which must be in courses designated as exclusively for graduate students.

The following courses are required of all candidates: BA 703, 704, 706, 712, one course in Organizational Behavior (BA 751 or 807(I), or equivalent), one course in Quantitative Methods (BA 756, 757, 805 (I), or equivalent), and BA 752.

Elective courses are chosen with the consent of the student's adviser. These may be selected so as to lead to specialization in various fields such as the following: managerial accounting, public accounting, information systems, accounting research and teaching, and institutional accounting. With the consent of the student's adviser, special programs can be arranged involving the election of courses in other departments and schools on campus.

Highly qualfied non-business majors may be granted privileges of an accelerated program, at the discretion of the School.

The CPA laws in Massachusetts and some other states, permit the holder of the master's degree to substitute the degree for part of the Public Accounting experience required for the certificate.

2. **The M.S.B.A./Industrial and Personnel Relations Program**

This program prepares students for careers in private and public organizations in personnel management, industrial relations, labor relations, and manpower affairs.

The industrial and personnel relations concentration requires a minimum of 30 semester hours of graduate study. Prerequisites for the program are those of all master's degree programs in this School. Students must complete these prerequisites before taking related 700-level courses and before completing their master's programs. Substitutions for prerequisite requirements may be made with the consent of the adviser. No thesis is required.

The following courses are required: BA 761, 762, 763, one course in Quantitative Methods (BA 756, 757, 805(I), or equivalent), one course in Behavioral Science (BA 751, 807(I), or equivalent), and BA 752. Three industrial relations electives (nine credits) and two electives in management, economics, sociology, psychology, government, or related fields are chosen with the consent of the student's adviser.

3. **The M.S.B.A./Management Science Program**

This program is specifically designed for individuals who are interested in the application of quantitative techniques to the problems of business and administration. It is anticipated that persons with undergraduate training in engineering, mathematics, science, business, or economics will find this program appealing.

The number of credits necessary to complete the program is dependent upon previous preparation. Depending on the number of prerequisites already fulfilled, the program can involve between 30 and

51 credit hours. Thus, while it is possible to complete the program in a year, as a general rule one should plan to spend three or four semesters.

A key feature of this program is its flexibility in meeting the professional goals of the individual student. The program allows between six and eight elective courses. These electives allow the individual to develop considerable strength in specific disciplines or problem areas.

The following are required courses in the Management Science Program: BA 758, 759, 770, one course in Organizational Behavior (BA 751, 765 or 807(I), or equivalent), and BA 752.

In addition, nine credit hours of electives in Quantitative Analysis and other electives in the area of specialization are required.

An *Operations Research/Management Science Program* has been approved. It will be administered jointly by the School of Business Administration and the department of Industrial Engineering. The program will not grant degrees (each School will grant its own degrees). It is a formal recognition of long standing cooperation in an area which is of vital interest to both Schools. We expect this formal recognition of cooperation to aid us in stimulating interest in operations research management science and to strengthen the offerings in both Schools.

4. **The M.S.B.A./Marketing Program**

The program prepares students for careers in marketing administration, sales management, product management, advertising management, marketing research, or wholesale/retail enterprise.

The Marketing concentration requires a minimum of 30 semester hours of graduate study. Prerequisites for this program are those of all master's degree programs in the School of Business Administration. *A thesis is required.*

The following courses are also required: BA 722, 723, 724, 725, one course in Quantitative Methods (BA 756, 757, or 805), one course in Behavioral Science (BA 751, or 807), and BA 752. In addition, a six-credit master's thesis is required.

5. **The M.S.B.A./Urban and Regional Management Program**

The program prepares its graduates for careers in city and state government, community relations departments of business firms, business firms concerned with real estate and/or urban problems, research consulting firms, foundations, non-profit service organizations, and educational institutions.

This program of graduate study is designed to be flexible in order to meet the needs of students with different interests and abilities. A core of quantitative methods, behavioral science and management seminars forms the first semester. Thereafter, enough electives are available so that the student may develop skills and understanding in the field of his choice. Specialization may be developed in the following areas:

a. Urban Economic Planning.
b. Real Estate and Housing.
c. Research and Analysis.
d. Transportation Planning & Policies.
e. Other areas designed in cooperation with the program coordinator.

Sixteen of the *thirty-six* hours required for the degree must be in courses designed exclusively for graduate students. All candidates for the degree must:

a. Complete an independent work-study project approved by the program coordinator *OR*
b. Present a thesis (six to nine credit hours allowed).

The requirements of the program are: BA 572, 782, 799, one course in Quantitative Methods (BA 756 or 757), one course in Behavioral Science (BA 751 or 807), and BA 752.

In addition to the above 15 credit hours of required courses, the above-mentioned work-study project (or thesis) is required along with enough specialized electives (18 to 24 credits) to complete a total of 36 credit hours.

6. **The M.S.B.A./Finance**

The M.S.B.A. Finance Program is designed to prepare students for professional careers in business through breadth and specialization in the field of finance. Stress is on financial principles and techniques with applications in financial management, investments, and insurance.

A minimum of 30 semester hours of graduate study are required. Prerequisites for this program are those of all Master's Degree Programs in the School of Business Administration. Thesis writing is encouraged, but is not absolutely essential.

The requirements of the program are: BA 706, 708, 709, one course in Quantitative Methods (BA 756, or equivalent), one course in Behavioral Science (BA 751, 807(I), or equivalent), and BA 752.

In addition to the above 18 credit hours of required courses, nine credit hours in Corporate Financial Management, Financial Institutions, Macroeconomic Policy, and International Finance are required along with a thesis or other electives.

GENERAL

The M.B.A. and M.S.B.A./Management Science degree programs are also offered on an evening basis in Pittsfield, Mass.

Questions concerning any of the graduate degree programs of the School should be addressed to Dean John T. Conlon, Graduate Program Director, School of Business Administration, University of Massachusetts, Amherst, Massachusetts 01002.

Application

Application for Graduate Study should be made directly through the Dean of the Graduate School, as described elsewhere in this Bulletin. A complete application consists of (a) the application form, (b) two references, (c) two sets of official transcripts of all college-level work, and (d) an official score report on the Admission Test for Graduate Study in Business (ATGSB). The Graduate Record Examination is not acceptable for admission. Information on the ATGSB may be obtained from the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540. Application deadlines are found elsewhere in this Bulletin. Action is taken immediately upon receipt by the Graduate School of a complete application.

Standards for admission are consistent with those described earlier in this Bulletin. A minimum ATGSB score of 450 is required, but a higher score may be necessary depending on the applicant's grade-point-average. Foreign students are not exempt from this requirement. (The Graduate Record Examination is not an acceptable substitute for the ATGSB). The present master's student average ATGSB score at this school is 524. This examination may be taken

more than once. Recommended are use of one of the commercially available study guides, and taking the ATGSB as early as possible in order to allow time for retaking the exam without delaying the admissions process. For applicants desiring entry in the Summer Session or fall semester, the ATGSB should be taken during the preceding November, or (at the latest) February. Applications for the ATGSB must be at the Educational Testing Service three weeks before the scheduled examination date.

Fellowships, assistantships, and other financial aid from the School of Business Administration normally are not available to foreign students during their first year of study. An application from a foreign student must be accompanied by a statement of financial sufficiency.

Program ABLE (Accelerated Business Leadership Education) is a 24-month program designed to identify and assist members of minority groups who have the potential to achieve the Master of Business Administration degree. Although there is an apparent need for top level minority managers and administrators to enter the mainstream of American business, our program is more concerned with the development of managers and administrators to service the growing needs of minority businessmen.

Candidates selected for this program must have a bachelor's degree or the equivalent from any college or university of recognized standing. Applicants *must* take the ATGSB (Admission Test for Graduate School of Business) in August or November. Applicants will be judged primarily on the basis of past academic achievement, ATGSB scores, and recommendations. Classes start June 1, therefore the deadline for all application materials (including ATGSB scores) is February 1. Decisions will be made by April 15.

Each person who qualifies for admission under Program ABLE is eligible for a fellowship to pursue the master's degree. The awarding of fellowships is based on need.

Students once selected are required to attend an intensive 12-week summer program on the campus of one of the ABLE consortium member schools. This summer program is designed to concentrate on areas where most students experience difficulties.

Following the summer session, the students return to enter the regular master's program at the School to which they have been admitted.

Further information on Program ABLE may be obtained from Dr. Lawrence Johnson, Assistant Dean, School of Business Administration.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

DOCTORAL COURSES IN BUSINESS ADMINISTRATION (B.A.)

(Open to doctoral students only, except by special permission of the Graduate Program Director and the instructor.)

801. PHILOSOPHICAL FOUNDATIONS OF BUSINESS ADMINISTRATION.
Conceptual foundations of business administration in context of social and economic philosophy. Topics include corporate objectives and goal models, theories of organization, and social responsibilities of corporate management.
Mr. O'Donnell.

802. BUSINESS ORGANIZATION AND ADMINISTRATIVE THEORY.
Investigation and critique of contemporary theories of organization, administration, and decision, with a view of their scientific support and practicality for increasing rationality, prediction, and control in business administration.
Mr. Finch, Mr. Litterer.

803. MANAGEMENT SYSTEMS: THEORY, ANALYSIS, AND DESIGN.
Review of systems with stress on normative behavioral systems. Designing, implementing, operating, maintaining, and controlling such systems. The organization viewed as a total system. The student designs a behavioral system as a class project. Mr. Young.

804. DECISION MODELS IN BUSINESS ADMINISTRATION.
Application of probability theory and selected topics in maehematics to stochastic and deterministic managerial decision models. Mr. Kaczka, Mr. Belovicz.

805. I, II. STATISTICAL ANALYSIS FOR BUSINESS RESEARCH.
Analysis of statistical theory and techniques relevant to business research and decision making. First semester: probability and distribution theory; second semester: decision theory and multivariate methods. *Credit, 3-6.* Mr. Frederick.

806. SEMINAR IN QUANTITATIVE MANAGEMENT SCIENCE.
A presentation of journal reports on business topics utilizing a quantitative approach. *Credit, 3-6.* Mr. Belovicz.

807. I, II. SEMINAR IN BEHAVIORAL SCIENCE.
Selection of relevant findings in the behavioral and social sciences regarding human organizational behavior and conversion into forms suitable for transmission and application in business administration.
Credit, 3-6. Mr. Finch, Mr. Litterer.

808. ADVANCED TOPICS IN BUSINESS ADMINISTRATION.
An advanced topic section is available in each general or functional field of study, to facilitate investigation of current literature and research effort in these areas.
Credit, 1-6.

809. INTERNATIONAL ASPECTS OF BUSINESS ADMINISTRATION.
The basis of international division of labor, the history of international business policy, and the cultural differences that affect the management of international business enterprises.

810. TUTORIAL STUDY IN BUSINESS ADMINISTRATION.
Individualized secondary or applied research in special areas of guided doctoral-level investigation. Permission of instructor required. *Credit, 3-5.*

811. BUSINESS HISTORY.
American business institutions as they have evolved through time. The impact of social and economic processes on their development and operations.

812. JURISPRUDENCE AND BUSINESS.
Social-scientific and philosophical theories of law; the systems, functions, processes and limits of law, applications to the business organization in its external and internal affairs.

821, 822. ADVANCED TOPICS IN MANAGEMENT SCIENCE I, II.
Selected topics of current significance in mathematical, statistical, computer, and behavioral approaches to management and administration. Either semester may be elected independently. *Credit, 3-6.* Mr. Balintfy.

823. MATHEMATICAL PROGRAMMING.
Application of linear, quadratic, integer, and dynamic programming models and algorithms in pricing and resource allocation by firms; sensitivity analysis and parametric programming. Mr. Balintfy.

831. LONG RANGE BUSINESS PLANNING.
Advanced and intensive study of long-range planning practices in business firms. Emphasis on the planning process in relation to other managerial processes on the most recent

methods of reducing risk and uncertainty in long-term planning strategies. Mr. Michael.

832. DYNAMICS OF CORPORATE ORGANIZATION.
Changes in corporate organization as adaptive responses to challenges and constraints imposed upon the corporation by variations in endogenous and exogenous factors.
Mr. Michael.

841. MANAGEMENT INFORMATION THEORY.
Theories and applications of management information system in the context of total servomechanism system concept. Topics include the generation, organization, transformation, dissemination, codification, discrimination, and economics of information. Mr. Hare.

842. MANAGEMENT CONTROL SYSTEMS.
The function of total systems theory which provides direction in attaining planned objectives of the system. Various theories of control and measurement in relation to organization resources and information requirements. Mr. Hare.

851. THEORY AND SCIENCE IN MARKETING.
The state of marketing knowledge; the content and validity of marketing thought, theories, and other substantive and methodological contributions to the development of marketing science. Mr. Frederick.

852. SOCIAL SCIENCE ISSUES IN MARKETING.
Materials from the various social science disciplines that have been used to expand understanding of marketing; discernment of areas of ignorance about marketing involving social-science-related marketing phenomena.

861. ADVANCED ACCOUNTING THEORY.
The origin, development, and current status of accounting theory and its relationship to other disciplines and the needs of report users. Independent research required.
Mr. Backer.

862. MANAGEMENT INFORMATION PROBLEMS.
Methods of research for establishing: 1) The behavioral impact of incremental differences in information, 2) The determinants of useful information for problem solving and their normative implications. Existing literature examined.
Mr. Backer.

871. MICRO THEORY OF FINANCE.
Optimum financial policies and decisions of nonfinancial firms. Theory of competition and optimum asset management of financial firms.
Prerequisite, 12 hours in finance and economics.
Mr. Kumar.

872. FINANCIAL INTERMEDIARIES AND MARKETS.
Financial intermediaries and financial markets and the development of a theory of financial intermediation as it relates to growth, employment, and price levels.
Mr. Choate.

881. PRODUCTION MANAGEMENT ANALYSIS.
Application of mathematical and statistical methods and models for production management decisions and problem analyses and for managerial planning and control.
Mr. McGarrah.

882. PRODUCTION MANAGEMENT POLICY.
Formulation and administration and production and operations management policies with reference to developing an effective total business strategy. Mr. McGarrah.

891. MANPOWER PLANNING.
Investigation and comparative evaluation of systems of manpower planning both at the corporate and national levels, including systematic manpower inventory appraisal.
Mr. Wortman.

892. LEGAL ASPECTS OF INDUSTRIAL AND LABOR RELATIONS.
The historical evolution of national labor policy from its English origin in 1349 through modern experiences. Common law, statutory, and constitutional developments of labor policy examined against a historical, political, and economic background.

900. DOCTORAL DISSERTATION. *Credit, 15.*

MASTER'S LEVEL COURSES IN BUSINESS ADMINISTRATION (BA)

(Open to graduate students only, for major or elective credit. Students seeking entry may be required to demonstrate eligibility for advanced study through a qualifying examination or by other means.)

700. PROBLEMS IN BUSINESS ADMINISTRATION.
Independent study and research on selected problems in business administration.
Permission of instructor and the dean required.
Credit, 3-6 each semester.

702. ACCOUNTING SYSTEMS.
Accounting systems and their relationship to other business information systems. Mr. Burch, Mr. Krzystofik.

703. ACCOUNTING THEORY.
Agreed and controversial criteria for collecting and reporting financial information. Examination of the professional literature. Mr. Backer, Mr. Simpson.

704. CONTEMPORARY ACCOUNTING ISSUES.
Investigation and analysis of selected contemporary issues in accounting with presentation of individual findings through discussion and reports. Mr. Backer, Mr. Gosman.

705. SEMINAR IN ACCOUNTING.
Study and evaluation of current literature in accounting and related fields. Mr. Dennler, Mr. Stone.

706. FINANCIAL MANAGEMENT.
Internal financial problems of firms; capital budgeting, cost of capital, dividend policy, rate of return, and the financial aspects of growth. Readings and cases.
Mr. Barges, Mr. Ludtke.

707. GROWTH, MERGERS, AND ACQUISITIONS.
An analysis of the financial problems and implications of corporate growth. Mergers and acquisitions as instruments for achieving growth. Text and cases.
Prerequisite, BA 706 or equivalent. Mr. Barges.

709. INVESTMENTS.
Development of a general theory of investment management and its application to individual and institutional investors; computer portfolio management.
Mr. Cheng, Mr. Deets.

711. ACCOUNTING IN MANAGEMENT.
Production and use of accounting and other quantitative data for decision making related to planning and control.
Mr. Backer, Mr. Stone.

712. ADVANCED MANAGERIAL ACCOUNTING.
An advanced course in the use of accounting and other quantitative measurements for business planning, decision-making, and performance-evaluation.
Prerequisite, BA 711 or permission of instructor.
Mr. Zeisel.

722. MARKETING MANAGEMENT.
Marketing concepts of planning, organization, control, and decision-making from the viewpoint of the business executive. Stress on tools available for analysis and control of marketing activities.
Prerequisites, BA 406, 411, 422, 440, 456, and 457, or equivalents. Mr. Paul, Mr. Worthing.

723. MANAGEMENT SCIENCE IN MARKETING.
An analytical examination of the application of management-science techniques to marketing phenomena. Drawing upon the methodology of management science, the course analyzes the marketing problems facing a modern organization and examines the relationship of the behavioral and quantitative sciences to marketing.
Prerequisites, BA 722 and 756, or permission of instructor.

724. RESEARCH METHODS IN MARKETING.
Applicability and utilization of quantitative research techniques to marketing problems and processes.
Prerequisites, BA 722 and 756, or permission of instructor.
Mr. Frederick, Mr. Monroe.

725. PERSPECTIVES ON CONSUMER BEHAVIOR.
The social, psychological, and economic roles of the consumer in decision-making and market behavior. The external and internal determinants of buyer behavior.
Prerequisite, BA 422 or equivalent.

726. INTERNATIONAL MARKETING MANAGEMENT.
The impact of political, social, economic and cultural forces of divergent societies upon the managerial decision-making process in international marketing operations. Problems associated with the design of marketing strategy.
Prerequisite, BA 722 or equivalent. Mr. Liander.

730. SEMINAR IN MARKETING PROGRAMS AND ISSUES.
Selected areas of pronounced and current interest in the field of marketing. Topics include marketing and public policy, buyer-behavior research, and marketing communications.
Prerequisite, BA 722 or equivalent. Mr. Buell, Mr. Paul.

735. RISK MANAGEMENT.
Analysis of risks to which a business is exposed, determination of methods of providing protection, including loss-prevention techniques, risk retention, self-insurance, and use of commercial insurance. Case and field studies.
Mr. Osborn.

740. MANAGERIAL ECONOMICS.
Application of microeconomic analysis to typical business decisions such as: cost and profit analysis; demand and pricing, investment analysis, and capital budgeting; and the uses of economic forecasting in business decisions.
Prerequisite, one semester intermediate microeconomic theory.

742. OPERATIONS MANAGEMENT.
Analysis of production problems and solution techniques, applicable in industrial analysis.

746. BUSINESS LOGISTICS.
The total cost concept in the management of a business enterprise. Problems in inventory determination, location theory and practice, transportation and warehousing alternatives with the objective of maximizing customer service at least cost. A case and problem approach. Mr. Rivers.

751. ORGANIZATIONAL BEHAVIOR.
For students planning careers in a managerial position in some form of organization who want to develop professional skills dealing with organizational and interpersonal factors related to effective organizational performance. Emphasis on the impact of managerial actions on organizational behavior.
Prerequisite, BA 451 or equivalent.

752. BUSINESS POLICY.
Capstone course requiring application of knowledge, theories, and techniques derived from previous courses, using integrative cases and empirical observations to formulate improved policies and plans.

754. MANAGEMENT SCIENCE TECHNIQUES IN ENVIRONMENTAL PLANNING.
Introduction to mathematical and computer methods and techniques useful in the description and control of environmental systems. Large scale computer models used to demonstrate the technique in analysis of selected representative problems. Mr. Kaczka.

755. GAME THEORY.
Zero and non-zero games including theory, solution technique; experimental literature based upon game theory.
Prerequisites, BA 758 and BA 759.

756. QUANTITATIVE METHODS III.
Statistical methods employed in collection, analysis, and interpretation of data. Business applications of sampling, analysis of variance, experimental design, regression analysis, and forecasting models.

757. QUANTITATIVE METHODS IN BUSINESS ADMINISTRATION.
Application of probability theory (discrete and continuous), stochastic process, linear, quadratic and dynamic programming, waiting lines, sequencing, and computer simulation models to selected problems in management science.
Mr. Kaczka.

758. DETERMINISTIC MODELS IN MANAGEMENT SCIENCE.
Introduction to deterministic models and techniques relevant to business problems. Topics include Kuhn-Tucker theory, mathematical programming, difference equations and discrete and continuous maximum principles.

759. PROBABILISTIC MODELS OF MANAGEMENT SCIENCE.
Introduction to probabilistic models and statistical techniques relevant to the understanding of business problems.

760. WORK STANDARDS AND JOB CLASSIFICATION.
The principles and basic requirements in evaluating and classifying job positions, in establishing and applying production standards, and in work simplification.

761. SEMINAR IN PERSONNEL MANAGEMENT.
Current practices and major problems of personnel administration through use of the case method and role-playing techniques.
Prerequisite, personnel management course. Mr. Young.

762. MANAGEMENT OF INDUSTRIAL RELATIONS.
Organization and administration of the industrial relations function within business firms. Emphasis on alternative approaches to management rights and responsibilities in labor relations.
Prerequisite, Mgt 644. Mr. Conlon.

763. SEMINAR IN INDUSTRIAL RELATIONS.
Analysis of the major current problems encountered by business management in the negotiation and administration of labor relations agreements. A major research study is required.
Mr. Conlon.

765. BEHAVIORAL-SCIENCE MODELS IN BUSINESS.
Behavioral-science theories and models as they apply to the behavioral problems of enterprises.

770. MANAGEMENT SCIENCE AND MANAGERIAL PLANNING AND CONTROL SYSTEMS.
Application of the methodology of management science to problems of design testing and evaluation of facilities usage, manpower organization, and information procedures actually employed by business firms or government agencies to execute socio/economic purposes of society.
Mr. Hare, Mr. McGarrah.

780. RESEARCH METHODS.
Fundamental concepts of the purpose and practice of scientific research, including formulation of research design and objectives, collecting, processing, and analyzing socio-economic data.
Prerequisite, BA 457 or equivalent.

781. SYSTEMS THEORY & URBAN PROBLEMS.
The fundamentals of systems theory and its application to urban problems. Various social-economic urban problems, and how systems theory can be utilized in effective solutions.

782. CURRENT ISSUES IN URBAN & REGIONAL MANAGEMENT.
A capstone course; an inquiry into man's urban and regional problems. Application of theories and analytical tools to urban and environmental issues and problems. Recent thinking and work in the field.
Permission of instructor required.

783. PUBLIC BUDGETING AND SYSTEMATIC ANALYSIS.
The theory and techniques of budgeting and systematic analy-

sis and the political processes that relate these techniques to decision-making within governmental organizations.

788. LAND AND THE DEVELOPMENT OF COMMUNITIES.
Land and its use from ancient to modern times. Emphasis on the resource base and its importance as the intensity of land-use increases in the development of both rural communities and highly urbanized areas. Mr. Bacon.

799. SEMINAR IN BUSINESS ADMINISTRATION.
The relationship of business and management to the environment in which they operate.

800. MASTER'S THESIS. *Credit, 9.*

MASTER'S FOUNDATION COURSES

(Courses numbered in the 400 series are reserved exclusively for graduate students who are completing foundation deficiencies, and do not carry graduate degree credit. These courses are open only to students meeting master's degree admission requirements of the School.)

400. COMPUTER METHODS FOR BUSINESS.
Current and potential management usage of computers, basic computer programming, and computer-based information systems in management decision-making.

406. BUSINESS FINANCE.
Survey of principles and practices of financing business. Not open to students with undergraduate work in corporation finance.
Prerequisite, elementary accounting (through corporate accounts.)

411. INTRODUCTION TO ACCOUNTING.
Principles underlying preparation of financial statements and the development and application of accounting data for planning and control. Mr. Dennler.

422. MARKETING ENVIRONMENT.
Dimensions of change in social, economic, and political factors, related to efforts surrounding establishment and attainment of marketing policy and corporative objectives.
Mr. Buell, Mrs. Barber.

440. MANAGERIAL ECONOMICS.
Microeconomic analysis and application to business decisions such as: cost and profit analysis; demand and pricing; investment analysis and capital budgeting; and economic forecasting.

447. LAW AND GOVERNMENT.
An introduction to nature, functions, and limitations of state and non-state law-government systems, industrial jurisprudence, and politico-legal environment of business.

451. ADMINISTRATIVE THEORY.
Analysis of fundamental psychological and sociological phenomena that underlie group behavior; exploration of organization processes including leadership, communication, and change; analysis of classical decision and system theory.

456. QUANTITATIVE METHODS I.
Business applications of algebra including ratios, proportions, logarithms, partial fraction series, limits, convergence, combinations, and permutations. Basic concepts of differential and integral calculus, and matrix algebra.
Prerequisite, one semester of college algebra.

457. QUANTITATIVE METHODS II.
Laws and theories of probability and statistics, with applications in business and economics. Topics include probability models, sampling distribution, estimation, hypothesis testing, and decision theory.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For major or minor credit)

Accounting (ACCTG)

510. BUSINESS APPLICATIONS OF THE COMPUTER.
Intermediate and advanced computer programming applied to business problems. The COBOL language treated in depth, related to accounting problems. Also surveys the Computer application in areas such as simulation, PERT, and business gaming.
Prerequisites, Acctg 110 or COINS 121 or equivalent.

535. MANAGERIAL COST ANALYSIS.
Analysis of Cost-Volume-Profit relationships, cost behavior, budgeting and planning, responsibility accounting and control systems, behavioral aspects of budgets, divisional performance evaluation, inventory planning, and accounting aspects of capital budgeting.
Prerequisites, Introductory Managerial Accounting and a Calculus course. Mr. Zeisel.

563. LAW IV.
Limited to Accounting majors. Also listed under General Business and Finance.

620. FINANCIAL REPORTING III.
Consolidation problems of merged firms. Application of interest to accounting problems. Both general price-level and specific price change problems. Problems of foreign operations and firms in financial difficulty.
Prerequisite, Acctg 221 or equivalent.
Ms. Motekat, Mr. Simpson.

635. INVENTORY CONTROL.
Mathematical modeling applied to control of inventory investments. Emphasis on the recognition of relevant costs for the development and solution of appropriate models.
Prerequisites, BA 759 or permission of instructor.

640. AUDITING AND CONTROL.
Basic principles of auditing with emphasis on theory, types of audits, duties and responsibilities of the auditor, audit programs, and methods of internal control. Emphasis on the reponsibilities of both the independent and internal auditor.
Prerequisites, Acctg 221 or equivalent and a Cost Accounting course. Mr. Krzystofik.

671. ADVANCED FEDERAL TAX PROCEDURES.
Emphasis on corporations, partnerships, estates and trusts, gifts and estate taxes, tax planning and research.
Prerequisite, Acctg 370 or equivalent.
Mr. Anderson, Mr. Fitzgerald.

680. C.P.A. PROBLEMS.
Extensive practice in solution of problems for CPA examinations. Topics include: proper treatment of assets, liabilities, and ownership equity; partnerships; consolidations; funds and cash flow; cost accounting and management uses of accounting information; and governmental accounting.
Prerequisite, Acctg 620 or equivalent.
Mr. Lentilhon, Mr. O'Connell.

General Business and Finance (GB FIN)

504. MODELS OF FINANCIAL ANALYSIS AND MANAGEMENT.
An analytical approach to financial management. Emphasis on theoretical topics of financial decision-making. Through the use of mathematical, statistical, and computer simulation methods, various financial decision-making models are made explicit in their assumptions, rigorous in their construction, and testable in their implications.
Prerequisites, Gen Bus 201 and elementary knowledge of mathematics, statistics, and programming.
Mr. Cheng, Mr. Kumar.

512. TOPICS IN FINANCIAL INSTITUTIONS AND MARKETS.
Intensive study of selected topics relating to financial insti-

tutions and markets with emphasis on management implications.
Prerequisite, Fin 210 or Econ 211.

521. SECURITY ANALYSIS.
Factors affecting investment values of securities, and methods used in their analysis. Mr. Cheng, Mr. Deets.

522. THEORY OF INVESTMENT PROCESSES.
An in-depth study of portfolio analysis and stochastic processes in security markets. Emphasis on quantitative solution techniques and testing procedures.
Prerequisites, Fin 220 and 221 or permission of instructor.
Mr. Cheng, Mr. Deets.

545. METROPOLITAN TRANSPORTATION.
Analysis of economic, social, and technological developments on demand and supply factors for the movement of people and goods within urban areas. Determination of the optimal mix of modal facilities to maximize the total transport resources of the urban area. The coordination of internal and external transport systems.
Prerequisite, Gen Bus 240 or permission of instructor.
Mr. Rivers.

561. LAW II.
Sales, negotiable instruments and secured transactions; their economic functions and consequences.
Prerequisite, Gen Bus 260.

562. LAW III.
Economic functions and consequences of agency, partnerships and corporations.

563. LAW IV.
Legal problems most commonly encountered by certified public accountants with attention to the subjects currently being included in C.P.A. examinations.
Prerequisite, Gen Bus 260. Limited to Accounting majors.

564. LAW OF URBAN DEVELOPMENT.
Legal problems generated by the changing urban environment. Topics include the law of race relations, poverty and welfare, land use planning, urban and regional planning.
Prerequisite, Gen Bus 260 or equivalent. Mr. Bonsignore.

569. (I), 570 (II). CITY PLANNING.
(Reg Pl 573, 574).
The historical and legal aspects of land use and regional development, and a critical examination of planning techniques used in guiding the physical growth of communities.
Credit, 3 each semester.

572. SEMINAR IN URBAN AND REGIONAL STUDIES.
Analysis of the dimensions of urban growth and change, discussion of the reasons behind, and the problems growing out of, the economic growth and stagnation of urban areas.
Prerequisite, Gen Bus 270, Econ 271, Econ 282, or permission of instructor.

573. INTRODUCTION TO SIMULATION METHODS (IE 573).
The principles and methods of computer simulation. Each student expected to construct, test, and run a complex simulation model. Mr. Kaczka.

574. REAL ESTATE FINANCE.
A problem-oriented course; financial practices, institutions, and methods of analysis related to real-estate investment. Topics include investment theory, taxation, and government programs.
Prerequisites, Fin 201, Gen Bus 270.

575. HOUSING ANALYSIS.
The urban housing market; government housing programs and practices of private enterprises analyzed and evaluated. A housing-market model is used for analysis. All students required to complete a project.
Prerequisite, Gen Bus 270 or equivalent.

658. QUEUEING-THEORY MODELS.
Development and application of models of waiting lines, including single- and multiple-channel and single- and multiple-stage queues for various priorities and queue disciplines.
Prerequisites, BA 758 and 759 and permission of instructor.

659. TIME-SERIES ANALYSIS.
Analysis of time-series and dynamic models for use in forecasting and control of business and economic systems.

660. ADVANCED METHODS OF COMPUTERIZATION IN NUTRITION AND FOOD SERVICE.
The mathematical foundations of computations with food nutrient and recipe data. The data file structure of computerized food and nutrient accounting systems. The principle of mathematical optimizations techniques and its utilization in computerized menu planning and scheduling models. Laboratory work with computer applications.
Prerequisite, NF 340, Mgt 110 and Math 115 or equivalents.
Mr. Balintfy.

Management (MGT)

510. MANAGERIAL APPLICATIONS OF COMPUTER PROGRAMMING.
Intermediate and advanced computer programming. Emphasis on problems in accounting and management information systems.
Prerequisite, Mgt 110 or permission of instructor.

534. WAGE AND SALARY ADMINISTRATION.
Objectives, procedures, and problems involved in establishment and administration of operative and executive compensation plans. Mr. Wortman.

641. MANAGEMENT DECISION SIMULATION.
Participation in management of a firm in a simulated industry. Students, organized into management teams, apply their knowledge of business administration and economics in a competitive struggle for profit and market position.

644. MANAGEMENT-UNION RELATIONS I.
Comparison of union-management objectives, functions, and structures including scope and impact of union penetration into areas of managerial authority.
Mr. Conlon, Mr. Wortman, Mr. Carlisle, Mr. Bornstein.

645. MANAGEMENT-UNION RELATIONS II.
Problems in the interpretation and administration of collective-bargaining agreements studied by use of the case method of analysis.
Prerequisite, Mgt 644 or permission of instructor.
Mr. Conlon, Mr. Wortman, Mr. Carlisle, Mr. Bornstein.

Chemical Engineering

GRADUATE FACULTY

John W. Eldridge, *Professor and Head of the Department of Chemical Engineering,* B.S., Maine, 1942; M.S., Syracuse University, 1946; Ph.D., University of Minnesota, 1949.

Leland H. S. Roblee, Jr., *Professor and Graduate Program Director,* B.S., Purdue, 1949; M.S., 1956; Ph.D., 1958.

Kenneth D. Cashin, *Professor,* B.S., Worcester Polytechnic Institute, 1947; M.S., 1948; Ph.D., Rensselaer Polytechnic Institute, 1955.

David C. Chappelear, *Adjunct Associate Professor,* B.E., Yale, 1953; Ph.D., Princeton, 1960.

James M. Douglas, *Professor*, B.S., Johns Hopkins, 1954; Ph.D., University of Delaware, 1960.

Robert S. Kirk, *Associate Professor*, B.S., Illinois Institute of Technology, 1943; M.S., Illinois Institute of Technology, 1943; Ph.D., University of Wisconsin, 1948.

James R. Kittrell, *Associate Professor*, B.S., Oklahoma State University, 1962; M.S., University of Wisconsin, 1963; Ph.D., 1966.

Robert L. Laurence, *Professor*, B.S., Massachusetts Institute of Technology, 1957; M.S., University of Rhode Island, 1960; Ph.D., Northwestern, 1965.

Robert W. Lenz, *Professor*, B.S., Lehigh University, 1949; M.S., Institute of Textile Technology, 1951; Ph.D., State University of New York, 1956,

E. Ernest Lindsey, *Professor*, B.S., Georgia Institute of Technology, 1936; Ph.D., Yale, 1940.

Thomas J. McAvoy, *Associate Professor*, B.S., Brooklyn Polytechnic Institute, 1961; Ph.D., Princeton, 1964.

Stanley Middleman, *Professor*, B.S., Johns Hopkins, 1958; D.Eng., 1961.

W. Leigh Short, *Professor*, B.S., University of Alberta, 1956; M.S., 1957; Ph.D., University of Michigan, 1962.

Marcel Vanpee, *Professor*, B.S., M.S., University of Louvain, Belgium; Ph.D., 1940.

The graduate program in chemical engineering emphasizes advanced study in engineering fundamentals rather than specific technological applications. To be admitted to full graduate status in the field, either of the following requirements should be met:

1. Applicant must have a Bachelor's degree in chemical engineering from a recognized school, or
2. Applicant must show satisfactory academic training or demonstrate proficiency in these subjects as a minimum:
   - Mathematics: through Calculus.
   - Chemistry: through Organic and Physical.
   - Engineering Mechanics: Statics, Strength of Materials, Dynamics.
   - Chemical Engineering: Stoichiometry, Unit Operations.
   - Thermodynamics (including thermodynamics of chemical change).
   - Electrical Engineering: Elements of Circuits and Machines.

REQUIREMENTS FOR THE PH.D. DEGREE

In the Chemical Engineering Department, the Ph.D. candidate is required to successfully complete (with a grade of B or better) English 634, Advanced Technical Writing. The Department does not impose any other requirements beyond those established by the Graduate School.

REQUIREMENTS FOR THE M.S. DEGREE

1. Ch E 800, Thesis, six to 10 credits (may be research or design). If a student elects a nonexperimental thesis, he must demonstrate experimental proficiency by other evidence such as from industrial experience.
2. At least 12 credits of Chemical Engineering 700-level courses. Ch E 662 may also be used toward meeting this requirement (*i.e.*, in lieu of three of these 12 credits).
3. Additional graduate-credit courses, chosen according to the student's interests from the fields of engineering, science, mathematics, and the humanities, to constitute the total requirement of 30 credits for the M.S. degree.
4. University-wide requirements as described in the front section of this Bulletin.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS. *Credit, 1-3.*

701. CHEMICAL ENGINEERING THERMODYNAMICS I.
Review of the fundamental laws of thermodynamics, P-V-T relations of fluids, thermodynamic functions, fluid flow, compression and expansion of gases, liquefaction and separation of gases.
Prerequisite, Ch E 126 or equivalent. Mr. Roblee.

702. CHEMICAL ENGINEERING THERMODYNAMICS II.
Phase equilibria and chemical reaction equilibria and their applications in chemical processing.
Prerequisites, Chem 586 and Ch E 701.
Credit, 2. Mr. Vanpee.

703. CHEMICAL ENGINEERING ANALYSIS III.
Mathematical analysis of chemical engineering problems continued. Advanced matrix techniques, perturbation analysis, and analytical solutions to partial differential equations.
Prerequisite, Ch E 662. Mr. Douglas.

705. CHEMICAL REACTOR DESIGN.
Principles of chemical reaction kinetics and their application to industrial chemical processes. Systems homogeneous and heterogeneous, batch and flow, catalyzed and uncatalyzed, isothermal and adiabatic.
Prerequisites, Chem 586, Math 186 or 541 or equivalent.
Mr. Kirk.

706. ADVANCED KINETICS AND REACTOR DESIGN.
Topics from the recent literature including reactions in gradients, catalysis and optimization of chemical reactors by methods of dynamic programming.
Prerequisites, Ch E 705 and Ch E 361 or equivalent.
Mr. Kirk.

707. ADVANCED PROCESS CONTROL.
Theory of closed loop control. Use of LaPlace transforms and transfer functions; stability analysis, root-locus, Bode diagrams; frequency response and time response in controller design.
Prerequisite, Ch E 376 or equivalent. Mr. McAvoy.

708. PROCESS DYNAMICS.
Translating process performance into mathematicl form, application to control system design. Fluid systems, thermal systems, mass transfer systems (distillation, drying), reaction kinetics.
Prerequisite, Ch E 707. Mr. Douglas.

710. APPLIED OPTIMIZATION IN CHEMICAL ENGINEERING.
Topics include non-linear programming, (Kuhn-Tucker theorem, quadratic programming), geometric programming, calculus of variations, dynamic programming, Pontyragin's Maximum Principle.
Prerequisite, Ch E 688. Mr. Novak.

711. CHEMICAL ENGINEERING FLUID MECHANICS.
Introduction to advanced work in chemical engineering fluid mechanics. Viscosity, momentum balances (Navier-Stokes

equation), friction, turbulence, the motion of suspended solids in fluids, and non-Newtonian fluids.
Prerequisite, Ch E 256. Mr. Middleman.

712. CHEMICAL ENGINEERING HEAT TRANSFER.
Introduction to advanced work in heat transfer as applied to chemical engineering. Thermal diffusivity; energy balances; analytical, graphical, and numerical solutions to steady and transient problems; convection and radiation.
Prerequisite, Ch E 711. *Credit, 2.* Mr. Roblee.

713. ANALOG-HYBRID SIMULATION IN CHEMICAL ENGINEERING.
Topics in analog-hybrid simulation useful to students beginning research. Linear and non-linear components, magnitude and time scaling, digital logic, hybrid operation.
Mr. Novak.

714. POLYMER RHEOLOGY.
Definition and measurement of rheological properties; continuum mechanics and constitutive equations; molecular theories of polymer deformation; correlation and interrelation of material functions. Relation of the various approaches taken in describing the viscous and viscoelastic properties of polymers, evaluation of the utility of these approaches, and indication of the role of modern rheology in the characterization and processing of polymers.
Prerequisite, Ch E 711. Mr. Middleman.

715. COMBUSTION PHENOMENA.
Fundamentals of combustion. Combustion thermodynamics, Rankin-Hugoniot relations, propagation of explosions, laminar flames, turbulent flames, detonations, radiation processes, kinetics of combustion.
Prerequisites, Ch E 358 and 380. Mr. Vanpee.

716. MASS TRANSFER.
A unified treatment of mass transport phenomena, emphasizing scientific principles. Diffusional phenomena, convective mass transfer and application of integral averaging techniques to mass transfer.
Prerequisite, Ch E 711. *Credit, 2.* Mr. Laurence.

731. ADVANCED MASS TRANSFER.
Mass transfer with emphasis on theory of diffusion. Molecular diffusion, multicomponent diffusion, convective mass transfer, diffusion with chemical reaction and chromatographic separations.
Prerequisites, Ch E 662 and 716. Mr. Laurence.

741. ADVANCED PROCESS DESIGN I.
Solution of advanced process design problems which require the use of principles covered in previous courses. The problems may be conceptual designs, economic decision-making in process design or engineering design calculations for a specific process.
Prerequisites, Ch E 256 and 382. Mr. Short.

800. MASTER'S THESIS.
A theoretical or experimental study of some chemical engineering problem. Credit determined by the work done, and by agreement with the Department and the Graduate Thesis Committee. *Credit, 6-10.*

801. ADVANCED TOPICS IN CHEMICAL ENGINEERING.
An in-depth exploration of the advanced aspects of an area pertinent to chemical engineering.
Prerequisites, Ch E 662, 712, and 716. *Credit, 1-3.*

802. ADVANCED TOPICS IN TRANSPORT PHENOMENA.
An in-depth exploration of a particular aspect of advanced transport phenomena.
Prerequisites, Ch E 662, 712, and 716.
Credit, 1-3. Mr. Roblee.

803. ADVANCED TOPICS IN THERMODYNAMICS.
An intensive consideration of current literature and research in a particular area of thermodynamics.
Prerequisite, Ch E 702. *Credit, 1-3.* Mr. Short.

804. ADVANCED TOPICS IN KINETICS.
Selected topics from the current literature.
Prerequisite, Ch E 705. *Credit, 1-3.* Mr. Kirk.

805. ADVANCED TOPICS IN PROCESS DYNAMICS AND CONTROL.
Topics from the current literature, discussed in depth.
Prerequisite, permission of instructor.
Credit, 1-3. Mr. Douglas.

806. ADVANCED TOPICS IN CHEMICAL ENGINEERING ANALYSIS.
For advanced graduate students in chemical engineering. Application of mathematics to problems in chemical engineering. Specific topics vary according to instructor and student interests.
Prerequisites, Ch E 662, 703 or permission of instructor.
Credit, 1-3. Mr. McAvoy.

807. ADVANCED PROCESS DESIGN II.
Continuation of Advanced Process Design I. Emphasis on more complex designs and the uses of mathematical models or optimization techniques in the solution of these design problems.
Prerequisites, Ch E 256, 257, and 688. Mr. Short.

900. DOCTORAL DISSERTATION.
A theoretical or experimental study of a chemical engineering problem. Credit determined by the work done and by agreement with the Department and the Graduate Thesis Committee.
Maximum credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

661. CHEMICAL ENGINEERING ANALYSIS I.
Application of mathematical techniques to chemical engineering problems. Emphasis on analysis of problems and the devising of satisfactory mathematical models. Machine computation with digital and analog devices.
Prerequisites, Ch E 256 and Math 256. Mr. Roblee.

662. CHEMICAL ENGINEERING ANALYSIS II.
Mathematical analysis of chemical engineering problems continued. Topics include: matric methods, vector analysis, calculus of finite differences, numerical solution of ordinary and partial differential equations, complex variables and La-Place transformations. Emphasis on applying these techniques to real chemical engineering processes and on the physical and mathematical interpretation of the results.
Prerequisite, Ch E 661. Mr. Novak.

663, 664. SURVEY OF NUCLEAR ENGINEERING I, II.
Introduction to the principles of nuclear physics and a survey of problems involved in the design and operation of nuclear reactors. Heat transfer, shielding, metallurgy, controls, waste disposal, and health physics.
Two lectures, one laboratory period per week each semester.
Prerequisite, two semesters of physics and mathematics through integral calculus.
Credit, 3 each semester. Mr. Marcus.

670. APPLIED POLYMER SCIENCE.
A survey of the methods of preparing important synthetic polymers, and their properties and applications.
Prerequisite, undergraduate organic and physical chemistry.
Mr. Lenz.

676. PROCESS CONTROL AND DYNAMICS.
Theoretical and practical factors governing automatic control of industrial processes. Topics include control systems, measurement devices, control modes, mathematical relationships, and laboratory work.
Prerequisites, Ch E 256 and Math 256. Mr. Novak.

684. PROCESS AND PLANT DESIGN.
Application of the principles of stoichiometry, unit operations, thermodynamics, and cost estimation to the design of chemical plants. The economic factors influencing the design are stressed. Lecture and laboratory.
Prerequisites, Ch E 256 and Ch E 381 or equivalent.
Mr. Cashin.

688. OPTIMIZATION.
Fundamental ideas and application of optimization techniques in operation and design. Topics include: extrema of functions, effect of constraints, LaGrange multipliers, introduction to linear programming, geometric programming and dynamic programming.
Prerequisite, Math 187. Mr. Novak.

689. OPTIMIZATION USING VARIATIONAL TECHNIQUES.
Application of the calculus of variations, Pontyragin's maximum principle, and dynamic programming to the design and control of chemical process equipment. Systems described by both ordinary and partial differential equations are considered. Topics include optimal reactor design, the synthesis of optimal control systems, and optimal periodic operation of processing units.
Prerequisite, Math 187. Mr. Douglas.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit given for students majoring in Chemical Engineering)

660. AIR POLLUTION CONTROL PROCESSES.
Introduction to the techniques of air pollution control; particulate removal, wet and dry scrubbing processes, removal of selected species from gases (*e.g.*, sulfur dioxide).
Prerequisites, Freshman chemistry and permission of instructor. Mr. Short.

685, 686. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Chemistry

GRADUATE FACULTY

William E. McEwen, *Professor and Head of the Department of Chemistry*, B.A., Columbia, 1944; M.A., 1945; Ph.D., 1947.

George W. Cannon, *Professor and Graduate Program Director*, B.A., Dakota Wesleyan University, 1939; M.A., Illinois, 1941; Ph.D., 1943.

Ronald D. Archer, *Professor*, B.S., Illinois State at Normal, 1953; M.S., 1954; Ph.D., Illinois, 1959.

Ramon M. Barnes, *Assistant Professor*, B.S., Oregon State, 1962; M.A., Columbia, 1963; Ph.D., Illinois, 1966.

John F. Brandts, *Professor*, B.A., Miami, 1956; Ph.D., Minnesota, 1961.

Paul E. Cade, *Associate Professor*, B.S., Texas, 1954; Ph.D., Wisconsin, 1961.

Louis A. Carpino, *Professor*, B.S., Iowa State College, 1950; Illinois, 1951; Ph.D., 1953.

John A. Chandler, *Associate Professor*, B.S., Ohio, 1955; M.S., Illinois, 1958; Ph.D., 1959.

James C. W. Chien, *Professor*, B.S., St. John's, 1949; B.A., Wayland College, 1950; M.S., Kentucky, 1951; Ph.D., Wisconsin, 1954.

David J. Curran, *Associate Professor*, B.S., Massachusetts, 1953; M.A., Boston College, 1958; Ph.D., Illinois, 1961.

John W. George, *Associate Professor*, B.A., Princeton, 1948; M.A., North Carolina, 1950; Ph.D., M.I.T., 1958.

Stephen S. Hixson, *Assistant Professor*, B.A., Pennsylvania, 1965; Ph.D., Wisconsin, 1970.

Robert R. Holmes, *Professor*, B.S., Illinois Institute of Technology, 1950; Ph.D., Purdue, 1954.

Clifford P. Lillya, *Professor*, B.A., Kalamazoo College, 1959; Ph.D., Harvard, 1964.

William J. MacKnight, *Associate Professor*, B.S., Rochester, 1958; M.A., Princeton, 1963; Ph.D., 1964.

Earl J. McWhorter, *Associate Professor*, B.S., Rensselaer Polytechnic Institute, 1950; Ph.D., Cornell, 1955.

Bernard Miller, *Professor*, B.S., C.C.N.Y., 1951; M.A., Columbia, 1953; Ph.D., 1955.

John L. Ragle, *Professor*, B.S., California (Berkeley), 1954; Ph.D., State College of Washington, 1957.

Marvin D. Rausch, *Professor*, B.S., Kansas, 1952; Ph.D., 1955.

Marion B. Rhodes, *Assistant Professor*, B.A., Connecticut, 1958; M.S., Massachusetts, 1960; Ph.D., 1966.

George R. Richason, Jr., *Professor and Associate Head of the Department of Chemistry*, B.S., Massachusetts, 1937; M.S., 1939.

John E. Roberts, *Professor*, B.S., New Hampshire, 1942; M.S., 1944; Ph.D., Cornell, 1947.

Robert L. Rowell, *Associate Professor*, B.S., State Teachers College at Bridgewater, Mass., 1954; M.S., Boston College, 1956; Ph.D., Indiana, 1960.

Sidney Siggia, *Professor*, B.S., Queens College, 1942; M.S., Brooklyn Polytechnic Institute, 1943; Ph.D., 1944.

J. Harold Smith, *Professor*, B.S., Utah, 1936; M.S., 1938; Ph.D., Wisconsin, 1941.

Richard S. Stein, *Professor*, B.S., Brooklyn Polytechnic Institute, 1945; M.S., Princeton, 1948; Ph.D., 1949.

Thomas R. Stengle, *Professor*, B.S., Franklin & Marshall College, 1951; M.S., Michigan, 1953; Ph.D., 1961.

Howard D. Stidham, *Associate Professor*, B.S., Trinity College, 1950; Ph.D., Massachusetts Institute of Technology, 1955.

Peter C. Uden, *Associate Professor*, B.S., Bristol, 1961; Ph.D., 1964.

Robert M. Williams, *Assistant Professor*, B.A., Dartmouth, 1951; M.S., New Hampshire, 1953; Ph.D., Iowa State, 1958.

John S. Wood, *Associate Professor*, B.A., Keele, 1958; Ph.D., Manchester, 1962.

Oliver T. Zajicek, *Assistant Professor*, B.S., Baldwin-Wallace, 1950; M.S., Wayne State, 1958; Ph.D., 1961.

The chemistry department offers programs leading to the M.S. and Ph.D. degrees in analytical, inorganic, organic, and physical chemistry and in interdisciplinary areas. In addition, the department actively participates in the Five College Ph.D. Program.

During their first year doctoral students are ex-

pected to complete qualifying requirements in the four areas of chemistry (or certain cognate areas). Qualification requires the demonstration of competence at the advanced undergraduate or beginning graduate level. It can be accomplished by formal course work or by examination. Students fulfill the Ph.D. comprehensive examination requirement by passing a series of cumulative examinations in their specialty. All doctoral candidates are required to pass a departmental examination showing that they have a reading knowledge of German, Russian, or Japanese sufficient to understand journal literature.

In order to allow each student's program to be tailored as closely as possible to individual needs, the department has few formal course requirements for the doctoral degree. On entrance, the student is assigned an adviser who helps plan the initial program. After the student has selected a research topic, the research adviser helps plan the remainder of the course program.

M.S. degree candidates must qualify in three areas in their first year. Thirty credits of graduate work must be presented; 10 of these are awarded for the thesis. The course of study is planned by the student and the adviser. No language or cumulative examinations are required. An acceptable research thesis must be presented and defended.

The M.S. degree may be awarded to doctoral candidates after they have satisfied all Ph.D. qualifying and cumulative examination requirements and requirements of the Graduate School.

Students accepted into graduate programs are expected to have undergraduate preparation comparable to that recommended by the American Chemical Society. Those who have not fulfilled these requirements may be admitted as special students or provisional students until the deficiencies have been removed. All entering graduate students take placement examinations in the week prior to the beginning of the first week of graduate study. These are designed to evaluate the student's preparation and assist in planning a course of study. When a student elects an interdisciplinary research problem, an individual program of courses and examination requirements may be worked out to satisfy special needs. For example, the chemistry department has a close association with the Polymer Science and Engineering Program and many graduate students pursue interdisciplinary work in the two areas.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

701. ADVANCED ANALYTICAL CHEMISTRY.
Special laboratory work to meet the needs of the individual student.
Prerequisite, Chem 513 or equivalent. *Credit, 1-5.*

705. LABORATORY GLASS BLOWING FOR SCIENTISTS.
Technique of fabrication and repair of glass apparatus useful in research.
Prerequisite, permission of instructor.
Two 1-hour laboratory periods. *Credit, 0.* Mr. Good.

706. APPLIED ANALYTICAL CHEMISTRY.
The application of basic analytical principles and techniques to the solution of actual analytical problems. The interrelationship between the diverse analytical approaches, as applied to organic, inorganic, qualitative, and quantitative problems.
Prerequisite, Chem 513. Mr. Siggia.

710. ELECTROANALYTICAL CHEMISTRY.
Principles of electrochemistry and their relation to the newer electroanalytical methods.
Prerequisite, Chem 513 or equivalent.
Mr. Curran.

715. SPECTROANALYTICAL CHEMISTRY.
Theory and practice of modern methods of chemical analysis based upon spectroscopic measurements of atoms and molecules in solid, liquid, gas, and plasma states. Includes x-ray, optical, and radio frequency absorption and emission techniques.
Prerequisite, Chem 513 or equivalent.
Credit, 4. Mr. Barnes.

716. CHEMICAL SEPARATION METHODS.
Methods of chemical analysis using separatory techniques. Theory of separations and practical treatment of chromatographic methods, liquid-liquid extraction, precipitation, distillation, electrical and membrane separations.
Prerequisite, Chem 513 or 515 or permission of instructor.
Credit, 4. Mr. Uden.

741. INORGANIC PREPARATIONS LABORATORY.
Preparation and testing of various types of inorganic substances, to teach important techniques and give familiarity with the reactions and properties of inorganic materials.
Credit, 3-5.

742. INORGANIC CHEMISTRY OF THE LESS FAMILIAR ELEMENTS.
Lectures and collateral reading on the descriptive chemistry of some of the less familiar elements such as boron, gallium, indium, thallium, the lanthanides, fluorine, titanium, vanadium, tantalum, tungsten, and uranium, with correlations between structure or spatial configurations and chemical properties.

747. STRUCTURAL INORGANIC CHEMISTRY.
Applications of principles of spectroscopy, magnetic resonance, and dielectrics toward an understanding of structural aspects of inorganic substances in the gas, liquid, and solid states. Discussion of symmetry, stereochemically non-rigid molecules, metal carbonyl compounds, hydrogen bonding, unusual coordination compounds, solid state effects.
Prerequisite, Chem 546 or equivalent. Mr. Holmes.

748. COORDINATION CHEMISTRY.
Molecular orbital bonding theory, spectroscopy, magnetism, stereochemistry, and reaction mechanisms as applied to coordination species. Emphasis on transition elements.
Prerequisite, Chem 546 or equivalent. Mr. Archer.

756. TOPICS IN INORGANIC CHEMISTRY.
Topics such as coordination chemistry, non-aqueous solvents, less familiar oxidation states, acid base theories, reaction mechanisms, etc.
Prerequisite, Chem 546 or equivalent.
Credit, 2 each semester. Maximum credit, 6.

760. ORGANIC REACTION MECHANISMS.
Continuation of Chem 571. A detailed survey of the basic organic reactions in terms of the relationship between structure and reactivity. Mechanistic presentation brings each topic up-to-date on the basis of current work.
Prerequisite, Chem 571 or permission of instructor.

761. PHYSICAL ORGANIC CHEMISTRY.
Application of theory and physical principles to problems of structure, spectroscopy, and reactivity of organic molecules. Topics include molecular orbital theory, symmetry conservation, kenetics, linear free energy relationships, and isotope effects.
Prerequisite, Chem 571; corequisite, Chem 594 or permission of instructor.

765. ADVANCED ORGANIC CHEMISTRY LABORATORY.
Discussion and laboratory work involving experimental techniques of research and design of experiments. Syntheses of

compounds desired for research and use of the original literature.
Prerequisite, a year course in organic chemistry.
Credit, 1-5.

770. HETEROCYCLIC CHEMISTRY.
The chemistry of the common organic heterocyclic compounds containing nitrogen, oxygen, and sulfur. Consideration of mechanisms of the reactions discussed.
Prerequisite, Chem 571 or equivalent. Mr. McEwen.

771. ORGANOMETALLIC CHEMISTRY.
The chemistry of compounds containing carbon-metal and carbon-metalloid bonds. Preparation, structure, physical properties, chemical reactions, and synthetic applications of organometallic derivatives. Topics of current interest stressed.
Prerequisite, Chem 571 or equivalent. Mr. Rausch.

772. CHEMISTRY OF NATURAL PRODUCTS.
Natural products of current interest, primarily from the steroid, terpene, and alkaloid groups. Emphasis on structural proofs, stereochemistry, synthesis, and biogenetic relationships.
Prerequisite, Chem 571 or permission of instructor.
Mr. McWhorter.

775. SPECIAL TOPICS IN ORGANIC CHEMISTRY.
One to three topics of current interest discussed in detail. Recent developments of theoretical and/or synthetic importance to organic chemistry. Topics covered in recent years include small-ring chemistry, photochemistry, perfluoro compounds, organonitrogen and organosulfur chemistry.
Prerequisite, Chem 571 or permission of instructor.
Maximum credit, 6.

776. ORGANIC SYNTHESIS.
Important synthetic reactions, with stress on recent developments in methods of organic synthesis. Develops the student's ability to propose his own syntheses of complex molecules. Organic reaction mechanisms as guides to the development of new synthetic reactions and to criticism of proposed syntheses.
Prerequisite, Chem 571 or permission of instructor.

785. STATISTICAL THERMODYNAMICS.
Introduction to statistical thermodynamics. Applications of Microcanonical, Canonical, Grand Canonical, and Generalized Ensembles to chemical systems. Calculation of thermodynamic functions from spectroscopic data, fluctuations, imperfect gases, nearest neighbor lattice statistics, and other topics of current interest.
Prerequisite, Chem 595 or equivalent.
Mr. Stidham, Mr. Cade.

787. CHEMICAL SPECTROSCOPY, TECHNIQUE AND APPLICATIONS.
Introduction to the elementary theory, experimental techniques, and interpretation of data obtained in applications of infrared, Raman, visible, ultraviolet, nuclear quadrupole and nuclear magnetic resonance spectroscopy to the solution of chemical problems.
Prerequisite, Chem 586 or equivalent.
Mr. Stengle, Mr. Stidham.

788. CHEMICAL SPECTROSCOPY THEORY.
Introduction to the theory of infrared, Raman, visible and ultraviolet, nuclear quadrupole and nuclear magnetic resonance spectroscopy.
Prerequisites, Chem 787 and permission of instructors.
Mr. Stidham, Mr. Stengle.

791, 792. QUANTUM CHEMISTRY.
Quantum mechanics and its application to chemical problems. The exact theory of structure of simple atoms, the application of approximate methods for complex atoms and molecules, the chemical bond, resonance, the interaction of radiation and matter, group theory.
Prerequisite, Chem 546 or equivalent.
Credit, 3 each semester. Mr. Cade, Mr. Ragle.

793, 794. X-RAY CRYSTALLOGRAPHY.
Crystal symmetry, the diffraction of x-rays and the powder method as a tool for identification and determination of unit-cell constants. Intensities and some factors affecting them; space groups and systematic extinctions; single crystal diffraction methods; refinement of crystal structures; methods of obtaining trial structures.
Prerequisite, Chem 281 or equivalent.
Credit, 3 each semester. Mr. Wood.

795. TOPICS IN PHYSICAL CHEMISTRY.
Prerequisites, Chem 595 and 546 or equivalent.
Credit, 2 each semester. Maximum credit, 6.

797. ORGANIC POLYMERIZATION REACTIONS.
Mechanisms, kinetics, and thermodynamics of principal types of polymerization reactions and their relationship to the properties of resulting polymers.
Prerequisite, Chem 166 or equivalent. Mr. Lenz.

798, 799. PHYSICAL CHEMISTRY OF HIGH POLYMERS.
Structure of solid polymers, determination of molecular weights, sizes and shapes, mechanical porperties of solid polymers, colligative properties of polymer solutions, polyelectrolytes, and physical chemistry of proteins.
Prerequisite, Chem 785 or equivalent.
Credit, 3 each semester. Mr. Stein, Mr. MacKnight.

891. SEMINAR.
Conference, reports or lectures.
Credit, 1 each semester. Maximum credit, 2.

895. RESEARCH PROBLEM.
Students prepare two proposals for research problems primarily involving library research, not directly related to the thesis topic, if the latter has been selected.
Credit, 4.

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

513. INSTRUMENTAL ANALYSIS.
Theory and practice of modern analyses utilizing optical, electrical, and thermal properties. Selected modern separation methods may be included.
Two class hours, one 4-hour laboratory period.
Prerequisites, Chem 210 and 586. Mr. Barnes.

515. THEORY OF ANALYTICAL PROCESSES.
Topics such as chemical equilibrium, precipitate formation, chelating agents, multistage separation, etc., having general applicability in chemical investigations.
Three class hours, laboratory optional (1 extra credit).
Prerequisites, Chem 166 and 586. *Credit, 3-4.*

516. CHEMICAL MICROSCOPY.
Optics of the microscope, micrometry, microscopic study of fibers, crystals, physiochemical phenomena, qualitative analysis, and an introduction to electron microscopy.
Prerequisite, Chem 513 or permission of instructor.
Two 3-hour laboratory periods. *Credit, 2.* Mr. Roberts.

517. MICROQUANTITATIVE ANALYSIS.
Quantitative determination of carbon, hydrogen, oxygen, nitrogen, sulfur, halogens, phosphorous. Both organic and inorganic compounds included in microgram scale analyses.
Prerequisite, Chem 513 or permission of instructor.
One 4-hour laboratory period. *Credit, 1.* Mr. Dabkowski.

519. ELECTRONICS INSTRUMENTATION FOR SCIENTISTS.
Laboratory-oriented course. Begins with electronic principles and leads through servo-systems, operational amplifiers, digital circuits, and other measurement devices.
Two 3-hour laboratory periods.
Prerequisites, one year of physics and permission of instructor.
Mr. Barnes, Mr. Curran.

544. RADIOCHEMISTRY.
Character of atomic nuclei, nuclear reactions, radiation and its detection, and techniques for the study and utilization of radionuclides.

Three class hours, one 3-hour laboratory period.
Prerequisite, Chem 210 or 127 or permission of instructor.
Credit, 4. Mr. Richason.

546. THEORETICAL INORGANIC CHEMISTRY.
Survey of theoretical aspects of inorganic chemistry chosen from such topics as electronic structure and its relation to periodic properties, chemical bonding, molecular structure, coordination chemistry, acid-base theory, non-aqueous systems, and reaction mechanisms.
Prerequisite, Chem 585.

547. INORGANIC CHEMISTRY OF THE COMMON ELEMENTS.
The chemistry of the common elements and their compounds based on the periodic relationships and modern concepts of structure and bonding. An optional 2-credit, six-hour laboratory session provides an introduction to inorganic laboratory techniques and practices.
Prerequisite, Chem 546 or permission of instructor.
Credit, 3-5.

571. ADVANCED ORGANIC CHEMISTRY.
An intensive survey. Covers basic fundamentals and brings the student up-to-date on current work. Includes electronic effects, stereochemistry and a thorough consideration of the effect of structure on physical and chemical properties. Includes a detailed mechanistic study of some of the more important organic reactions.
Prerequisite, one year of organic chemistry or permission of instructor.

572. IDENTIFICATION OF ORGANIC COMPOUNDS.
Identification of unknowns, both single compounds and mixtures of organic compounds, by their reactions, preparation of derivatives, spectra, and other physical properties.
Two class hours, two 3-hour laboratory periods.
Prerequisites, one year of organic chemistry and permission of instructor. *Credit, 4.*

594. ADVANCED PHYSICAL CHEMISTRY.
Survey of modern physical chemistry emphasis on fundamentals of quantum mechanics and statistical mechanics. For students not taking further advanced work in these areas.
Prerequisite, Chem 586.

595. ADVANCED PHYSICAL CHEMISTRY.
Topics such as chemical thermodynamics, statistical mechanics, introductory quantum chemistry, and theories of gases, liquids, and solids.
Prerequisite, Chem 586.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in chemistry)

561, 562. ORGANIC CHEMISTRY.
Introduction to the chemistry of carbon compounds. Survey of the principal classes of organic compounds and their reactions with emphasis on the relation of structure and reactivity.
Prerequisite, Chem 112. *Credit, 3 each semester.*

563, 564. ORGANIC CHEMISTRY LABORATORY.
Application of the experimental techniques of organic chemistry to the preparation, purification, and identification of organic compounds.
One 3-hour laboratory period.
Concurrent enrollment in Chem 561, 562 required.
Credit, 1 each semester.

580. ELEMENTARY PHYSICAL CHEMICAL LABORATORY.
One 3-hour laboratory period.
Concurrent enrollment in Chem 582 required.
Credit, 1. Mr. Stengle.

581. ELEMENTARY PHYSICAL CHEMISTRY.
Basic principles of physical chemistry designed for students with a limited mathematical background. Not open to chemistry majors.
Prerequisites, Chem 112, Physics 142, and Math 124.
Mr. Stengle.

582. ELEMENTARY PHYSICAL CHEMISTRY.
Continuation of Chemistry 581.
Two class hours. *Credit, 2.* Mr. Stengle.

585, 586. PHYSICAL CHEMISTRY.
Fundamental theories and laws of physical chemistry.
Prerequisites, Math 174 and Physics 142.
Credit, 3 each semester.

587, 588. PHYSICAL CHEMISTRY LABORATORY.
Experience in modern physiochemical techniques. Concurrent enrollment in Chem 585, 586 required.
Credit, 2 each semester. Mr. Stidham.

Civil Engineering

GRADUATE FACULTY

Merit P. White, *Commonwealth Professor and Head of the Department of Civil Engineering,* B.A., Dartmouth, 1930; C.E., 1931; M.S.C.E., California Institute of Technology, 1932; Ph.D., 1935.

William A. Nash, *Professor and Graduate Program Director,* B.S.C.E., Illinois Institute of Technology, 1944; M.S., 1946; Ph.D., Michigan, 1949.

Clayton Adams, *Associate Professor,* B.S., U.S. Naval Academy, 1947; Nav. Eng., Massachusetts Institute of Technology, 1952.

Donald D. Adrian, *Professor,* B.A., Notre Dame, 1957; B.S., 1958; M.S., California at Berkeley, 1959; Ph.D., Stanford University, 1964.

Robert R. Archer, *Professor,* B.S., Massachusetts Institute of Technology, 1952; Ph.D., 1956.

Stanley M. Bemben, *Associate Professor,* B.S., Massachusetts, 1956; M.S., Illinois, 1958; Ph.D., Cornell, 1966.

Bernard B. Berger, *Professor,* B.S., Massachusetts Institute of Technology, 1935; M.S., Harvard, 1948.

William W. Boyer, *Professor,* B.S.C.E., North Carolina State, 1947; M.S.C.E., 1950.

Charles E. Carver, Jr., *Professor,* B.S.C.E., Vermont, 1947; M.S.C.E., Massachusetts Institute of Technology, 1949; D.S., 1955.

Alexander Chajes, *Associate Professor,* B.S.C.E., Cooper Union, 1952; M.S.C.E., Polytechnical Institute, 1955; Ph.D., Cornell, 1964.

Joseph M. Colonell, *Associate Professor,* B.S.C.E., Colorado, 1958; M.S.C.E., Washington State, 1960; Ph.D., Stanford, 1966.

Francis A. DiGiano, *Assistant Professor,* B.S.C.E., Massachusetts, 1964; M.S.C.E., Tufts, 1965; Ph.D., Michigan, 1969.

Frederick J. Dzialo, *Associate Professor,* B.S.C.E., Massachusetts, 1954; M.S.C.E., 1957; Ph.D., Rensselaer Polytechnic Institute, 1965.

Tsuan H. Feng, *Professor,* B.S.C.E., Pei-Yang University, China, 1940; M.S.C.E., Wisconsin, 1946; Ph.D., 1950.

James Halitsky, *Associate Professor,* B.M.E., City College of New York, 1940; M.A.E., New York University, 1952; Ph.D., 1970.

Denton B. Harris, *Assistant Professor,* B.S.C.E., Massachusetts, 1952; M.S.C.E., 1953.

Karl N. Hendrickson, *Professor*, B.S.G.E., Maine, 1938; B.S.C.E., 1939; M.S.C.E., 1941.

William E. Heronemus, *Professor*, B.S., United States Naval Academy, 1941; M.S., Massachusetts Institute of Technology, 1948.

George R. Higgins, *Professor*, B.S.C.E., New Hampshire, 1948; M.S., Massachusetts Institute of Technology, 1951.

Lawrence N. Kuzminski, *Assistant Professor*, B.A., Toronto, 1962; M.S., 1964; Ph.D., Massachusetts, 1967.

Peter A. Mangarella, *Assistant Professor*, B.S.C.E., Carnegie-Mellon University, 1965; M.S.C.E., Stanford, 1966; Ph.D., 1970.

Joseph S. Marcus, *Professor and Associate Dean*, B.S.Ch.E., Worcester Polytechnic Institute, 1944; M.S.C.E., Massachusetts, 1954.

Melton M. Miller, Jr., *Associate Professor*, B.S.C.E., Vermont, 1955; M.S.C.E., Purdue, 1958; Ph.D., 1964.

Paul W. Shuldiner, *Professor*, B.S.C.E., University of Illinois, 1951; M.S.C.E., 1953; Eng.D., California, Berkeley, 1961.

Fred D. Stockton, *Associate Professor*, B.S.C.E., Alabama, 1942; M.E., Brown, 1949; Ph.D., 1953.

Roscoe F. Ward, *Associate Professor and Associate Dean*, B.A., College of Idaho, 1953; B.S.C.E., Oregon State College, 1959; M.S., Washington State University, 1951; D.S., Washington University, 1964.

Lee A. Webster, *Assistant Professor*, B.C.E., University of Delaware, 1963; M.S., University of Illinois, 1965; Ph.D., 1968.

The Civil Engineering Department offers the M.S. and Ph.D. degrees in Civil Engineering, Environmental Engineering, and Ocean Engineering. The two latter programs and the corresponding degrees and degree requirements are described elsewhere in this Bulletin under the corresponding headings. The Master of Science degree in Civil Engineering requires 31 graduate credits, of which six must be for a thesis or project with report, at the discretion of the Guidance Committee. There are the following options, each with a required core of four of five courses: Environmental Engineering, Fluid Mechanics and Hydraulics, Mechanics and Structures, Ocean Engineering, Soil Mechanics and Foundations, and Transportation Engineering.

The requirements for the degree of Doctor of Philosophy are specified by the Graduate School. The student's course of study, including both technical and non-technical courses as well as the dissertation topic, is determined by the student and individual guidance committee. It is intended that the entire program, including all non-technical courses, shall be related to the candidate's interests and career plans.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS. *Credit, 3-6.*

710. TRANSPORTATION ANALYSIS AND PLANNING.
Analysis of traffic and transportation engineering problems in highways, railroads and airports and the planning related to those facilities.
Prerequisite, permission of instructor.
Mr. Shuldiner, Mr. Webster.

715. PAVEMENT DESIGN.
The theory of flexible and rigid pavement design: soil conditions, joints, base and subgrade material and mix.
Mr. Boyer.

716. TRANSPORTATION DESIGN.
Design of the visible features of rural and urban roadways and intersections. Mr. Boyer, Mr. Webster.

720. THEORETICAL SOIL MECHANICS.
The behavior of soil masses subjected to such forces as seepage, frost and imposed loads.

721. APPLIED SOIL MECHANICS.
Solution of case problems applying the principles of soil mechanics to the design of embankments, retaining walls, footings, raft foundation, and pile structures.
Prerequisite, CE 720. Mr. Bemben, Mr. Hendrickson.

722. SEEPAGE ANALYSIS.
Analytical study of ground water and seepage problems related to earth structures. Mr. Hendrickson.

723. SHEAR STRENGTH OF SOILS.
Survey of current theory and research.
Mr. Bemben.

724. SUBMARINE SOIL MECHANICS AND FOUNDATION ENGINEERING (OE 761).
Exploration of marine sediments, the assessment of the geotechnical properties and methods for altering the properties of marine sediments; submarine slope stability; foundation design factors for structures on and in marine sediments.
Prerequisite, CE 220. Mr. Bemben.

730. PLASTIC STEEL DESIGN.
Plastic analysis and design of steel frames, plates, and shells.
Prerequisites, CE 331 and 532.
Mr. Chajes, Mr. Dzialo, Mr. Stockton.

731, 732. CIVIL ENGINEERING ANALYSIS I, II.
Mathematical and computational methods for the solution of civil engineering problems. Topics include equilibrium problems in continuous systems and the solution of related self adjoint boundary value problems in one or more space variables; vibration and stability problems, orthogonal functions, and eigenvalue problems; propagation problems in discrete and continuous systems.
Prerequisite: mathematical background covering topics in advanced engineering mathematics.
Credit, 3 each semester. Mr. Archer, Mr. Stockton.

734. NUMERICAL METHODS IN STRUCTURAL MECHANICS.
Application of numerical methods to the solution of problems of structural mechanics. Finite difference techniques and other methods for the solution of problems in the vibration, stability and equilibrium of structural elements.
Prerequisite, Math 585, introductory computer programming, or permission of instructor.
Mr. Archer, Mr. Miller, Mr. Stockton.

737. COASTAL STRUCTURES (OE 764).
Factors influencing the loading, performance, and durability of coastal structures. Design of waterfront structures including breakwaters, piers, and bulkheads. Design of submerged, large diameter, reinforced concrete cylindrical and spherical shells in shallow water.
Prerequisites, CE 333 and 532.

738. ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES (OE 765).
Structural design of offshore structures such as buoys, towers, bridges, artificial islands, tunnels, and other special struc-

tures. Functional design considerations and methods of construction.
Prerequisites, CE 559, 534, and 540. Mr. Miller.

741. STRUCTURAL DYNAMICS.
Behavior of linear and non-linear mechanical systems subjected to periodic forces, to non-periodic forces and to shock loads.
Mr. Archer, Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

742. EXPERIMENTAL STRESS ANALYSIS.
Experimental procedures for determination of stresses and strains due to static and dynamic loads.
Mr. Harris.

743. ELASTICITY.
General equations of the mathematical theory of elasticity in space. Plane strain and plane stress in cartesian, polar, and general orthogonal coordinates.
Mr. Archer, Mr. Dzialo, Mr. Nash, Mr. Stockton.

744. THEORY OF PLATES.
Classical theory of plates as well as modern developments. Relationship of the general theory of elasticity to plate theory.
Mr. Archer, Mr. Dzialo, Mr. Nash, Mr. Stockton.

745. STRUCTURAL STABILITY.
Linear and non-linear buckling of columns, frames, plates and shells; elastic, inelastic, and finite deformation theories. Exact solutions and approximate solutions by energy and finite difference methods.
Mr. Archer, Mr. Chajes, Mr. Nash.

746. SEISMIC ANALYSIS OF STRUCTURES.
Principles of engineering seismology including the analysis and design of structures to resist earthquake motions.
Prerequisite, CE 741.
Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

747. STRUCTURAL DYNAMICS II.
A continuation of CE 741. Emphasis on analysis of civil engineering structures subject to various steady state and transient loadings.
Prerequisite, CE 741.
Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

748. STRUCTURAL SHELLS.
Analysis of structural shells. Membrane theory, bending theory of shells of revolution, shear deformation shell theory, nonlinear theories, stability.
Prerequisite, permission of instructor.
Mr. Archer, Mr. Nash.

751. FLUID MECHANICS OF THE OCEANS (OE 711).
An introduction to geophysical fluid dynamics. Emphasis on interactions between the oceans and the atmosphere.
Prerequisites, CE 556 and 559.
Mr. Colonell, Mr. Mangarella.

752. OCEAN WAVE THEORY (OE 712).
Classical theory of water waves, generation and propagation of waves at sea, observation and recording of waves, wave spectra and sea forecasting, tsunami propagation and detection.
Prerequisites, CE 559 and 556. Mr. Colonell.

763. SUBSURFACE HYDROLOGY.
Interrelation of surface and subsurface hydrology. Saturated and unsaturated flow in permeable media. Development and utilization of subsurface waters. Chemical, bacteriological, and physical aspects of ground water quality. Deep well liquid wastes disposal.
Prerequisite, CE 660 or permission of instructor.
Mr. Adrian.

764. COASTAL ENGINEERING (OE 777).
Estuary and coastline hydrodynamics. Emphasis on environmental considerations in the planning, design, and operation of engineering works in coastal wafers.
Prerequisite, CE 559 or permission of instructor.
Mr. Colonell.

770. ENVIRONMENTAL ENGINEERING DESIGN.
Selection, evaluation, and design of environmental engineering processes and systems based on laboratory evaluations and pilot plant studies.
Prerequisites, CE 771 and 772.
Mr. DiGiano, Mr. Lindsey.

771. UNIT PROCESSES OF ENVIRONMENTAL ENGINEERING.
Application of biological processes in environmental engineering: aerobic and anaerobic biological oxidation. Design of aeration and disinfection subsystems.
Prerequisite, CE 669 and 670. Mr. Lindsey.

772. UNIT OPERATIONS OF ENVIRONMENTAL ENGINEERING.
Application of physical and chemical processes in environmental engineering: sedimentation, flotation, filtration, adsorption, ion exchange, drying and chemical coagulation.
Prerequisites, CE 669 and 670. Mr. DiGiano.

773. AIR SAMPLING AND ANALYSIS.
Applications of fluid mechanics and gas laws to measurement and collection of gaseous atmospheric pollutants including those which are injurious to health. Manual and automated analysis of these pollutants by electrochemical, spectrophotometric and gravimetric techniques.
Prerequisite, Public Health 632 or permission of instructor.
Mr. DiGiano, Mr. DiNardi.

774. ADVANCED WASTE TREATMENT.
Application of new techniques for treatment of waste water with the ultimate objective of providing closed-cycle use. Methods of removing nonbiodegradables and inorganics from wastewater using physical and chemical processes.
Prerequisites, CE 771 and 772. Mr. DiGiano.

775. ENVIRONMENTAL SYSTEMS SIMULATION.
Theoretical and practical factors governing simulation in environmental engineering systems. Mathematical models of water resoures, water supply, waste treatment and disposal systems.
Prerequisites, Math 187 and CE 270.
Mr. Adrian, Mr. Mangarella.

776. BIO-INSTRUMENTATION OF ENVIRONMENTAL SYSTEMS.
Instrumentation and analytical techniques for research on biological, biochemical, and chemical systems influencing man's environment. Spectral theory and absorption spectroscopy, chromatographic and mass spectrographic analysis, automatic analysis instruments.
Prerequisite, CE 672 or equivalent. Mr. Kuzminski.

780. MECHANICS OF MATERIALS.
Advanced topics related to the mechanical behavior of structural materials. Mr. Harris.

781. MATERIALS FOR SUBMARINE STRUCTURES (OE 731).
The response of materials subjected to high compressive loadings in the sea water medium; theory of deformation and fracture under high compressive stress; brittle-ductile transition in materials; stress corrosion, corrosion fatigue.
Prerequisite, CE 580. Mr. Harris.

783. STRUCTURAL MECHANICS OF DEEP SUMERSIBLE VEHICLES (OE 763).
Elastic and inelastic action of pressure hull structure for deep submersible vehicles. Presentation of design criteria for stiffened shells and plating common to such systems.
Prerequisites, CE 141 (MAE 246) or CE 240.
Mr. Nash.

792. DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN II (OE 772).
A continuation of systems engineering applied to deep ocean systems (CE 591). The class, organized and operating as a multidisciplinary engineering team, executes engineering and design for one or more complete systems.
Three class hours, one 3-hour laboratory period.
Prerequisite, CE 591. *Credit, 4.* Mr. Heronemus.

793. PUBLIC POLICY AND THE USE OF THE SEAS (OE 773).
Policies of the United States and other nations toward possession and use of the seas. Laws and agreements relating to jurisdiction in the marine frontier. Use of continental shelf,

world-wide navigation systems, exploitation of natural resources, pollution of the oceans.
One class hour. *Credit, 1.* Mr. Heronemus.

794. FUNDAMENTALS OF NAVAL ARCHITECTURE (OE 774).
Vehicle buoyancy and stability. Vehicle resistance and production of thrust. Motion of surfaced and submerged bodies. Vehicle maneuvering and control. Towing and mooring line analysis.
Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Adams, Mr. Heronemus.

795. OCEAN ENGINEERING FIELD LABORATORY I (OE 775).
Introduction to oceanographic measurements and field operations related to waves, currents, seawater characteristics, materials durability, and marine instrumentation techniques. Preliminary design of field engineering project.
Prerequisite, completion of Ocean Engineering core curriculum. (Summer only.)

796. OCEAN ENGINEERING FIELD LABORATORY II (OE 776).
Design, fabrication, installation, and evaluation of instrumentation involved in ocean engineering. Emphasis on development of practical engineering approaches to problems in the ocean environment.
Prerequisite, CE 795. (Summer only.)

850, 851. SEMINAR.
Presentation by the graduate student of selected current literature and research. Visiting lecturers. One class hour.
Credit, 1.

800. MASTER'S THESIS. *Minimum credit, 6.*

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit).

522. SOIL TESTING.
Sampling and testing of soils for engineering purposes.
One class hour, two 3-hour laboratory periods.
Prerequisite, CE 220 or equivalent. Mr. Bemben.

523. SOIL MECHANICS FOR TRANSPORTATION ENGINEERING.
Application of the principles of soil mechanics to the field of Transportation Engineering. Topics include evaluation of the stability of soils as subgrade and embankment materials, the role of the subgrade properties of soils on the design of pavements, and methods for improving the subgrade properties of soils.
Prerequisite, CE 220. Mr. Bemben.

532. THEORY OF STRUCTURES II.
Analysis of statically indeterminate structures.
Prerequisite, CE 230.
Mr. Archer, Mr. Chajes, Mr. Nash, Mr. Stockton.

534. THEORY OF STRUCTURES III.
Analysis of complex or special structures.
Prerequisite, CE 232; corequisite CE 331 and 333.
Mr. Miller.

535. MATRIX ANALYSIS OF STRUCTURES.
Development and use of the flexibility and stiffness methods of matrix analysis for determinate and indeterminate structures.
Prerequisite, CE 232.
Mr. Archer, Mr. Chajes, Mr. Stockton.

540. STRENGTH OF MATERIALS II.
Calculation of stresses and strains in components of machines and structures.
Prerequisite, CE 141.
Mr. Archer, Mr. Chajes, Mr. Dzialo, Mr. Stockton, Mr. White.

556. INTRODUCTION TO HYDRODYNAMICS.
Mathematical treatment of basic theorems of classical hydrodynamics: potential flow, conformal mapping, wave and vortex motion. Practical application of hydrodynamic principles to engineering problems.
Prerequisite, Math 186 or permission of instructor.
Mr. Carver, Mr. Colonell.

559. ENGINEERING OCEANOGRAPHY (OE 510).
Fluid mechanics problems of ocean and coastal engineering including currents, tides, surface waves, tsunami and seiche phenomena, and coastal processes.
Prerequisite, CE 257 or permission of instructor.
Mr. Colonell, Mr. Mangarella.

561. OPEN-CHANNEL FLOW.
Steady flow in open channels including channel transitions and controls, sediment transport, and elementary design of related hydraulic structures.
Prerequisite, CE 260. Mr. Higgins, Mr. Mangarella.

575. ATMOSPHERIC DISPERSION OF POLLUTANTS.
Physical and dynamical properties of the atmosphere and their effect on dispersion of air-borne material. Methods of calculation of concentration fields in simple and complex flowfields. Practical approaches to the analysis of diffusion from point, jet, and urban area sources. Review of research techniques for measuring diffusion parameters.
Prerequisite, Math 174. *Credit, 2.* Mr. Halitsky.

581. MATERIALS IN THE OCEAN ENVIRONMENT (OE 530).
The response of structural materials to the ocean environment. Theories of corrosion, abrasion, erosion, and biological attack.
Prerequisite, Marine Sci 525. Mr. Harris.

590. ENGINEERING DESIGN OF OCEAN SYSTEM PAYLOAD DEVICES (OE 570).
Techniques for augmentation of man's ability to measure, test, and synthesize the ocean environment through the development of tethered, towed, or stationary equipment. Topics include underwater photography, lighting, manipulative and prosthetic devices, data-gathering equipment, and underwater equipment design.
Prerequisite, Marine Sci 525.

591. DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN I (OE 571).
Systems engineering applied to analysis and synthesis of systems capable of doing useful work in the deep oceans. Emphasis on design of deep-submergence vehicles. Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Heronemus.

605. ADVANCED SURVEYING.
Elements of astronomical, geodetic, and photogrammetric surveying; coordinate systems and map projections.
Two class hours, one 3-hour laboratory period.
Prerequisite, CE 101. Mr. Boyer, Mr. Weidmann.

611. TRAFFIC ENGINEERING.
Engineering solutions to planning, design, and operations problems of urban and rural street and highway networks.
Two class hours, one 3-hour laboratory period.
Prerequisite, CE 210. Mr. Boyer, Mr. Webster.

634. ADVANCED TOPICS IN CONCRETE.
Design of various types of reinforced concrete-building frames; elastic theory and ultimate strength procedures.
Prerequsites, CE 232 and 333.
Mr. Miller.

657. THEORY OF HYDRAULIC SIMILITUDE.
Hydraulic similitude, dimensional analysis, methods of obtaining dynamic similarity in hydraulic models in actual practice, analysis of typical hydraulic models.
Prerequisite, CE 257. Mr. Carver.

660. HYDROLOGY.
The hydrologic cycle, including precipitation, runoff, ground water, flood routing, reservoir sedimentation, water law, and applications of hydrologic techniques to water resources engineering.
Prerequisite, CE 260 or permission of instructor.
Mr. Higgins.

662. WATER RESOURCES ENGINEERING.
Planning and design of dams, reservoirs, and other related hydraulic structures, including analysis of existing and proposed water resources projects.
Prerequisite, CE 260 or permission of instructor.
Mr. Higgins.

665. ENVIRONMENTAL INSTITUTIONS AND POLICIES.
Public policies and laws relating to the use and conservation of water, air, land resources. Analysis of environmental-related governmental organizations at the federal, state, and local levels.
Prerequisite, permission of instructor.
Mr. Adrian, Mr. Berger.

669. ENVIRONMENTAL ENGINEERING TECHNOLOGY.
The technology available to provide clean air, clean water, and to dispose of solid waste. Some field trips to see environmental effects, treatment plants, and quality-monitoring stations.
One 4-hour laboratory (or field trip) and one 1-hour lecture.
Prerequisite, permission of the instructor. *Credit*, 2.

670. ADVANCED ENVIRONMENTAL ENGINEERING PRINCIPLES.
The underlying physical, chemical, and biological principles involved in engineering studies of air, water, and solid-waste pollution problems are developed. Basic concepts are combined to model pollution-control systems and responses of the atmospheric, aquatic, and terrestrial environments.
Prerequisite, permission of instructor. Mr. DiGiano.

671. INDUSTRIAL WASTE TREATMENT AND CONTROL.
Composition of industrial effluents; pollution criteria and effects of industrial wastes on receiving waters; physical, chemical, and biological methods and applications in treatment.
Two class hours, one 3-hour laboratory period.
Prerequisite, permission of instructor. Mr. Lindsey.

672. ENVIRONMENTAL ENGINEERING ANALYSIS I.
An application of chemical principles to environmental engineering analysis with specific reference to pollution indices. Two class hours, one 3-hour laboratory period.
Prerequisite, Chem 112. Mr. Kuzminski.

673. ENVIRONMENTAL ENGINEERING ANALYSIS II.
The fundamental microbiological and biochemical properties of the microorganisms important in environmental engineering practice. Two class hours, one 3-hour laboratory period.
Prerequisite, CE 672 or permission of instructor.
Mr. Kuzminski.

674. RADIOLOGICAL HEALTH ENGINEERING.
Basic principles and procedures pertaining to the safe control, use, and disposal of common sources of ionizing radiation. Mr. Marcus.

675. SURFACE WATER QUALITY CONTROL.
Evaluation and control of water quality in streams, lakes, and reservoirs. Mathematical analyses of patterns of water movement and their relation to water quality.
Prerequisite, permission of instructor.
Mr. Feng.

676. SOLID WASTES.
Production, collection, transportation, treatment, and disposal of solid waste products (including municipal, industrial, and agricultural wastes).
Prerequisite, permission of instructor.
Mr. Kuzminski.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in Civil or Environmental Engineering)

520. SOIL MECHANICS.
Engineering uses and mechanical properties of soils.
Two class hours, one 3-hour laboratory period.
Mr. Hendrickson.

571. INTRODUCTION TO ENVIRONMENTAL POLLUTION CONTROL.
Basic engineering aspects of environmental pollution control.
Mr. Feng, Mr. Ward.

Environmental Engineering Program

GRADUATE FACULTY
(see under Civil and Chemical Engineering and Public Health for degrees, institutions, and years.)

JAMES HALITSKY, *Associate Professor of Civil Engineering and Director of the Environmental Engineering Program.*

DONALD DEAN ADRIAN, *Professor of Civil Engineering.*

BERNARD B. BERGER, *Professor of Civil Engineering and Public Health and Director of Water Resources Research Center.*

JOSEPH M. COLONELL, *Associate Professor of Civil Engineering.*

FRANCIS A. DIGIANO, *Assistant Professor of Civil Engineering.*

SALVATORE R. DINARDI, *Assistant Professor of Public Health.*

TSUAN H. FENG, *Professor of Civil Engineering and Agricultural Engineering.*

GEORGE R. HIGGINS, *Professor of Civil Engineering.*

LAWRENCE N. KUZMINSKI, *Assistant Professor of Civil Engineering.*

E. ERNEST LINDSEY, *Professor of Chemical Engineering.*

PETER A. MANGARELLA, *Assistant Professor of Civil Engineering.*

HOWARD A. PETERS, *Associate Professor of Public Health and Civil Engineering.*

ROSCOE F. WARD, *Associate Professor of Civil Engineering and Associate Dean of the School of Engineering.*

The Environmental Engineering Program offers both M.S. and Ph.D. degrees. The overall objective of the Program is to prepare students for careers in engineering related to development of a better environment. This requires an understanding of water, air, and solid-waste treatment and disposal inasmuch as the processing of waste in one medium usually results in transfer of a by-product to one or both of the other media. Accordingly, the Environmental Engineering Master of Science curriculum requires each student to take a common core of fundamentals in the three media, while allowing him to pursue a subsequent specialty, in consultation with his adviser and in keeping with his career goals. The Ph.D. program has considerable flexibility to accommodate students who have been trained in various related or unrelated disciplines.

REQUIREMENTS FOR THE MASTER'S DEGREE

1. The Environmental Engineering Core.

Courses in the Core are intended to provide students from many different backgrounds with a technical

foundation for more advanced environmental engineering courses, as well as an understanding of the institutions and policies common to control of water and air quality and land usage. The core consists of the following:

Civil Engineering 665, 669, 670, 850, 851, and one environmental engineering laboratory course (CE 672, 673, 770, 773, 776). Total Core Credits, 13.

2. At least three courses listed in the Areas of Specialization.

Beyond the Core, environmental engineering elective courses have been conveniently grouped into three descriptive areas—systems, design, and science—each of which includes offerings in water, air and land resources. These are listed below:

Systems: CE 660, 662, 675, 764, 775, and Agricultural and Food Economics 582.

Design: CE 671, 676, 770, 771, 772, 774, Chemical Engineering 660, and Mechanical and Aerospace Engineering 577.

Science: CE 575, 672, 673, 674, 773, 776, and Public Health 632.

3. Thesis (six credits) or Special Problem (three credits).

4. Additional graduate credit courses which intensify a student's professional career goals. These are available in the fields of Engineering, Chemistry, Computer Science, Geology, Marine Science, Microbiology, Public Health, Statistics, Regional Planning, and Zoology. For example, rather than electing the more traditional environmental engineering program of study, a student may elect one reflecting an interest in environmental management by taking nine credits in Regional Planning and/or Economics.

5. Although the program is administered by the Department of Civil Engineering, individuals with a baccalaureate from accredited institutions in fields other than Civil Engineering are encouraged to apply.

A student who has a baccalaureate in engineering other than Civil Engineering is required to attain a certain level of proficiency in the following areas:

1. Statics (CE 140).
2. Fluid Mechanics (CE 257).
3. Fluid Mechanics Laboratory (CE 258).
4. Engineering Hydraulics (CE 260).
5. Basic Environmental Engineering (CE 270).

A student who has a baccalaureate in a field other than engineering must satisfy the mathematics and science requirements which are normally specified in an accredited undergraduate engineering program.

6. All general Graduate School requirements for admission and for the degree must be met. A total of 31 credits must be earned.

REQUIREMENTS FOR THE PH.D. DEGREE

1. Forty-eight credits of approved graduate-level course work beyond the bachelor's degree, of which two minor areas provide a minimum of 18 credits. Suitable minor areas include:

a. Chemical, Biological, or Physical Science.
b. Mathematics, Computer Science or Statistics.
c. Chemical Engineering or Agricultural Engineering.
d. Systems analysis, which may include courses offered in Industrial, Chemical, Electrical, and Mechanical Engineering.
e. Public Health or Environmental Science.
f. Economics, Planning, and Management.

2. There is no specific language requirement other than that which may be determined by the student's Guidance Committee. In certain cases the Guidance Committee might specify that the student's research objective might necessitate some knowledge of a language; in other cases, course work from other schools or departments on the campus might be appropriate.

Ocean Engineering

GRADUATE FACULTY

(See under listed fields for degrees, institution, and years.)

John W. Zahradnik, *Professor of Mechanical and Aerospace Engineering and Coordinator of the Ocean Engineering Program.*

Clayton R. Adams, *Associate Professor of Civil Engineering.*

Stanley M. Bemben, *Associate Professor of Civil Engineering.*

Charles E. Carver, Jr., *Professor of Civil Engineering.*

Joseph M. Colonell, *Associate Professor of Civil Engineering.*

Duane E. Cromack, *Associate Professor of Mechanical and Aerospace Engineering.*

Denton B. Harris, *Assistant Professor of Civil Engineering.*

William E. Heronemus, *Professor of Civil Engineering.*

Francis S. Hill, Jr., *Assistant Professor of Electrical and Computer Engineering.*

Charles E. Hutchinson, *Professor of Electrical and Computer Engineering.*

E. Ernest Lindsey, *Professor of Chemical Engineering.*

Peter A. Mangarella, *Assistant Professor of Civil Engineering.*

Melton M. Miller, Jr., *Associate Professor of Civil Engineering.*

Richard V. Monopoli, *Professor of Electrical and Computer Engineering.*

William A. Nash, *Professor of Civil Engineering.*

John E. Ritter, Jr., *Associate Professor of Mechanical and Aerospace Engineering.*

G. Albert Russell, *Associate Professor of Mechanical and Aerospace Engineering.*

G. Dale Sheckels, *Professor of Electrical and Computer Engineering.*

Fred D. Stockton, *Associate Professor of Civil Engineering.*

Ocean Engineering is that activity which combines knowledge of the oceans with engineering skill to preserve and utilize the oceans, their contents and boundaries, for the achievement of human objectives.

The Ocean Engineering Program is administered as a degree-granting sub-division of the Civil Engineering Department; however, the administrative mechanism provided preserves the interdisciplinary nature of ocean engineering as an objective of academic pursuit. Present programs lead to the Master of Science in Ocean Engineering and Doctor of Philosophy degrees.

Programs leading to the degree of Master of Science in Ocean Engineering are designed to promote understanding of the ocean environment while developing greater competence in a field of engineering applicable to ocean-oriented technical problems. The holder of this degree will have attained a general broad knowledge of ocean technology as it pertains to engineering endeavors, and, in addition, will have gained sufficient depth in his or her chosen professional specialty to approach ocean problems with confidence.

Doctoral study programs in ocean engineering have been designed to prepare individuals for high-level professional careers in academic, governmental, or industrial situations. Substantially greater competence in ocean technology is required of doctoral candidates, but professional breadth has not been sacrificed to attain this goal. Although the research leading to the doctoral dissertation assumes a predominant role in the study program, the problem-oriented character of professional engineering is preserved in selection of the research topic. Upon completion of an approved course of study, award of the doctoral degree indicates that the candidate has demonstrated excellence in a field of engineering which has significant relevance to ocean technology, and has acquired sufficient knowledge of oceanic processes to function in that field with due regard for the ocean environment.

To aid the definition of requirements for the degree programs described above, the formal courses available to students of ocean engineering are classified according to whether they are "core" or "specialty" courses. The course requirements for each degree are prescribed in terms of a "core curriculum" and, in addition, one or more groups of courses which combine to form areas of specialized knowledge, or "specialties," in an ocean engineering study program.

The core curriculum is a group of basic courses that will normally be required of every degree candidate in ocean engineering. The purpose of the core curriculum is to establish a base of knowledge which permits and encourages further study and eventual specialization.

At least five "specialties" are available among the ocean engineering courses:

1. Acoustics
2. Applied Physical Oceanography
3. Ocean Systems Engineering and Design
4. Ocean Structures and Materials
5. Systems for Aquacultural Engineering

Each specialty represents an area of specialized knowledge which is supported by courses from one or more of the traditional disciplines of engineering and science. Proficiency in at least one of the available specialties is required of candidates for the degree of Master of Science in Ocean Engineering. Doctoral candidates are required to pursue at least one specialty in considerable depth, and proficiency in a second area is encouraged. The means for demonstrating these proficiencies are discussed as specific requirements for each of the degrees.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN OCEAN ENGINEERING

All University requirements pertaining to the master's degree must be fulfilled. The following minimum requirements and information refer specifically to the degree of Master of Science in Ocean Engineering.

1. It is assumed that a student seeking this degree will have a baccalaureate in either engineering or science, with sufficient mathematics, physics, and chemistry to undertake graduate studies in engineering. To facilitate the determination of the adequacy of undergraduate preparation, the potential degree candidate should be able to demonstrate proficiency in the following subject areas:
(a) general chemistry and physics
(b) calculus and elementary differential equations
(c) engineering mechanics (fluid and solid)
(d) basic thermodynamics and heat transfer
(e) basic electrical circuits

2. Three core courses must be included in the program of every candidate. Two core courses are specified:
(a) MS 525. Introductory Oceanography.
(b) OE 510 (CE 559). Engineering Oceanography.
The third core course is to be chosen from the following:
(c) OE 530 (CE 580). Materials in the Ocean Environment.
(d) OE 550 (EE 587). Marine Instrumentation.
(e) OE 570 (CE 590). Engineering Design of Ocean System Payload Devices.
(f) OE 571 (CE 591). Deep Ocean Systems Engineering and Design I.

3. Every candidate must complete two or more courses in a single specialty of the ocean engineering curriculum.

4. All candidates for this degree will complete a thesis which will account for at least six credits in the 30-credit program.

5. Nine of the 30 credits required for this degree may be satisfied by a selection of electives which are approved by the Candidate's adviser. Electives are not restricted to engineering courses but they must form a cohesive program with a clearly defined objective. No more than three credits of Special Problems may be included in the program.

6. If coursework is pursued on a full-time basis it should be possible to complete the requirements for this degree in one calendar year. However, if financial aid is obtained through an assistantship, or if undergraduate deficiencies must be removed by additional coursework, a somewhat longer time will be necessary for completion of all requirements.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

All University requirements pertaining to this degree must be fulfilled. The following minimum requirements and information refer specifically to doctoral studies undertaken within the Ocean Engineering Program.

1. It is assumed that a student seeking this degree will have a baccalaureate in either engineering or science, with sufficient mathematics, physics, and chemistry to undertake studies in engineering. To facilitate the determination of the adequacy of undergraduate preparation, the potential degree can-

didate should be able to demonstrate proficiency in the following subject areas:
(a) general chemistry and physics
(b) calculus and elementary differential equations
(c) engineering mechanics (fluid and solid)
(d) basic thermodynamics and heat transfer
(e) basic electrical circuits

2. A core curriculum must be included in the study program of every doctoral candidate. Any or all of the core courses may have been utilized to satisfy requirements for the degree of Master of Science in Ocean Engineering; however, that degree is not a prerequisite for doctoral studies in Ocean Engineering. The core curriculum is composed of six courses:
(a) MS 525. Introductory Oceanography.
(b) OE 510 (CE 559). Engineering Oceanography.
(c) OE 530 (CE 581). Materials in the Ocean Environment.
(d) OE 550 (EE 587). Marine Instrumentation.
(e) OE 570 (CE 590). Engineering Design of Ocean System Payload Devices.
(f) OE 571 (CE 591). Deep Ocean Systems Engineering and Design I.

3. No specific course requirements other than the core curriculum are prescribed for the doctoral program. It is the obligation of the candidate, under the direction of the adviser, to propose a unified program of study and research which will lead to the achievement of specified academic and professional objectives. The proposed program should reflect the philosophy of doctoral studies already set forth in this section; that is, a professional engineering viewpoint of ocean technology must be evident. The program must receive the unanimous approval of the candidate's Guidance Committee.

4. All candidates will be required to obtain a first-hand familiarity with the oceanic environment. Normally, this experience can be obtained through responsible participation in a prolonged oceanographic cruise or coastal laboratory research project. Faculty of the Ocean Engineering Program can provide assistance in the arrangement of the appropriate experience for the candidates.

5. If coursework and dissertation research are pursued on a full-time basis, it should be possible to complete the requirements for the Ph.D. degree in approximately two calendar years following the award of a degree of Master of Science in Ocean Engineering. If financial aid is obtained through an assistantship, a somewhat longer time will be necessary for completion of all requirements. Prospective candidates will be urged to plan on the more realistic estimate of approximately three calendar years to complete the degree requirements following the award of the M.S. degree.

6. Preparation of dissertations *in absentia* will not generally be approved.

COURSE OFFERINGS IN OCEAN ENGINEERING

Study programs in Ocean Engineering typically consist of courses from two categories: (a) courses which are specifically oriented to ocean problems and thus carry the Ocean Engineering designation (an OE number) and (b) courses which enhance the preparation for any of the Ocean Engineering specialties but are not necessarily oriented to ocean problems. The proper selection of courses from both of these categories can ensure acquisition by the student of a broad ocean-associated knowledge combined with an acceptable level of professional competence. Ocean Engineering courses are grouped below according to the established Program specialty areas. Course descriptions are given under the parenthesized departmental course numbers.

Acoustics

OE 701 (EE 764).	UNDERWATER ACOUSTICS.

Applied Physical Oceanography

OE 510 (CE 559).	ENGINEERING OCEANOGRAPHY.
OE 711 (CE 751).	FLUID MECHANICS OF THE OCEANS.
OE 712 (CE 752).	OCEAN WAVE THEORY.
OE 777 (CE 764).	COASTAL ENGINEERING.

Ocean Systems Engineering and Design

OE 550 (EE 587).	MARINE INSTRUMENTATION.
OE 570 (CE 590).	ENGINEERING DESIGN OF SYSTEM PAYLOAD DEVICES.
OE 571 (CE 591).	DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN I.
OE 721 (EE 725).	ENERGY STORAGE AND CONVERSION.
OE 772 (CE 792).	DEEP OCEAN SYSTEMS ENGINEERING DESIGN II.
OE 773 (CE 793).	PUBLIC POLICY AND THE USE OF THE SEAS.
OE 774 (CE 794).	FUNDAMENTALS OF NAVAL ARCHITECTURE.
OE 775, 776 (CE 795, 796).	DEEP OCEAN SYSTEMS ENGINEERING FIELD LABORATORY I, II.

Ocean Structures and Materials

OE 530 (CE 580).	MATERIALS IN THE OCEAN ENVIRONMENT.
OE 731 (CE 781).	MATERIALS FOR SUBMARINE STRUCTURES.
OE 761 (CE 724).	SUBMARINE SOIL MECHANICS AND ENGINEERING.
OE 763 (CE 783).	STRUCTURAL MECHANICS OF DEEP SUBMERSIBLE VEHICLES.
OE 764 (CE 737).	COASTAL STRUCTURES.
OE 765 (CE 738).	ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES.

Systems for Aquacultural Engineering

OE 591 (MAE 555, FAE 555).	AQUACULTURAL ENGINEERING SYSTEMS.

Classics

GRADUATE FACULTY

Gilbert W. Lawall, *Professor and Head of the Department of Classics*, B.A., Oberlin College, 1957; Ph.D., Yale University, 1961.

Vincent J. Cleary, *Associate Professor and Graduate Program Director*, B.S., St. Joseph's College, 1954; M.A., Villanova University, 1959; Ph.D., University of Pennsylvania, 1967.

Leora Baron, *Assistant Professor*, B.A., University of Massachusetts, 1970; M.A., 1971; Ed.D., 1973.

Robert H. Dyer, *Professor,* B.A., Auckland University College, 1954; M.A., University of New Zealand, 1955.

Robert J. Goar, *Assistant Professor,* B.A., Harvard College, 1954; M.A., Harvard University, 1958; Ph.D., 1968.

Charles Isbell, *Assistant Professor,* A.B., Bethany Nazarene College, 1966; M.A., 1967; Ph.D., Brandeis University, 1973.

John D. Marry, *Instructor,* B.A., Fordham University, 1968; Ph.D., Stanford University, 1973.

Edward Phinney, Jr., *Professor,* B.A., University of Oregon, 1957; M.A., 1959; Ph.D., University of California at Berkeley, 1963.

Niki Scoufopoulos, *Visiting Associate Professor of Classical Humanities* (spring, 1974), A.B., Barnard College, 1960; M.A., Yale University, 1962; Ph.D., 1965.

Elizabeth Lyding Will, *Assistant Professor,* B.A., Miami University, 1944; M.A., Bryn Mawr College, 1945; Ph.D., 1949.

The degree of Master of Arts in Teaching (M.A.T.) may be earned in Latin and Classical Humanities. The program is designed to prepare students for teaching careers in secondary schools. It requires two full years of work and may include study in Italy during the summer. Teaching assistantships and summer scholarships are available. A minimum of 39 credits is required, distributed as follows: 21 credits in Latin and Classical Humanities, nine credits in professional education, and nine credits in a teaching practicum accompanied by a seminar. The credits in Classical Humanities may include courses in art, history, philosophy, English, and comparative literature. Courses may be taken at the neighboring colleges (Amherst, Mount Holyoke, and Smith) under the Five College Cooperation Program. Supervised practice teaching is done in Latin and classics courses at the University (pre-practicum) and in secondary schools (practicum). Special innovative projects and pilot programs are being conducted in schools throughout the state, staffed by M.A.T. candidates at the University. All students in the program must equip themselves with a minor in some other teaching field such as English, French, Spanish, history, or mathematics. At least 18 credits of undergraduate and graduate work must be earned in the minor field. Much or all of this should be done at the undergraduate level before the student enters the M.A.T. program. Applicants should also have completed courses in educational or adolescent psychology and foundations or philosophy of education at the undergraduate level.

The following Latin teachers in the state will serve as Consultants to the Master of Arts in Teaching program in Latin and Classical Humanities for the 1973/1974 academic year: Mary Faherty (Framingham North High School), Marie Frisardi (Boston Latin School), Kevin O'Mally (Somerville High School), and Lorraine Teller (Northampton-Williston School). These teachers will be available to meet with the M.A.T. students periodically throughout the year, and they will help arrange innovative practice teaching experiences in Latin and Classical Humanities in their own and other schools in the state.

Classics

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

CLASSICS 505. THE MATERIAL WORLD OF THE ROMANS.
The Romans as people on the basis of the archaeological evidence about their daily lives (their houses, pottery, coins, glass, textiles). Special attention to the finds from Pompeii.
Three class hours, plus tutorial session.

CLASSICS 506. THE ANCIENT CITY.
The city and the rise of city-planning in antiquity in the Near East, Greece, and Italy; stress on sociological and economic aspects. Special attention to the city of Rome and its urbanization in the Roman Empire.
Three class hours, plus tutorial session.

CLASSICS 528. RELIGIONS OF THE GREEK WORLD.
Origins and development of ancient Greek worship, deities, cults, festivals, and life-crisis ceremonies; prehistoric, Near-Eastern, and Indo-Iranian influences; chauvinistic, philosophical, and mystical reactions to received religion.
Three class hours, plus tutorial session.

CLASSICS 529. RELIGIONS OF THE ROMAN WORLD.
Origins and development of native Roman worship, deities, cults, festivals, and life-crisis ceremonies; importation of Greek, Asiatic, Hebrew, Egyptian, and Indo-Iranian cults and festivals; nature and causes of the failure of paganism and the victory of Christianity.
Three class hours, plus tutorial session.

CLASSICS 585. THE DEEP STRUCTURES OF GREEK THOUGHT.
The development of thought in the Greek world from Homer to Aristotle, tracing the evolution of mental concepts and ways of thinking about man and the world around him.
Three class hours, plus tutorial session.

CLASSICS 595. INTERPRETING ANCIENT MYTH.
What some thinkers have said about ancient myth for over 3,000 years; possible reasons for their misreading ancient myth; their prejudices and presuppositions, their shaping of popular modern views of ancient myth; their inability to reach a common definition of myth; future trends of myth interpretation.
Prerequisite, Classics 525 or 526 or permission of instructor.
Three class hours, plus tutorial session.

CLASSICS 608. THE TEACHING OF CLASSICAL HUMANITIES IN SECONDARY SCHOOLS.
Guidance in preparing enrichment material in Latin language classes and in designing and teaching courses dealing with classical life and institutions, drama, art, mythology, and literature in translation on the secondary level.

CLASSICS 610. STUDENT TEACHING: CLASSICS.
Supervised practice teaching in secondary schools.
Credit, 1-12.

CLASSICS 700. SPECIAL PROBLEMS.
Directed study of some problem in classical civilization.
Credit, 1-6.

CLASSICS 701. THE ROMAN CITY.
The topography, monuments, and daily life of selected Roman cities with emphasis on Rome itself. Sociological, economic, and environmental factors in ancient city planning. May involve travel and study in Italy. By arrangement.
Credit, 3-6.

Greek

GREEK 700. SPECIAL PROBLEMS.
Directed study of some problem in Greek literature.
Credit, 1-6.

Latin

Latin 505. ORAL INTERPRETATION OF LATIN LITERATURE.
Practice in the expressive reading of Latin texts.
One class hour. *Credit, 1.*
May be repeated up to 3 credits.

LATIN 515. ADVANCED GRAMMAR AND STYLE.
Structure of the language; evolution of grammatical and linguistic concepts and terminology used to describe it. Analysis of the style of representative Latin prose authors and exercises in composition in imitation of these authors.

LATIN 607. TEACHING THE LATIN LANGUAGE.
Methods and materials for teaching the Latin language in secondary schools. May be coordinated with practice teaching experiences. *Credit, 3-6.*

LATIN 608. TEACHING LATIN LITERATURE.
Methods and materials for teaching Latin literature in secondary schools. May be coordinated with practice teaching experiences. *Credit, 3-6.*

LATIN 610. STUDENT TEACHING: LATIN.
Supervised practice teaching in secondary schools.
Credit, 1-12.

(Two of the following courses—Latin 625-633—are offered each semester.)

LATIN 625. THE LATIN POLITICAL TRACT.
Selections from Sallust and Caesar accompanied by an historical and literary analysis of their works.

LATIN 626. LATIN DIDACTIC EPIC.
Selections from Lucretius, Vergil's *Georgics*, and Ovid's *Ars Amatoria.*

LATIN 627. LATIN HISTORY AND BIOGRAPHY.
Selections from Livy, Tacitus, and Suetonius.

LATIN 628. LATIN DRAMA.
Selected plays of Plautus, Terence, and Seneca.

LATIN 629. LATIN ESSAYS AND LETTERS.
The Roman mind as revealed in the philosophical works of Cicero and the moral epistles of Seneca; Roman private life and personal concerns as revealed in the letters of Cicero and Pliny.

LATIN 630. LATIN ELEGIAC POETRY.
Selections from Catullus, Tibullus, Propertius, and Ovid.

LATIN 631. CICERO'S ORATIONS.
The major orations of Cicero interpreted against their social and political background and analyzed according to ancient rhetorical theories.

LATIN 632. LYRIC POETRY.
Selected lyrics of Catullus and Horace.

LATIN 633. VERGIL'S *AENEID.*
The entire poem with attention to traditional and contemporary critical perspectives and evaluations.

LATIN 700. SPECIAL PROBLEMS.
Directed study of some problem in Latin literature.
Credit, 2-6.

LATIN 701. EXPLORING LATIN LITERATURE.
Exploratory readings in a variety of Latin authors.
Credit, 3-6.

LATIN 790. SEMINAR.
Intensive, advanced study of some aspect of Latin literature.
Credit, 3-6.

LATIN 800. MASTER'S THESIS.
Research and writing of a master's thesis. Optional.
Maximum credit, 9.

Communication Studies

GRADUATE FACULTY

James E. Lynch, *Professor and Chairman of the Department of Communication Studies,* B.A., 1948; M.A., 1949; Ph.D., Michigan, 1955.

Thomas W. Bohn, *Assistant Professor and Graduate Program Director,* B.A., Gustavus Adolphus College, 1963; M.S., Southern Illinois, 1964; Ph.D., Wisconsin, 1968.

Vincent M. Bevilacqua, *Professor,* B.A., 1957; M.A., Emerson, 1958; Ph.D., Illinois, 1961.

Jane Blankenship, *Associate Professor,* B.A., Akron, 1956; M.A., 1957; Ph.D., Illinois, 1961.

Arthur Boothroyd, *Associate Professor,* B.Sc., Kingston-upon-Hull, 1957; Ph.D., Manchester, 1968.

Kenneth L. Brown, *Associate Professor,* B.S., 1955; M.A., Syracuse, 1960; Ph.D., Northwestern, 1965.

Richard L. Conville, Jr., *Assistant Professor,* B.A., 1965; M.A., Samford, 1968; Ph.D., Louisiana State, 1970.

Vernon E. Cronen, *Assistant Professor,* B.A., Ripon College, 1963; M.A., 1968; Ph.D., Illinois, 1970.

Richard D. Harper, *Assistant Professor,* B.A., Vermont, 1948; M.A., 1949; Ph.D., Wisconsin, 1951.

Ronald J. Matlon, *Associate Professor,* B.A., Indiana State, 1960; M.S., 1962; Ph.D., Purdue, 1966.

Jay Melrose, *Professor,* B.A., Queens College, 1948; M.A., 1953; Ph.D., Illinois, 1954.

Timothy P. Meyer, *Assistant Professor,* B.A., Wisconsin State, 1967; M.A., 1969; Ph.D., Ohio University, 1970.

Gary P. Nerbonne, *Associate Professor,* B.S., Central Michigan, 1959; M.A., 1962; Ph.D., Michigan State, 1967.

Theodore L. Nielsen, *Assistant Professor,* B.A., State University of Iowa, 1955; Michigan, 1958; Ph.D., Wisconsin, 1971.

E. Harris Nober, *Professor,* B.A., 1951; M.A., Brooklyn College, 1952; Ph.D., Ohio State, 1957.

Henry B. Peirce, Jr., *Assistant Professor,* B.A., Massachusetts, 1950; M.A., Michigan, 1955; Ed.D., Boston University, 1970.

William K. Price, *Assistant Professor,* B.A., Maryland, 1954; M.S., 1960; Ph.D., Wisconsin, 1964.

Ronald F. Reid, *Professor,* B.A., Pepperdine College, 1950; M.A., New Mexico, 1951; Ph.D., Purdue, 1954.

Stewart R. Rood, *Assistant Professor,* B.S., Brooklyn College, 1967; Ph.D., Pittsburgh, 1972.

Charlena M. Seymour, *Assistant Professor,* B.A., Howard, 1965; M.A., 1967; Ph.D., Ohio State, 1971.

Harry N. Seymour, *Assistant Professor,* B.A., Howard, 1964; M.A., 1969; Ph.D., Ohio State, 1971.

Maurice E. Shelby, Jr., *Associate Professor,* B.A., Washington, 1960; Ph.D., Ohio State, 1963.

MALCOLM O. SILLARS, *Professor*, B.S., 1948; M.A., Redlands, 1949; Ph.D., State University of Iowa, 1955.

HERMANN G. STELZNER, *Professor*, B.A., Emerson, 1953; M.A., 1955; Ph.D., Illinois, 1957.

RICHARD L. STROMGREN, *Assistant Professor*, B.A., Massachusetts, 1954; M.A., Northwestern, 1958.

IAN B. THOMAS, *Associate Professor of Electrical Engineering*.

GILBERT C. TOLHURST, *Professor*, B.A., 1937; M.A., Brigham Young, 1946; Ph.D., Iowa, 1948.

KARL R. WALLACE, *Professor*, B.A., 1927; M.A., 1931; Ph.D., Cornell, 1933.

RICHARD L. WEAVER, II, *Assistant Professor*, B.A., 1964; M.A., Michigan, 1965; Ph.D., Indiana, 1969.

The Department of Communication Studies offers work leading toward the M.A., and Ph.D. degrees.

Graduate study leading to the Ph.D. in Communication Studies with a concentration in Communication and Rhetorical Theory emphasizes a combination of historical-critical and behavioral research methodologies for examining past and present phenomena of human communication.

Graduate study leading to the Ph.D. in mass communications emphasizes an interdisciplinary approach to the study of mass communications through which the graduate student interprets, consolidates, and makes more meaningful, information and research within the Department of Communication Studies and from other areas of the University interested in mass media. The program is designed to prepare students for academic careers and for research and development positions in commercial and public media.

Graduate study leading to the Ph.D. in communication disorders is designed to prepare students for academic careers and for positions as researchers in speech and hearing-science laboratories.

The department requires a research tool. It is up to the student's Guidance Committee to require the specific competencies deemed appropriate to the candidate's research. For example, students doing experimental research probably need advanced work in statistics or computer science; students doing historical-critical research in classical rhetoric probably need a reading-knowledge of more than one language.

Candidates for the M.A. degree should select one of the following major areas of concentration: (1) communication disorders (speech and hearing sciences), (2) mass communications, (3) communication and rhetorical theory, or (4) communication education.

Graduate study leading to the M.A. in communication disorders is designed to prepare students for careers as speech pathologists or audiologists or for doctoral study in these fields. Graduate work leading to an M.A. in mass communications provides the student with academic background for entering the communications industries in either educational or commercial media, and provides a foundation for doctoral study. The M.A. in Communication and Rhetorical Theory emphasizes theoretical, historical, and critical studies of these subjects and is designed primarily to prepare students for doctoral study and for careers in college and university teaching and research. Graduate work leading to the M.A. in Communication Education is a more general course of study to prepare candidates for secondary school teaching of interpersonal communication, oral interpretation, debate, theatre and mass communication.

Applicants to the graduate program should meet all requirements for admission to the Graduate School and either have a good undergraduate background in communication studies or proceed to correct deficiencies without graduate credit.

The M.A. degree is offered under thesis and nonthesis option. Candidates must complete a minimum of 30 credits for both options. The thesis option allows up to six credits for the thesis. A minimum of 60 credits beyond the bachelor's degree, exclusive of credits for dissertations is required for the Ph.D. Plans of study are prepared individually in consultation with faculty advisers.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Independent study in special subjects. Nor more than 9 credits may be applied toward the M.A. degree.
Credit, 1-3 each semester; maximum credit, 9.

707. SEMINAR IN MASS COMMUNICATIONS.
Revolving topics in mass communications; research papers, reports. Course may be repeated for credit; credit not granted for the same topic twice.
Prerequisite, 9 upper-division hours in mass communications and permission of instructor.

712. RHETORIC OF ARISTOTLE.
Intensive study of the *Rhetoric* in translation; related concepts in other works of Aristotle. Lectures, discussion, papers.
Mr. Wallace.

713. THEORIES OF LANGUAGE AND STYLE.
Theories of language and style from ancient times to the present. Emphasis on their application to rhetorical theory and criticism.
Prerequisite, 12 credits in communication and rhetorical theory. Miss Blankenship.

714. EXPERIMENTAL STUDIES IN PERSUASION THEORY.
Examination of quantitative research studies in persuasion. Attention to experimental research.
Prerequisites, Comm Studies 211/511 and 350/650.
Mr. Cronen.

715. DIRECTING THE FORENSIC PROGRAM.
Problems related to forensic programs: coaching individual and group activities, judging, tournament administration, and administration of the entire forensics program.
Prerequisite, permission of instructor. Mr. Matlon.

718. SEMINAR IN PUBLIC ADDRESS.
Selected topics in the history and criticism of public address.
Prerequisite, permission of instructor. May repeat for a total of 6 credits. Mr. Reid, Mr. Sillars.

719. SEMINAR IN RHETORICAL THEORY.
Selected topics in rhetorical theory; detailed consideration of the relationship of rhetoric to other disciplines, specific concepts, periods, and figures.
Prerequisite, permission of instructor. May repeat for a total of 6 credits.

720. SEMINAR IN MEDIA RESEARCH METHODS.
Historical, descriptive, critical, experimental, and quantitative mass communications research methodologies.
Prerequisite, 9 upper-division hours in mass communications and permission of instructor. May repeat for a total of 6 credits.

721. SEMINAR IN BROADCASTING.
Revolving topics pertaining to various political, social, and economic aspects of broadcasting; research papers, reports. Prerequisite, 9 upper-division hours in mass communications and permission of instructor. Course may be repeated for credit, but students may not receive credit for the same topic twice.

722. SEMINAR IN FILM.
Intensive study of topics in film history, theory, and criticism. Revolving topics.
Prerequisite, 9 upper-division hours in mass communications and permission of instructor. Course may be repeated; credit not granted for the same topic twice.

733. MASS PERSUASION.
The process, functions, and effects of persuasion on a mass level. The role of the mass media. Mr. Bohn.

734. FILM AND SOCIETY: THE CINEMA AS A SOCIAL FORCE.
The effective and reflective roles of film in society. Emphasis on the relationship of society to the structure, development, function, and effects of the motion picture. Mr. Bohn.

770. HISTORY OF COMMUNICATION EDUCATION.
Speech pedagogy from ancient Greece to the present. Emphasis on speech-communication education in America.
Mr. Brown.

771. SEMINAR IN COMMUNICATION PEDAGOGY.
Selected topics relevant to the principles and methods of teaching communication. Attention to communication and rhetorical theory. Mr. Brown, Mr. Price.

781. VOICE PROBLEMS.
Voice disorders, organic and functional; symptoms, and principles and techniques of therapy and diagnosis.
Prerequisites, Comm Studies 182 and 284 or equivalents.
Mr. Peirce.

782. ADVANCED CLINICAL PRACTICE.
Supervised clinical practice with children and adults with various speech and hearing disorders; group and individual therapy techniques.
Prerequisites, Comm Studies 181, 182 and 284 or equivalents.
Credits, 1-6.

783. INTRODUCTION TO EXPERIMENTAL PHONETICS.
Review of experimental research and instrumental approaches in the study and analysis of the phonetic elements of language. Individual student reports.
Prerequisites, Comm Studies 181, 284, or equivalents.
Mr. Nerbonne.

784. ORGANIC PATHOLOGIES OF SPEECH.
Etiology, classification, evaluation, and speech rehabilitation of cleft palate, laryngectomy, and other organic pathologies of speech.
Prerequisites, Comm Studies 283 and 284.

785. NEUROPATHOLOGIES IN COMMUNICATION DISORDERS I.
Principles concerning etiologies, instruments for evaluation, classification, and methods of clinical management of acquired aphasia and cerebral palsy.
Prerequisites, Comm Studies 284 or equivalent.

787. HEARING CONSERVATION AND INDUSTRIAL AUDIOLOGY.
Identification and management of the hearing-impaired in hospitals, public schools, and industry. Noise control and other preventative measures.
Prerequisite, Comm Studies 285.

788. ADVANCED CLINICAL AUDIOLOGY.
Theories, methodologies, and procedures for special diagnostic testing in audiology. Hearing, selection and evaluation procedures.
Prerequisite, Comm Studies 285.

789. TRENDS IN CONTEMPORARY AUDIOLOGY.
Investigation and evaluation of the recent research and advances in knowledge concerning the auditory capacities, and the management of audiological problems.
Prerequisite, Comm Studies 788. Mr. Nober.

790. BEHAVIOR MODIFICATION IN COMMUNICATION DISORDERS.
The habilitation and rehabilitation of speech and language disorders through behavior modification, using operant procedures.
Prerequisite, Comm Studies 182 and 283.

791. MANAGEMENT OF COMMUNICATION DISORDERS PROGRAMS.
Investigation, management, and supervision of speech pathology and audiology programs in public schools, rehabilitation centers, hospital clinics, and in special-education residential settings.
Prerequisite, permission of instructor.

792. THEORIES OF HEARING.
The current acoustic, psychophysiological, physical, anatomical, psychological, and clinical aspects of audition, and the theories of hearing developed to explain them.
Prerequisite, Comm Studies 284, 285, 287/587.
Mr. Tolhurst.

793. HEARING AIDS AND AMPLIFICATION.
The nature and types of amplifying systems employed with hearing-handicapped. Electro-acoustic characteristics including gain, power, acoustic response, distortion, etc. Principles and methods of selection and usage of hearing-aids.
Prerequisite, Speech 788.

794. DIFFERENTIAL DIAGNOSIS IN SPEECH & LANGUAGE DISORDERS.
Review, analysis and demonstrations of the diagnostic procedures used in the assessment and evaluation of speech and language disorders.
Prerequisites, Comm Studies 182 and 281/581.

800. MASTER'S THESIS. *Credit, 3-6.*

810. SEMINAR IN RESEARCH TOPICS AND METHODS.
Desirable areas and topics of investigation; application methodology and bibliography. Tentative exploration of selected subjects. Offered for doctoral students as needed, with sections arranged for each of the principal areas of the department.

812. SEMINAR IN CONTEMPORARY RHETORICAL PRACTICE AND CRITICISM.
Intensive study and analysis of the speaking and writing generated by a major public controversy, 1930 to the present.
Miss Blankenship, Mr. Sillars, and Mr. Stelzner.

881. ACOUSTIC PHONETICS.
In-depth study of the acoustic characteristics of speech; distinctive acoustic features of phonetic elements and their relations to production and reception; emphasis on laboratory approaches. Student research projects.
Prerequisite, Comm Studies 783.

882. PHYSIOLOGICAL PHONETICS.
In-depth study of the physiological processes involved in speech and voice production; distinctive physiological features of phonetic elements; laboratory approaches. Student research projects.
Prerequisite, Comm Studies 783.

884. GRADUATE SEMINAR IN COMMUNICATION DISORDERS.
Analysis and discussion of major problems in the field of communication disorders. One of the following topics is usually offered: a) communication disorders and the teacher, b) communication disorders in geriatrics, c) communication disorders and medicine, d) the non-verbal child, e) electrophysiologic audiometry and f) speech audiometry.
Prerequisite, permission of instructor. May be repeated for credit. *Maximum credit, 9.*

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

505. CLASSICAL RHETORICAL THEORY.
Major rhetorical theories from their emergence in ancient Greece to the late Roman Empire. Emphasis on the Sophists, Plato, Aristotle, Hermagoras, Cicero, Quintillian, and St. Augustine.

507. RHETORIC AND SOCIAL CHANGE IN AMERICA.
A survey of the rhetorical strategies of various American social movements such as the American Revolution, the populist movement, and the civil rights movement. Mr. Reid.

511. CONTEMPORARY RHETORICAL THEORY.
Contemporary philosophical approaches to rhetorical theory. Selected major contemporary theorists such as Weaver, Richards, Burke, Duncan, McLuhan, and Perelman.
Miss Blankenship.

525. HISTORY AND DEVELOPMENT OF THE MOTION PICTURE.
The motion picture as a social force and as a form of art. Interrelationship and analysis of form, technique, and social impact of film. Selected screenings of representative film styles and content.

527. FILM THEORY AND CRITICISM.
Basic theories of film communication; various film modes and structures. Development of bases for evaluation of films according to communicative and aesthetic values.
Prerequisite, Comm Studies 225/525. Mr. Stromgren.

528. MASS MEDIA IN SOCIETY.
Mass media as a major force in the American society. Emphasis on cultural, economic, political, and social effects.
Prerequisite, Comm Studies 121. Mr. Meyer.

532. BROADCASTING AND THE GOVERNMENT.
The role, function, and effect of regulation on broadcasting.
Prerequisite, Comm Studies 121. Mr. Shelby.

550. COMMUNICATION AND LANGUAGE THEORY.
The nature of speech and language, and the process involved in acquiring, understanding, and producing speech and language.
Prerequisite, permission of instructor.
Mr. Conville, Mr. Nober.

581. CLINICAL PROCEDURES.
Introduction to the clinical process in a Communication Disorders Clinic including personnel responsibilities, professional ethics, techniques of differential diagnosis, study of clinical forms and referrals. Supervised observations of diagnostic and therapy sessions. Laboratory training in clinical equipment. Mr. Melrose.

586. REHABILITATION OF THE ACOUSTICALLY HANDICAPPED.
Techniques of speech therapy, auditory training, and speech reading for hard-of-hearing children and adults; multi-sensory approach to language development. Laboratory practice under supervision.
Prerequisite, Comm Studies 285.

587. FUNDAMENTALS OF HEARING AND SPEECH SCIENCE.
Investigation of physiological, acoustical, and psychological correlates of speech production, transmission, and reception. Exercises in the application of laboratory methods.
Prerequisites, Comm Studies 181 and 284. Mr. Nerbonne.

588. CLINICAL PRACTICE.
Supervised experience in therapy with individuals having articulatory-type disorders.
May be repeated once.
Prerequisites, Comm Studies 181 and 182. *Credit, 1-3.*

589. COMMUNICATION PROBLEMS OF THE DEAF AND HARD-OF-HEARING.
The physical, psychological, social, and educational problems and needs of the hearing handicapped.
Prerequisite, Comm Studies 250/550. Mr. Nober.

591. PEDIATRIC AUDIOLOGY.
Assessment and clinical management of infants and children with auditory disorders. Problems of differential diagnosis, screening techniques, conditioning procedures and electrophysiologic methods. Parental guidance and employment of amplification with children.
Prerequisites, Comm Studies 285 and 286/586.

592. LEARNING AND LANGUAGE DISABILITIES IN CHILDREN.
Learning disabilities associated with physical, psychological, and social etiologies. Problems of language development and cognitive disorders, remedial practices in reading and writing problems, and learning patterns of the culturally disadvantaged. Diagnostic assessment and educational processes outlined.
Mr. Nober.

595. STUTTERING.
Major theories of the etiology, diagnosis, and clinical management of stuttering.
Prerequisite, Comm Studies 182.

650. BEHAVIORAL RESEARCH AND COMMUNICATION.
Introduction to research design and the practical problems in carrying out experimental and descriptive research in speech communication. Students pursue research projects either individually or in groups.
Prerequisite, 12 undergraduate credits in Communication Studies. Mr. Cronen.

659. POLITICAL COMMUNICATION: MEDIA AND CAMPAIGNING.
Diffusion of persuasive political communications through standard and created media. Examination of campaign techniques (*i.e.*, research on issues and themes, electorate polling, thematic media approaches, campaign strategies) in management and administration.

Comparative Literature

GRADUATE FACULTY

Warren D. Anderson, *Professor and Chairman of the Department of Comparative Literature,* B.A., Haverford, 1942; B.A. (Oxon.), 1949; M.A., Harvard, 1947; Ph.D., 1954.

Frederic Will, *Professor and Graduate Program Director,* B.A., Indiana, 1949; Ph.D., Yale, 1954.

Eric M. Beekman, *Associate Professor of Germanic Languages and Literature and Associate Professor of Comparative Literature.*

David R. Lenson, *Assistant Professor,* B.A., Princeton, 1967; M.A., 1970; Ph.D., 1971.

Don E. Levine, *Assistant Professor,* B.S., Columbia, 1964; M.A., Princeton, 1967; Ph.D., 1972.

Daniel P. Lucid, *Assistant Professor,* B.A., Reed, 1968; M.Ph., Yale, 1971; Ph.D., 1972.

Elizabeth P. Martin, *Assistant Professor,* B.S.Ed., Northwestern University, 1960; M.A., California at Berkeley.

Lucien M. Miller, *Assistant Professor,* B.A., California at Berkeley, 1961; M.A., 1963; Ph.D., 1970.

C. William Moebius, *Associate Professor,* B.A., Lawrence (Wis.), 1963; Ph.D., S.U.N.Y. at Buffalo, 1969.

SUPPORTING FACULTY

Thomas Cassirer, *Professor of French.*

Sarah N. Lawall, *Associate Professor of French.*

Paul A. Mankin, *Associate Professor of French.*

William E. Naff, *Associate Professor of Japanese.*

Alex R. Page, *Professor of English.*

Eva Schiffer, *Associate Professor of German.*

The Department of Comparative Literature offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Facilities and staff are available for specialized work in classical tradition studies and in medieval, Renaissance, Enlightenment, Romantic, modern, and contemporary European literature. Courses or seminars dealing with genres, themes, or movements are regularly offered as well. It is also possible to specialize in the study of Dutch literature or of classical and modern Chinese and Japanese literature. Graduate courses in Comparative Literature are open to all qualified graduate students and may, with prior approval of the other department or program concerned, be taken to meet a foreign language requirement.

PREREQUISITES FOR ADMISSION TO THE M.A. OR PH.D. PROGRAM
(beyond the usual requirements of the Graduate School)

Undergraduate Degree: Applicants must possess a bachelor's degree or a recognized foreign equivalent, either with a major in a language-literature field or awarded upon completion of substantial literary studies.

Languages: All applicants are required to have at least two major languages besides English; one of these must be either French or German. Applicants who intend to work toward the Ph.D. should have completed, with a grade of B or better, at least three years' undergraduate study of one of these languages and two years' study of the other. Applicants who are planning a course of study leading to the terminal M.A. should have at least three years' undergraduate study of one of these languages and one year of the other.

Intending doctoral students who do not offer for admission at least three years' study of Greek or Latin past high school level will be required to pursue further study of one of these languages.

Students whose native language is not English must demonstrate reasonable fluency in English by examination or enroll for remedial course work.

Grade Point Average: The applicant should have a grade point average equivalent to at least 3.0 out of a possible 4.0.

Graduate Record Examination: This examination is required of all applicants, without exception.

Written Work: Applicants are required to submit with their applications an example (unique copies should not be sent) of written work which may be taken as fairly demonstrating their critical abilities in dealing with literary material. It is preferred, though not absolutely required, that the applicant should have read this material in the original language of composition, and that it be taken from an ancient or modern foreign literature.

THE DOCTOR OF PHILOSOPHY DEGREE

Qualification: Successful completion of the qualifying procedure enables the student to proceed with preparations for the preliminary comprehensive examination, beginning with the formation of a guidance committee. The qualifying procedure involves competence in foreign languages and a reasonable degree of professional maturity, as shown in the successful completion of basic graduate courses within the department.

Languages: Students are required to demonstrate competence in two foreign languages, one of which may be Latin or Greek. This requirement may be met by a satisfactory performance in a two-hour written examination; other options are also available.

Program of Study: The balance among the main constituent elements of a candidate's course of study will necessarily vary with individual circumstances. The following kinds of competence, however, are taken to characterize the holder of a Ph.D. in comparative literature: a knowledge of one language and its literature sufficient to warrant the respect of specialists; a reading knowledge of three major European or Oriental languages (ancient or modern) in addition to English; a wide command of the literature of one main historical period; ability to make serviceable use of at least three literatures, one of which may be English; a reading competence in a classical language; and training in research method, literary translation, and problems of criticism.

Requirements: Work in the major literature requires historical coverage from the earliest literary forms of the language to the present, with emphasis either on a genre or on a major period, and a thorough reading-knowledge of the language. Work in the second and third literatures requires coverage of the period or genre related to the field of emphasis in the major literature. Reading knowledge of the languages involved should be very good in the case of the second literature and good in the case of the third. Finally, work in Comparative Literature courses and seminars will be determined according to the candidate's needs in acquiring the ability to deal with the broad demands of the discipline and the more limited ones of his special field.

The Preliminary Comprehensive Examination: Successful completion of this examination allows the candidate to proceed to the dissertation. In its standard form, the examination consists of the following two parts: a written portion, lasting ten hours, which covers in depth one literary period or genre that the candidate has studied in three literatures, and also the general history of the major literature; an oral portion, following the written, which will last not less than two hours. The option of a two-hour oral examination with previous satisfactory completion of a number of assigned papers is also available, conditional upon the approval of the candidate's guidance committee.

The Dissertation: This may be concerned with any subject in literary history or with the critical comparison of texts, carried on within a literary rather than a philosophical frame of reference. The candidate's guidance committee may approve the option of a translation dissertation, provided that the project is judged to admit of the inclusion of an extensive critical introduction, undertaken at a level of analysis appropriate to a doctoral dissertation.

THE MASTER OF ARTS DEGREE

Two types of M.A. degrees are offered in Comparative Literature. Students who do not plan to proceed to the Ph.D. will normally choose the M.A. with thesis; the M.A. without thesis should be elected as a degree plan by students planning doctoral study.

Program of Study: A minimum of 30 graduate credit hours (500-level or higher) will be required in all cases. The following is to be included: 12 graduate credits in the major literature, six graduate credits in a second literature studied in the original language of composition, and six graduate credits in Comparative Literature courses. One of these courses must be Comparative Literature 701 (Bibliography and Methods of Literary Research). Students who elect the M.A. without thesis must take at least nine credits in a second literature and also in Comparative Literature.

Examinations: All candidates for the M.A. are required to take a written examination lasting four hours and an oral examination lasting at least one hour.

Thesis: The M.A. thesis is intended to demonstrate ability to formulate and resolve a specific literary problem, relatively limited in scope. A thesis consisting of a translation preceded by a substantial critical introduction will be considered an acceptable alternative to the regular thesis form, subject to conditions similar to those specified above in connection with translation dissertations.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.
Directed study of some problem in comparative literature. May be repeated for credit. *Credit, 2-6.*

701. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH.
Introduction to the bibliography and methodology of comparative studies in literature.
Miss Schiffer, Mr. Levine.

702. LITERARY CRITICISM I: CLASSIC TO NEOCLASSIC.
Problems in critical theory prior to the modern period. Not necessarily chronological or limited to Occidental critics.

703. LITERARY CRITICISM II: INTRODUCTION TO THE HISTORY OF CONSCIOUSNESS.
Modern crises of consciousness, ethics, and form, as manifested in seminal works of avant-garde criticism and fiction.
Mr. Levine.

704. CONTEMPORARY THEORIES OF LITERATURE.
Intensive study of theories of literature which have importance for contemporary criticism and scholarship.
Mrs. Lawall, Mr. Will.

705. THEORY AND PRACTICE OF TRANSLATION.
The history of translation theory. Intensive practical experience in translating poetry and prose.
Mr. Anderson, Mr. Moebius, Mr. Will.

890. SEMINAR.
Intensive, advanced study of a topic in comparative literature. *Credit, 3-6.*

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

621. RENAISSANCE PERSPECTIVES.
The tradition of the Middle Ages, the heritage of the Renaissance—the rhetoric of writing and the arts of reading and interpretation as handed down to the Renaissance. Mr. Levine.

622. THE SHAPE OF THE RENAISSANCE.
Diversity and changes of literary style in the 15th and 16th centuries. Emphasis on cultural continuity. An examination of critical method. Mr. Levine.

631. THE ENLIGHTENMENT.
Characteristic ideas, themes, and attitudes in 18th-century European literature. Focus on major representatatives of the Age of Reason. Mr. Page, Mr. Will.

641. ROMANTICISM.
The Romantic movement in Western literature as exemplified by its principal figures from the age of Rousseau to 1850.

642. FROM IDEALISM TO REALISM.
Main currents in the post-Romantic literature of the nineteenth century.

647. LITERATURE AND MUSIC.
Relations between literature and music from Plato to Samuel Beckett. Emphasis on the aesthetics of Schopenhauer and the Wagnerian synthesis. Mr. Moebius.

651. SYMBOLISM.
The development of symbolism in English, French, and German poetry of the 19th and 20th centuries.
Mr. Lenson, Mr. Mankin.

652. MODERN DRAMA.
Currents in Western drama since Ibsen: naturalism, symbolism, neo-Romanticism, expressionism, folk drama and fantasy, epic realism, and the "grotesque" and "absurd" theatre are possible topics. Mr. Mankin, Mr. Moebius.

661. THE CONTEMPORARY EUROPEAN NOVEL.
Ideological commitments and innovations in English, French, and German novels of the 20th century.

671. EUROPEAN EPIC POETRY.
Literary analysis of major classical and Renaissance epics. Emphasis on their intrinsic qualities as works of art. Specific epic techniques and the epic tradition.
Mr. Anderson.

675. ANGLO-GERMAN LITERARY RELATIONSHIPS.
Subjects and problems common to English and German literature since the middle of the 18th century.
Mr. Page.

676. THEORIES OF COMPARATIVE LITERATURE.
Major theories concerning the nature and proper province of comparative literature. Emphasis on their significance for graduate study. Mr. Will.

Computer and Information Science

GRADUATE FACULTY

Michael A. Arbib, *Professor and Chairman of the Department of Computer and Information Science, and Professor of Psychology,* B.S., University of Sydney, 1961; Ph.D., Massachusetts Institute of Technology, 1963.

Caxton C. Foster, *Professor and Graduate Program Director,* B.S., Massachusetts Institute of Technology, 1950; M.S., University of Michigan, 1957; Ph.D., 1965.

G. Ernest Anderson, Jr., *Associate Professor of Education.*

Robert R. Archer, *Professor of Civil Engineering.*

Leonard S. Bobrow, *Associate Professor of Electrical and Computer Engineering.*

Richard H. Eckhouse, Jr., *Assistant Professor*, B.E.E., Cornell University, 1962; M.S., University of Illinois, 1963; Ph.D., SUNY at Buffalo, 1971.

Roger W. Ehrich, *Assistant Professor of Electrical and Computer Engineering.*

Robert M. Glorioso, *Associate Professor of Electrical and Computer Engineering.*

Peter H. Greene, *Adjunct Associate Professor*, A.B., Amherst College, 1951; Ph.D., University of Chicago, 1958.

William L. Kilmer, *Professor*, B.S., Pennsylvania State, 1954; M.S., 1955; Ph.D., University of Michigan, 1958.

Henry F. Ledgard, *Associate Professor*, B.S., Tufts University, 1964; M.S., Massachusetts Institute of Technology, 1966; Ph.D., 1969.

John A. N. Lee, *Professor*, B.S., University of Nottingham, 1955; Ph.D., 1957.

Ernest G. Manes, *Assistant Professor of Mathematics.*

Robert N. Moll, *Assistant Professor*, B.S., Carnegie-Mellon University, 1967; M.S., 1968; Ph.D., Massachusetts Institute of Technology, 1973.

Howard A. Peelle, *Assistant Professor of Education.*

Edward M. Riseman, *Associate Professor*, B.S., Clarkson College of Technology, 1964; M.S., Cornell University, 1966; Ph.D., 1969.

Kenan Sahin, *Associate Professor of Management.*

D. N. Spinelli, *Professor of Computer and Information Science and Professor of Psychology*, Liceum G. Parini, 1954; M.D. in Medicine and Surgery, University of Milan Medical School, 1958.

Fred D. Stockton, *Associate Professor of Civil Engineering.*

Robert W. Taylor, *Assistant Professor*, B.S., Yale University, 1966; M.S., University of Michigan, 1968; Ph.D., 1971.

Richard L. Tenney, *Assistant Professor*, B.A., University of California at Los Angeles, 1965; M.S., Cornell University, 1969; Ph.D., 1972.

Conrad A. Wogrin, *Professor and Director of the University Computing Services*, B.Eng., Yale, 1949; M.Eng., 1951; Eng.D., 1955.

The Department of Computer and Information Science (COINS) offers the M.S. and Ph.D. degree in the three focal areas of computers, theory of computation, and cybernetics. Comprehensive course offerings are available, and active research is ongoing, in each of these areas, as well as in inter-area fields. Active collaboration is maintained with colleagues in such diverse schools and departments as Art, Business, Education, Electrical and Computer Engineering, Linguistics, Mathematics, Psychology, and Zoology. Students are encouraged to take advantage of these interdepartmental links to enrich their university experience.

Students in the graduate program should be aware of the ongoing seminar series, which meets on Thursday afternoons. All students are strongly recommended to attend as part of rounding out their graduate education. In addition, most advanced students will wish to take part in the research seminars (700 A, B, C) in their own area of concentration.

To be admitted to full graduate status in this field, candidates must be holders of B.S. or B.A. degrees, with good academic records and recommendations, and have either a major in Computer Science or exhibit a good knowledge of computer programming and college mathematics. Students are expected to have mastered the equivalent of COINS 122 and 202 and Math 167: Introduction to Linear Algebra (corequisite, second semester of calculus). Exceptions will be exceptional.

Students who have already studied computer science will note that at most six credits may be transferred from other institutions, and these must be of a grade B or better. It is the policy of the department to grant such transfer credit sparingly, since we believe that our program is sufficiently rich for most students to be able to take a full 24 units of course credit to their advantage.

THE MASTER OF SCIENCE DEGREE PROGRAM

The following are the requirements for the M.S. degree in Computer and Information Science:

(i) Each student shall take (or receive advanced standing in) the core courses 601, 602, and 603.

(ii) Each student shall take two COINS 700 series courses other than 701.

(iii) Each student shall take 6 units of COINS 701, Project. The project must be completed in one semester, with a grade of B or better. Students are required to plan their project in the semester preceding that in which they register for 701. A written proposal must be approved by two faculty members as first and second readers, and submitted to the Graduate Program Director by the preregistration day preceding the semester of registration.

(iv) Each student shall take additional graduate courses, chosen with the approval of the adviser, to satisfy the 30-credit requirement for the M.S. degree. Each student must obtain a B grade average or better in the 24 units other than the project.

(v) Students entering with deficiencies in the equivalent of COINS 122, 202, or Math 167 are required to remove these deficiencies by the end of their first semester. The credits so obtained do not count toward the 30 credits for the M.S. degree.

THE PH.D. QUALIFYING EXAM

A qualifying examination is offered in March and October of every year. Students enrolled as M.S. candidates who wish to proceed to the Ph.D. program are advised to first take the examination no later than the semester of enrollment in COINS 701; they normally are expected to pass the exam before being admitted to the second year of their Ph.D. candidacy.

There are three COINS *areas* (computers, theory of computation, and cybernetics) and three core *courses* (601, 602, 603). The content of the three core courses, as laid down in the official syllabi, serve as the conceptual base for the exam, which tests the student's ability to *relate* and *apply* the fundamental concepts of the core courses. However, the grading of the exam is *not* based on detailed knowledge of the core so much as on the ability to think in a creative and intelligent manner.

The exam is in two parts:

(i) A written open-book examination. The student has

from 9:00 a.m. to 5:00 p.m. on a given day to complete the written exam, and may work in a place of his own choosing. The exam consists of a total of nine questions, three in each of the three areas.[Note: A question in any *area* may make use of concepts from any of the three core *courses*.] Students answer at least two questions in their major area of interest, and one in each of the other two areas.
(ii) After correction, the written exam is returned to the student for review. An oral interview may then be required.

The student is graded as either (1) Pass; (2) Fail with remedial advice for taking the exam again, or (3) Unconditional Fail. This grade is based not only on performance in the exam, but also on course grades and other faculty input.

Students who do not pass the exam the first time are given at most one further opportunity to do so, subject to the timing conditions outlined in the first paragraph.

Only students with at least a B average in the three courses (or equivalent standing) and a Grade Point Average above 3.0 are allowed to take the exam. Students are invited to discuss with the faculty their likelihood passing before deciding to stand for the qualifying examination.

THE DOCTOR OF PHILOSOPHY DEGREE

To be confirmed in their candidacy for the Ph.D. Degree, students must pass the Ph.D. qualifying exam, as described above. In addition to course work appropriate to the M.S. degree, Ph.D. students are required to take some six 700-level courses from both within and without the department (including COINS 604) to lay a firm basis for thesis research. There is no formal language requirement for the degree. Students are discouraged from taking more than two or three years beyond the M.S. to complete their Ph.D. degree. M.S. candidates intending to proceed to the Ph.D. should choose their 701 projects with this time restriction in mind. Other conditions for the Ph.D. are as listed under general University requirements.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL SEMINARS.
Topics by arrangement. Recent advanced and current problems in a specialized field of computer and information science.
Prerequisite, permission of instructor. *Credit variable, 1-6.*

701. ADVANCED TOPICS IN COMPUTER SCIENCE.
A project-type course for second-year graduates. Integrates and expands the student's knowledge of the field. Moderately large projects of implementation, design of computers, languages, operating systems, cybernetic simulation, theoretical integration, etc.
Prerequisite, permission of instructor. *Credit, 6.*

711. SYNTACTIC ANALYSIS.
An introduction to the concepts and techniques of syntactical analysis with respect to context-free grammars, the recognitive processes involved in the analysis and generative algorithms of computer translators. Special consideration of precedence grammars and semantical implications of grammars.
Prerequisites, COINS 301/601 and 210/510.

724. ADVANCED PROGRAMMING.
Use of list processing and associative computers. Design of interpreters and higher level languages. Topics vary.
Prerequisite, COINS 302/602.

741. COMPUTABILITY AND COMPLEXITY.
The idea of recursion; partial recursive functions and their algebraic and machine characterizations; primitive recursive functions and hierarchies of partial recursive functions; complexity of computation by both axiomatic and machine-oriented criteria; speed-up and gap theorems.
Prerequisites, COINS 301/601 or Math 381.

743. TOPICS IN THEORY OF COMPUTATION.
Algebraic automata theory; advanced topics in language theory; theory of problem-solving in hierarchically structured systems; theory of machines which compute and construct; related advances in theory of theorem proving. Topics vary from year to year.
Prerequisite, COINS 301/601.

762. FOUNDATIONS OF PROGRAMMING LANGUAGES.
Fundamental concepts underlying higher-level languages. Methods of syntactic and semantic definition; Vienna definition language; mathematical models of Scott and Strachey; recursion and fixed points; lambda-calculus; models for assignment, transfer of control, bloc structure and procedures.
Prerequisites, COINS 301/601 and 302/602.

777. ADVANCED OPERATING SYSTEMS.
Systems analysis, feasibility studies and applicable techniques of operating systems. Input/output file control systems; remote terminal devices, management information systems and other on-line applications, case studies, design and use of extended machine language function facilities for systems programming.
Prerequisites, COINS 335/635 and 377/677.

782. COMPUTATIONAL CYBERNETICS.
A computer simulation model of the core of the vertebrate nervous system, the reticular formation; the frog's visual system; delay-differential learning equations; a comparison of several models of the cerebellum; mathematical and computer simulation models of archicortex and neocortex; models of statistical neuronal processing; considerations for an action-oriented model of human vision.
Prerequisite, COINS 303/603.

784. PATTERN RECOGNITION.
Techniques of pattern recognition; optical character recognition (typed and handwritten); measurement selection; feature extraction and contextual cuing; automata and grammars for two-dimensional patterns; statistical decision theory; scene analysis.
Prerequisites, COINS 383/683, 303/603.

790. SEMINAR ON COMPUTER AND INFORMATION SCIENCE.
Conferences, reports and lectures on topics not currently covered in regular courses.
Prerequisite, permission of instructor. *Credit variable, 1-6.*

795. SEMINAR ON IMPLICATIONS.
Interdepartmental studies of social and economic factors in relation to computer-based solution of large-scale problems. Topics vary.
Prerequisite, permission of instructor.

900. DOCTORAL DISSERTATION. *Credit variable, 1-30.*

COURSES NOT FOR MAJOR CREDIT

422. INTRODUCTION TO PROBLEM SOLVING USING THE COMPUTER. *Credit, 0.*

450. INTRODUCTION TO COMPUTER AND INFORMATION SCIENCE. *Credit, 0.*

502. COMPARATIVE CONCEPTS IN PROGRAMMING LANGUAGES. *Credit, 4.*

532. ALGORITHMIC METHODS FOR SCIENTISTS AND ENGINEERS.

COURSES OPEN TO GRADUATE AND UNDERGRADUATE STUDENTS

501. ASSEMBLY LANGUAGE PROGRAMMING.
Basic ideas of computer hardware and principles of computer systems organization; input/output equipment, machine organization, logical design, elementary data structures, and assembly language programming. Lab involves hands-on experience with programs, loaders, and assemblers.
Prerequisite, COINS 122/422 or programming experience.
Credit, 4.

510. TRANSLATOR DESIGN.
A project-oriented course covering techniques of language definition and translation. Particular reference to symbolic assemblers and algebraic compilers.
Prerequisites, COINS 201/501 and 202/502.

533. MINI COMPUTERS.
The use of small-scale digital computers for data gathering, analysis and on-line control of experiments. Interfacing computers and logical design of input/output facilities.
Prerequisite, programming experience.

552. TOPICS IN NUMERICAL METHODS.
Computer-oriented numerical analysis, including linear algebra, solution of simultaneous equations, homogeneous equations, eigenvalues, solution of differential equations, solution of algebraic and transcendental equations, and functional representations.
Prerequisite, COINS 122/422 or programming experience.

560. LINGUISTICS AND AUTOMATA.
An introduction to formal language theory in relation to linguistic and psychological studies of the origins, properties, and structure of natural languages; phrase structure and transformational grammars; pushdown, linear-bounded and stack automata; applications of grammatical descriptions in behavior and pattern description.
Prerequisite, COINS 301/601.

575. COMBINATORIAL THEORY AND ITS APPLICATIONS.
The solution of problems of enumeration using permutations and combinations, generating functions, and recurrence relations. Introduction to graph theory, linear and dynamic programming. Block designs, difference sets, and orthogonal Latin squares. Applications.
Prerequisites, COINS 501 and 504.

591. ECOLOGICAL CYBERNETICS.
Vectors, matrices and eigenvector problems; deterministic and random ecosystem population models; solutions of nonlinear differential equation systems arising in population biology; analytical formulations of ecosystem stability problems, species-packing models, epidemiological problems, and the evolution of altruism. Computer simulation projects encouraged.
Prerequisite, calculus; computer programming desirable.

601. FUNDAMENTALS OF COMPUTATION.
Integrates application and theory by presenting the mathematical underpinnings of algorithms, languages, and machines; recursion and induction; models for machines, state diagrams, switching theory, and regular sets; trees; formal grammars; syntax and semantics; basic notions of automata, pushdown automata, and Turing machines; proving properties of programs.
Prerequisite, Math 167 or equivalent.

602. FUNDAMENTALS OF COMPUTING SYSTEMS.
Core concepts of computer software and hardware, including syntax, semantics and implementation models; data structures and accessing strategies; operating systems, control programs and languages, and machine architecture.
Prerequisite, COINS 202/502; COINS 201/501 recommended.

603. FUNDAMENTALS OF CYBERNETICS.
Integrates brain analysis and artificial intelligence to convey a basic understanding of systems and neural networks, modelling, feedback; scene analysis and pattern recognition in brains and machines; parameter adjustment and adaptation; heuristic search; and planning of complex behavior in the brains of animals and the control computers of robots.
Prerequisite, COINS 150/450 or background in biology or psychology.

604. FUNDAMENTALS OF INFORMATION.
Concepts of information theory with background in discrete probability theory; semi-groups applied to coding and automata theory; linear machines and codes.
Prerequisite, COINS 301/601.

620. DEVELOPMENT OF QUALITY SOFTWARE.
Recent developments in the study of programming as a systematic, creative activity. Notion of quality software; measurement of quality; top-down and other approaches to programming; structured programs; proofs of correctness; software engineering; psychology of programming.
Prerequisites, COINS 201/501 and 202/502.

635. COMPUTER ARCHITECTURE.
The various elements of computer design; the historical influence of certain real computers and the concepts behind them.
Prerequisite, COINS 302/602.

650. COMPUTATIONAL MODELLING.
An introduction to probabilistic techniques such as Markov process, Random Walk and Monte Carlo techniques. Statistical techniques, distributions, and correlation coefficients. Brief introduction to simulation languages. Simple queues, n-person zero sum games. Topics generated by class interest from various areas of application.
Prerequisite, COINS 202/502.

660. COMPUTER GRAPHICS (ECE 660).
Basic organization of computer-driven graphical display systems. Methods for generation and manipulation of vectors and characters for real-time display. Data structures for picture and text processing.
Prerequisite, COINS 201/501.

677. INTRODUCTION TO OPERATING SYSTEMS.
A study of the programs and techniques needed to transform computer hardware into a comprehensive computer. Topics include input/output control systems, mono-programming, multi-programming, and multi-processing.
Prerequisite, COINS 302/602.

683. ARTIFICIAL INTELLIGENCE.
Game-playing by machines; mathematical problem solving by machine, including geometry, algebra and calculus; mathematical theory of heuristic search; automatic theorem-proving; question answering systems; natural language processing; an introduction to robotics, vision and planning.
Prerequisite, COINS 303/603.

685. SPECIAL PROBLEMS.
(Topics by arrangement each semester.)
Prerequisite, permission of instructor. *Credit variable, 1-6.*

686. SPECIAL PROBLEMS.
(Topics by arrangement each semester.)
Prerequisite, permission of instructor. *Credit variable, 1-6.*

687. DATA AND INFORMATION STRUCTURES (ECE 642).
Mathematical and practical concepts relevant to description and manipulation of data and information structures such as lists, trees, and graphs, and the relationship of these ideas to the constraints imposed by physical storage devices.
Prerequisites, COINS 301/601 and 302/602.

IN ADDITION TO THE ABOVE COURSES, STUDENTS ARE ADVISED TO TAKE COURSES IN OTHER DEPARTMENTS, SUCH AS:

Electrical and Computer Engineering

510. DIGITAL CIRCUIT THEORY.

644. PROGRAMMING STRUCTURES.

662. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION.

666. ANALOG AND HYBRID COMPUTERS.

668. ADVANCED SWITCHING THEORY.

702. ALGEBRA AND CODING.

750. GRAPH THEORY AND ITS APPLICATIONS.

Linguistics

703. LINGUISTIC THEORY III.

710. SEMANTICS.

Mathematics

511, 512. INTRODUCTION TO MODERN ALGEBRA.

541. APPLIED ANALYSIS I.

545, 546. APPLIED MATHEMATICS.

551, 552. NUMERICAL ANALYSIS.

557. LINEAR PROGRAMMING AND THEORY OF GAMES.

735. LATTICE THEORY.

745, 746. ADVANCED APPLIED MATHEMATICS.

Philosophy

672, 673. MATHEMATICAL LOGIC.

Psychology

711, 712. SENSORY PROCESSES.

715. PERCEPTION.

725, 726. INFORMATION PROCESSING.

746. QUANTITATIVE METHODS IN PSYCHOLOGY.

750. PHYSIOLOGICAL PSYCHOLOGY.

752. THE NEUROANATOMICAL BASIS OF BEHAVIOR.

753. PSYCHOPHARMACOLOGY.

Zoology

770. COMPARATIVE NEUROPHYSIOLOGY.

Economics

GRADUATE FACULTY

Norman D. Aitken, *Associate Professor and Chairman of the Department of Economics*, B.A., University of Cincinnati, 1961; Ph.D., University of Tennessee, 1967.

Marshall C. Howard, *Professor and Graduate Program Director*, B.A., Princeton, 1941; Ph.D., Cornell, 1951.

Solomon Barkin, *Professor*, B.S., College of The City of New York, 1928; M.A., Columbia, 1929.

Michael H. Best, *Assistant Professor*, B.A., University of Washington, 1963; M.A., University of Oregon, 1967; Ph.D., 1969.

John L. Blackman, Jr., *Associate Professor*, B.A., Haverford, 1930; M.A., 1948; Ph.D., Harvard, 1957.

Samuel S. Bowles, *Professor*, B.A., Yale, 1960; Ph.D., Harvard, 1965.

Galen D. Burghardt, Jr., *Assistant Professor*, B.A., University of Washington, 1966; Ph.D., 1970.

James C. Cox, *Associate Professor*, B.A., University of California (Davis), 1965; M.A., Harvard, 1968; Ph.D., 1970.

Thomas E. Duston, *Assistant Professor*, B.S., University of Maine, 1962; M.A., State University of New York (Binghamton), 1967; Ph.D., Brown, 1972.

Richard C. Edwards, *Assistant Professor*, B.A., Grinnell College, 1966; Ph.D., Harvard, 1972.

Ronald G. Ehrenberg, *Associate Professor*, B.A., Harpur, 1966; M.A., Northwestern, 1968; Ph.D., 1970.

Bradley T. Gale, *Associate Professor*, B.S., Worcester Polytechnic Institute, 1964; M.A., Massachusetts, 1965; Ph.D., Rutgers, 1968.

Herbert Gintis, *Associate Professor*, B.A., University of Pennsylvania, 1961; M.A., Harvard, 1962; Ph.D., 1969.

Vaclav Holesovsky, *Professor*, Diploma in Political Sciences, University of Paris, 1950; M.A., 1958; Ph.D., Columbia, 1964.

James K. Kindahl, *Professor*, B.A., Chicago, 1951; M.B.A., 1953; Ph.D., 1958.

Bruce R. Morris, *Professor*, B.A., Western Reserve, 1931; M.A., Ohio State, 1932; Ph.D., Illinois, 1937.

Ernest L. Murphy, *Assistant Professor*, B.A., Morehouse College, 1965; Ph.D., Harvard, 1970.

Ronald L. Oaxaca, *Assistant Professor*, B.A., Fresno State College, 1965; M.A., Princeton, 1969; Ph.D., 1971.

Cadwell L. Ray, *Assistant Professor*, B.A., Texas A & M, 1959; M.A., 1961; Ph.D., University of Texas, 1967.

Stephen A. Resnick, *Professor*, B.S., University of Pennsylvania, 1960; Ph.D., Massachusetts Institute of Technology, 1964.

Simon Rottenberg, *Professor*, B.A., George Washington, 1939; M.A., Harvard, 1948; Ph.D., 1950.

Vernon L. Smith, *Professor*, B.S., California Institute of Technology, 1949; M.A., Kansas, 1951; Ph.D., Harvard, 1955.

George I. Treyz, *Associate Professor*, B.A., Princeton, 1958; Ph.D., Cornell, 1967.

Che S. Tsao, *Assistant Professor*, B.S., Chung Hsing University, 1955; M.S., University of Wisconsin, 1964; Ph.D., 1966.

Richard D. Wolff, *Associate Professor*, B.A., Harvard, 1963; M.A., Stanford, 1964; M.A., Yale, 1967; Ph.D., Yale, 1969.

Arthur W. Wright, *Assistant Professor*, B.A., Haverford College, 1960; Ph.D., Massachusetts Institute of Technology, 1969.

FIELDS OF STUDY

Programs of graduate study in economics are offered in the following fields of specialization: Economic Theory; Econometrics; Monetary Theory and Policy; Public Finance; Economic History; Economic Development; Industrial Organization and Regulation; Labor Economics; Human Resources; International Economics; Comparative Economic Systems.

THE MASTER OF ARTS DEGREE PROGRAM

Entrance and Admission Requirements

All entering students must have completed at least one semester each of intermediate micro theory, intermediate macro theory, and calculus. All applicants should take the Graduate Record Examinations; foreign applicants must take the Test of English as a Foreign Language (TOEFL). Recommendations from professors in economics and mathematics courses are the most useful in reaching admissions decisions.

Degree Requirements

Courses: All candidates for the M.A. are required to complete 36 graduate credits subject to the following restrictions: 12 credits must be earned in 700 to 900 series courses; candidates must take one semester each of microeconomic theory (Econ 701), macroeconomic theory (Econ 705), mathematical methods in economics (Econ 751) and econometrics (Econ 752); 21 of the credits must be taken within the Department of Economics. The candidate must earn grades of B or better in the four required theory courses and maintain a 3.0 average overall.

Optional Thesis: M.A. candidates have the option of submitting a thesis, which counts for between six and nine semester credit hours.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Entrance and Admission Requirements

Same as for the M.A. Program, plus at least one semester of linear algebra. Persons applying for the Ph.D. program without the M.A. may be required to complete the M.A. program first.

Degree Requirements

Courses: Unless the subject areas are offered as fields on the comprehensive exams (see below), all Ph.D. candidates must take two semesters of econometrics and one semester each of economic history, history of economic thought, and mathematical methods in economics. There is no minimum requirement for semester credits (however 30 credits minimum of Econ 900 are required for the Dissertation).

Comprehensive Examinations: Ph.D. candidates write comprehensive examinations in microeconomic theory, macroeconomic theory, and two fields of the candidate's choice. An oral exam may be included as part of the Ph.D. comprehensives, at the request of a written exam grader. Ph.D. comprehensives may be taken in any order and combination subject to the following restrictions: all four examinations must be taken at least once by the end of a candidate's third full academic year at the University; candidates studying full time or candidates who receive financial assistance from the University must have taken the microeconomic and macroeconomic theory examinations at least once by the end of the second year at the University. The oral exam, if necessary, is normally held after all written exams have been passed; the student normally has two chances to pass each exam. Other conditions for the Ph.D. are as listed under general University requirements.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

GRADUATE COURSES
(For either major or minor credit)

(Open to undergraduates with instructor's permission)

700. SPECIAL STUDIES IN ECONOMICS.
Credit, 2-9 each semester.

701 (I), 702 (II). MICROECONOMIC THEORY.
A systematic development of the theory of the consumer, the firm, the industry, and their interactions.
Prerequisite, Econ 203. *Credit, 3 each semester.*
Mr. Cox, Mr. Smith, Mr. Tsao, Mr. Wright.

705 (I), 706 (II). MACROECONOMIC THEORY.
Nature, construction, and use of social accounting systems. A systematic development of static and dynamic theories of aggregative economic behavior and their applications.
Prerequisites, Econ 212 or 204 or equivalent.
Credit, 3 each semester.
Mr. Burghardt, Mr. Ehrenberg, Mr. Treyz.

711. MONETARY THEORY.
Relationship among the supply of money, interest rates, capital market, price levels and output.
Prerequisite, Econ 705. Mr. Russell.

712. MONETARY AND FISCAL POLICY.
An analytical treatment of the effects of government and central bank policies intended to achieve such objectives as price stabilization and economic growth.
Prerequisite, Econ 312 or 612 or permission of the instructor.
Mr. Russell.

721. INTERNATIONAL FINANCE.
An analysis of the properties of foreign exchange markets, adjustment mechanisms, speculation, capital flows, and transfer problems; the relationship between balance of payments correctives and domestic policy goals, the balance of payments as a policy problem, and the problem of international liquidity.
Prerequisite, Econ 204 or permission of instructor.
Mr. Aitken.

722. INTERNATIONAL TRADE THEORY.
The pure theory of international trade. The reasons for trade, the gains from trade, factor price equalization, commercial, policy, trade and economic development, and customs unions.
Prerequisite, Econ 322 or 622 or permission of instructor.
Mr. Aitken.

731. INDUSTRIAL ORGANIZATION.
A survey of the literature on the market structure, conduct, and performance of industry.
Prerequisite, Econ 203 or 503 or permission of instructor.
Mr. Howard, Mr. Gale.

732. INDUSTRIAL REGULATION.
A survey of the literature on controls extended by government over the business sector of the economy.
Prerequisite, Econ 203 or 503 or permission of instructor.
Mr. Howard, Mr. Gale.

741. COLLECTIVE BARGAINING.
The legal background of collective bargaining, the process, subject matter, and problems involved. Individual case problems.
Prerequisite, Econ 141. Mr. Blackman.

743. WAGE THEORY AND COLLECTIVE RELATIONSHIPS.
Theoretical and institutional study of theories of wages and wage structure.
Prerequisite, Econ 141. Mr. Blackman.

745. LABOR DISPUTE SETTLEMENT.
Ways of settling labor disputes, including grievance proceedings, arbitrations, and presidential intervention.
Given alternate years (not given 1973-74).
Prerequisite, Econ 141. Mr. Blackman.

746. COMPARATIVE LABOR MOVEMENTS.
Labor movements in various countries with an analysis of their similarities and differences.
Prerequisites, Econ 141 and History 336. Mr. Barkin.

747. MANPOWER DEVELOPMENT.
A critical examination of current manpower policies and problems. The quantity and quality of manpower resources, problems of labor employment and mobility. Adjustment policies and research tools are reviewed.
Prerequisite, Econ 141. Mr. Barkin.

751. MATHEMATICAL METHODS IN ECONOMICS.
The various modern applications of mathematics to economic analysis. Both static and dynamic processes. Given as required.
Prerequisites, Econ 301, 251, or equivalent, one year of college mathematics, and permission of instructor.
Mr. Cox, Mr. Smith, Mr. Tsao.

752 (I), 753 (II). ECONOMETRICS.
The application of modern statistical methods to micro- and macroeconomic theory formulated in mathematical terms.
Prerequisite, Econ 251 or permission of instructor.
Credit, 3 each semester.
Mr. Gale, Mr. Kindahl, Mr. Treyz.

761 (I), 762 (II). GENERAL ECONOMIC HISTORY.
Topics in the history of economic activity in the Western world.
Prerequisite, Econ 261.
Mr. Resnick, Mr. Wolff.

765. ECONOMIC DEVELOPMENT: STRUCTURAL PROBLEMS.
The concept of economic development and the structural changes needed in underdeveloped countries to permit development.
Prerequisite, 15 hours of economics.
Mr. Humphries, Mr. Morris, Mr. Resnick.

766. ECONOMIC DEVELOPMENT: POLICY ISSUES.
Policy decisions involved in efforts of underdeveloped countries to induce development.
Prerequisite, Econ 765.
Mr. Humphries, Mr. Morris, Mr. Resnick.

773. THEORIES OF ECONOMIC SYSTEMS.
The theory of alternative economic systems, of national economic planning, and of resource allocation under different systems.
Prerequisite, Econ 172. Mr. Holesovsky, Mr. Wright.

774. SELECTED TOPICS IN SOVIET AND EAST-EUROPEAN ECONOMIES.
Application of advanced economic theory to selected major problems of planned economies of the Soviet type.
Prerequisites, Econ 172, 173. Mr. Holesovsky.

781 (I), 782 (II). HUMAN RESOURCE AND LABOR MARKET ECONOMICS.
A theoretical and empirical analysis of human resource and labor market problems using primarily the tools developed in microeconomics and statistics. First semester is a general survey of research in the area; second semester is an intensive analysis of selected topics.
Prerequisite for 781—Econ 201/501 or permission of instructor.
Prerequisite for 782—Econ 781 or permission of instructor.
Credit, 3 each semester. Mr. Ehrenberg.

785. ECONOMIC MODELS OF NATURAL RESOURCES AND THE ENVIRONMENT.
Theoretical economic models of the institutional, technological, and economic features of natural-resource utilization. Economic analysis of public-policy problems. Public control techniques. Some degree of mathematical sophistication required.
Mr. Cox, Mr. Smith.

795. TOPICS IN THEORETICAL WELFARE ECONOMICS.
Recent developments in theoretical welfare economics, following introduction to Pareto optimum conditions in general equilibrium. Properties of allocation mechanisms and their adequacy for achieving Pareto optima. Some degree of mathematical sophistication required.
Prerequisites, Econ 701, 702.
Mr. Smith, Mr. Sonnenschein, Mr. Wright, Mr. Cox.

797. TOPICS IN THE ECONOMICS OF UNCERTAINTY.
Recent developments in the theory and application of expected utility and decision theory. Discussion of experimental studies of choice under uncertainty. Some degree of mathematical sophistication required.
Prerequisite, Econ 701, 702. Mr. Smith, Mr. Cox.

801. HISTORY OF ECONOMIC THOUGHT.
Treatment in depth of various topics within the history of economic thought.
Prerequisite, Econ 306 or permission of instructor.
Mr. Wolff.

803 (I), 804 (II). SEMINAR IN ECONOMIC THEORY.
Development of models of economic processes, with emphasis on analysis in depth. Specific subject matter may vary from year to year.
Prerequisites, Econ 701, 702.
Credit, 3 each semester. Mr. Smith.

813 (I), 814 (II). PUBLIC FINANCE.
Theory of public goods and non-market allocation. Normative models of public expenditure and taxation. The integration of equity and efficiency considerations in evaluation of tax-expenditure programs. Social discount rates and shadow prices of resources used in the public sector. The structure and incidence of U.S. taxes. Discussion of tax reform proposals. Fiscal federalism and proposals for federal revenue-sharing.
Prerequisite, Econ 701 or permission of instructor.
Credit, 3 each semester. Mr. Cox.

897 (I), 898 (II). SEMINAR IN QUANTITATIVE ECONOMICS.
For advanced students with interest in econometrics. Weekly seminars are of two kinds: (1) lectures on advanced topics, especially new theoretical developments; (2) discussion of econometric and other empirical studies in process by members of the seminar, by other students and faculty, and by visiting speakers. Emphasis on the use of econometric tools in economic research.
Prerequisite, Econ 753 or permission of instructor.
Credit, 3 each semester. Mr. Gale, Mr. Treyz.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

ECON 104 is prerequisite to all courses listed below.

505. MARXIAN ECONOMICS.
Exposition of the Marxian economic theory in modern idiom. Comparison of methodological assumptions and conceptualization of economic phenomena in Marx and in "mainstream economics."
Prerequisite, Econ 103.
Mr. Best, Mr. Holesovsky, Mr. Wolff.

511. MONEY AND BANKING.
The development and operation of the monetary and banking systems of the United States; problems of achieving full employment and price stability through monetary controls.
Mr. Russell.

512. MONEY, INCOME, AND MONETARY POLICY.
The relationships among money, income, and monetary policy, and among individuals, banks, money markets, governments and central banks.
Prerequisite, either Econ 211 or Finance 210.
Mr. Russell.

531. SOCIAL CONTROL OF BUSINESS.
The formal and informal methods and efforts to maintain, supplement, and moderate competition, and the substitution of regulation and public enterprises for competition.
Prerequisite, Econ 103. Mr. Howard.

532. THE STRUCTURE OF AMERICAN INDUSTRY.
Business enterprise, market competition, and economic development in American industries. The social effectiveness of industries analyzed through measures of industrial structure and market performance.
Econ 103 and 203 recommended.
Mr. Gale, Mr. Howard.

542. LABOR LAW AND LEGISLATION.
Economic effects and historical survey of Federal and state laws and an analysis of important court decisions.
Prerequisite, Econ 141, or permission of instructor.
Mr. Blackman.

552. ECONOMETRICS.
The application of mathematical and statistical methods to economic theory. Emphasis on the application to both microeconomic and macroeconomic policy issues.
Prerequisite, permission of instructor.
Mr. Gale, Mr. Tsao.

561. EUROPEAN ECONOMIC EVOLUTION.
Evolution of economic organization in agriculture, industry, and commerce; the surrounding social and institutional life.
Prerequisites, Hist 100 or 101 or an economics course.
Mr. Resnick, Mr. Wolff.

562. AMERICAN ECONOMIC HISTORY.
An analytical approach to structural change, economic growth, and the development of market institutions in the United States from colonial times to the present.
Prerequisite, Econ 100 or 103. Mr. Wolff.

566. ECONOMIC DEVELOPMENT.
Economic problems of underdeveloped countries and the policies necessary to induce growth. Individual projects required.
Prerequisite, Econ 100 or 103.
Mr. Best, Mr. Morris, Mr. Resnick.

567. LATIN AMERICAN ECONOMIC DEVELOPMENT.
Development of the Latin American economies with emphasis on the central problems of the various economies and proposed economic programs.
Prerequisite, Econ 266 or permission of instructor.
Mr. Best.

570. ECONOMICS OF PLANNING.
Theoretical analysis of selected aspects of the Soviet economy: growth models applicable to the Soviet case; problems of measurement of growth and factor productivity; coordination of economic activities through centralized planning and decentralization; investment allocation criteria; conduct of foreign trade; other.
Prerequisites, Econ 103 and 203. Mr. Wright.

571. COMPARATIVE ECONOMIC SYSTEMS.
Evaluation of the performance of alternative economic systems in theory and practice. Problems of planning in the advanced economies of the United States, Western Europe, and Soviet area.
Prerequisite, Econ 103. Mr. Wright, Mr. Holesovsky.

581. REGIONAL ECONOMICS.
The process of regional economic growth; location theory and basic techniques of regional analysis; public and private area development programs.
Prerequisite, Econ 103; Econ 203 recommended.
Mr. Burghardt.

606. DEVELOPMENT OF ECONOMIC THOUGHT.
Development of economic analysis since 1500. Main currents in the evolution of mercantilistic, Physiocratic, classical, neoclassical, Marxian, and Keynesian economic thought.
Mr. Wolff.

612. PUBLIC FINANCE.
Principles of public revenues and expenditures; systems and problems of taxation; use of taxes; expenditures, debt policy to provide full employment; economic growth and price stability.
Prerequisite, Econ 103. Mr. Cox, Mr. Ray.

614. STATE AND LOCAL PUBLIC FINANCE.
State and local government revenue and expenditure programs. Individual research projects relating to Massachusetts or surrounding states required.
Prerequisite, Econ 100 or 103. Mr. Ray.

621. INTERNATIONAL TRADE AND ECONOMIC POLICY.
Intermediate theory of international trade, including the analysis of the balance of payments mechanism, pure nonmonetary theory and its application to problems of commercial policy.
Prerequisites, Econ 203 and 321. Mr. Aitken.

638. ECONOMICS OF HEALTH.
Economic aspects of health care and ill-health and social policies relative to health care and prevention of ill-health.
Mr. Duston.

641. ECONOMIC SECURITY.
Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes, and economic contingencies . Mr. Blackman.

645. HUMAN RESOURCES ECONOMICS.
An economic analysis of private and social means for providing access to higher education, housing, medical care, and an improved environment. Poverty, population concentration, and discrimination as barriers to the achievement of these ends. Policies and priorities in human resource development.
Prerequisite, Econ 103 or equivalent.
Mr. Duston, Mr. Oaxaca.

647. ECONOMICS OF THE LABOR MARKET.
A theoretical and empirical analysis of labor markets, utilizing primarily the tools developed in microeconomics. Topics include the determinants of the personal distribution of income, the level and structure of unemployment, dynamic wage determination, the impact of trade unions and other imperfections in the labor market, and an economic analysis of existing and proposed government legislation or programs which affect the operation of labor market. An introduction to labor-market data and to the formulation and testing of economic models.
Prerequisite, Econ 203. Mr. Ehrenberg.

673. NATIONAL ECONOMIC POLICIES OF ADVANCED EUROPEAN COUNTRIES AND PROGRAMS.
Evaluates the economic objectives, instruments, measures, and results of economic policy and decision-making mechanisms in the United States in comparison with Norway, Sweden, Netherlands, United Kingdom, Canada, and such other advanced non-socialist countries as the students may select.
Prerequisite, Econ 103. Mr. Barkin.

682. URBAN ECONOMIC ANALYSIS.
Economic analysis of urban markets and investigation of how urban problems result from the breakdown and imperfections of those markets. Topics include: the urban economy, urban land and housing markets, urban transportation, and the urban public economy.
Prerequisite, Econ 103 or permission of instructor.
Mr. Duston, Mr. Rottenberg.

Education

GRADUATE FACULTY

Dwight W. Allen, *Professor and Dean of the School of Education,* B.A., Stanford, 1953; M.A., 1957; Ed.D., 1959.

EARL SEIDMAN, *Professor and Associate Dean for Academic Affairs*, B.A., Oberlin, 1959; M.A.T., Harvard, 1960; Ph.D., Stanford, 1967.

NORMA JEAN ANDERSON, *Professor and Assistant Dean for Graduate Affairs*, B.S., 1956; M.Ed., 1961; Ed.D., Illinois, 1966.

RICHARD J. CLARK, JR., *Associate Professor and Assistant Dean for Undergraduate Programs*, B.A., Amherst, 1960; M.Ed., Harvard, 1961; Ed.D., Stanford, 1969.

ATRON A. GENTRY, *Associate Professor and Associate Dean for Special Programs*, B.A., California State College at Los Angeles, 1966; Ed.D., Massachusetts, 1970.

BOB SUZUKI, *Associate Professor and Assistant Dean for Administration*, B.S., University of California at Berkeley, 1960; M.S., 1962; Ph.D., California Institute of Technology, 1967.

CLEO ABRAHAM, *Assistant Professor*, B.A., Claflin, 1964; M.S., Southern Connecticut State College, 1968; Ed.D., Massachusetts, 1971.

ALFRED S. ALSCHULER, *Professor*, B.A., Amherst, 1961; M.A., Harvard, 1963; Ph.D., 1967.

G. ERNEST ANDERSON, JR., *Associate Professor*, B.A., Amherst, 1950; A.M.T., Harvard, 1955; Ed.D., 1965.

ALBERT S. ANTHONY, *Professor*, B.S., Trinity, 1937; M.A.T., Harvard, 1941; Ed.D., 1955.

ERNEST BEALS, *Adjunct Associate Professor*, B.Ed., Plymouth State College, 1953; M.Ed., Boston University, 1959; Ed.D., University of Massachusetts, 1968.

MARY H. BEAVEN, *Associate Professor*, B.S., Northwestern, 1959; M.A., 1967; Ph.D., 1971.

KENNETH H. BLANCHARD, *Associate Professor*, B.A., Cornell, 1961; M.A., Colgate, 1963; Ph.D., Cornell, 1966.

LINDA-SUE BLANE, *Assistant Professor*, B.A., Miami, 1963; M.S., 1965; Ed.D., Florida, 1967.

STEPHEN M. BLANE, *Assistant Professor*, B.A., Miami, 1960; M.Ed., 1965; Ed.D., Florida, 1967.

PAUL S. BOSLEY, *Assistant Professor*, B.S., Northwestern, 1954; B.D., Union Theological Seminary, 1957; M.A., University of Chicago, 1964; Ph.D., 1972.

SUSAN BRAINERD, *Assistant Professor*, B.A., Smith, 1968; Ed.D., Massachusetts, 1971.

LIANE BRANDON, *Assistant Professor*, B.A., Boston, 1962; M.Ed., 1967.

PRESTON BRUCE, *Horace Mann Lecturer*, B.S., Lyndon State Teacher's College, 1958; Ed.D., Massachusetts, 1972.

RICHARD M. BUNKER, *Assistant Professor*, B.S., Farmington State, 1959; M.Ed., Maine, 1965; Ed.D., Illinois, 1970.

BARBARA BURN, *Adjunct Associate Professor*, B.A., Michigan, 1947; M.A., Fletcher School of Law and Diplomacy, 1948; Ph.D., 1955.

JUAN CABAN, *Assistant Professor*, B.A., City College of New York, 1957; M.A., Columbia, 1960; Ed.D., Massachusetts, 1972.

EMMA M. CAPPELLUZZO, *Professor*, B.S., Boston, 1955; M.Ed., Arizona, 1959; Ed.D., 1965.

DONALD CAREW, *Professor*, B.A., Ohio, 1955; M.A., 1956; Ed.D., Florida, 1962.

F. THOMAS CLARK, *Assistant Professor*, B.A., Allegheny College, 1962; M.A., 1964; Ed.D., Cornell University, 1967.

DAVID G. COFFING, *Associate Professor*, B.A., Iowa, 1951; M.A., San Francisco State, 1964; Ed.D., Stanford, 1971.

ROBERTA A. COLLARD, *Associate Professor*, B.S., Texas, 1940; Ph.D., Chicago, 1962.

GRACE CRAIG, *Assistant Professor*, B.A., Massachusetts, 1959; M.S., 1962; Ph.D., 1967.

REGINALD G. DAMERELL, *Associate Professor*, B.A., Columbia College, 1946.

DAVID E. DAY, *Associate Professor*, B.S., State University of New York at Brockport, 1952; M.S., 1958; Ed.D., Wayne State, 1962.

CHRISTOPHER DEDE, *Assistant Professor*, B.S., California Institute of Technology, 1969; Ed.D., Massachusetts, 1972.

JOHN DELANY, *Adjunct Assistant Professor*, B.A., Providence College, 1965; M.Ed., Hartford, 1969; Ed.D., Massachusetts, 1971.

LARRY DYE, *Assistant Professor*, M.Ed., Massachusetts, 1971; Ed.D., 1972.

H. TODD EACHUS, *Assistant Professor*, A.B., California, 1961; M.A., Nevada, 1962; Ed.D., Massachusetts, 1969.

S. PHILIP EDDY, *Assistant Professor*, B.A., State College at Wayne, Nebraska, 1951; M.A., Columbia, 1951.

JEFFREY W. EISEMAN, *Assistant Professor*, B.A., Stanford, 1962; M.A., Michigan, 1964; Ph.D., 1971.

GLENN ERICKSON, *Assistant Professor*, B.S., Minnesota, 1965; M.S., 1966; Ed.D., Massachusetts, 1972.

KENNETH A. ERTEL, *Professor*, B.S., Minnesota, 1953; M.Ed., Eastern Washington College of Education, 1960; Ed.D., Washington State, 1967.

DAVID R. EVANS, *Associate Professor*, B.S., Oberlin, 1959; M.S., Illinois, 1961; Ph.D., Stanford, 1969.

ARTHUR W. EVE, *Associate Professor*, B.Ed., Chicago Teachers College, 1957; M.A., Chicago, 1961; Ph.D., 1967.

WILLIAM V. FANSLOW, *Associate Professor*, A.B., Chapman College, 1959; M.A., Stanford, 1961; Ph.D., 1967.

LOUIS FISCHER, *Professor*, B.A., Stanford, 1949; LL.B., 1951; M.A., 1954; Ph.D., 1958.

DAVID FLIGHT, *Assistant Professor*, B.A., Pennsylvania, 1950; M.A., Columbia, 1956; Ph.D., Chicago, 1969.

GEORGE E. FORMAN, *Assistant Professor*, B.S., Louisiana State, 1963; Ph.D., Alabama, 1967.

DOUGLAS R. FORSYTH, *Assistant Professor*, B.A., Bucknell, 1960; M.A., 1962; Ph.D., Colorado State, 1968.

RONALD H. FREDERICKSON, *Professor*, B.S., Kansas State Teachers, 1953; M.S., 1959; Ph.D., 1963.

Robert Gonzales, *Assistant Professor,* B.S., New Mexico, 1959; M.S., Gallaudet College, 1960; Ed.D., Tennessee, 1971.

William Gorth, *Assistant Professor,* B.A., State University of New York at Buffalo, 1964; Ph.D., Stanford University, 1971.

William Greene, *Assistant Professor,* B.A., North Carolina, 1966; M.S., Michigan State, 1970; Ph.D., 1971.

Michael Greenebaum, *Lecturer and Principal, Mark's Meadow School,* B.A., Harvard, 1955; M.A.T., 1956; Ed.D., Massachusetts, 1972.

William E. Griffiths, *Associate Professor,* B.A., Pennsylvania State, 1949; M.Ed., 1950; Ed.D., Pennsylvania, 1963.

Warren Gulko, *Adjunct Associate Professor,* B.A., San Diego State, 1965; M.S., Minnesota, 1968; Ph.D., 1970.

Donald E. Hall, *Associate Professor,* B.S., Gorham Teachers, 1954; M.Ed., 1955; Ed.D., Boston, 1965.

Ronald K. Hambleton, *Assistant Professor,* B.A., University of Waterloo, 1966; M.A., Toronto, 1967; Ph.D., 1969.

Glenn W. Hawkes, *Assistant Professor,* B.A., Wesleyan, 1961; M.A.T., Harvard, 1962; Ed.D., Harvard, 1968.

Jack Hruska, *Assistant Professor,* B.A., Michigan State, 1956; M.A., Colorado State College, 1960; Ph.D., Michigan State, 1969.

Thomas E. Hutchinson, *Associate Professor,* B.A., Rutgers, 1959; M.Ed., Boston University, 1961; Ed.D., Harvard, 1969.

Allen E. Ivey, *Professor,* B.A., Stanford, 1955; Ed.D., Harvard, 1959.

Byrd L. Jones, *Professor,* B.A., Williams, 1960; Ph.D., Yale, 1966.

Robert C. Jones, *Assistant Professor,* B.S., Maine, 1937; M.S., Massachusetts, 1953; Ed.D., Cornell, 1960.

Daniel C. Jordan, *Professor,* B.Mus., Wyoming, 1954; B.A., Oxford, 1959; M.A., Chicago, 1960; Ph.D., 1964.

Alfred L. Karlson, *Assistant Professor,* B.A., Antioch, 1964; M.Ed., Tufts, 1966; Ph.D., Chicago, 1971.

Simon Keochakian, *Assistant Professor,* B.S., Springfield College, 1958; M.S., 1961; Ed.D., Massachusetts, 1970.

A. Donn Kesselheim, *Professor,* B.A., Stanford, 1948; M.A., Colorado State, 1951; Ed.D., Harvard, 1964.

Richard D. Konicek, *Associate Professor,* B.S., Illinois, 1963; M.S., 1954; Ed.D., Columbia, 1967.

William G. Kornegay, *Professor,* B.A., North Carolina, 1949; M.Ed., 1957; Ph.D., 1959.

Russell Kraus, *Assistant Professor,* B.A., Paterson State, 1963; M.S., Southern Illinois, 1969; Ed.D., Massachusetts, 1971.

William A. Kraus, *Assistant Professor,* B.A., Alma, 1965; M.A., Iowa, 1967; Ph.D., Ohio, 1970.

Susan C. LaFrance, *Assistant Professor,* B.A., Drew, 1962; M.A., Temple, 1963; Ph.D., Massachusetts, 1967.

William Lauroesch, *Associate Professor,* B.A., Colgate, 1942; M.A., Syracuse, 1947; Ed.D., New York, 1956.

Barbara Love, *Assistant Professor,* B.A., Arkansas State A. M. & N. College, 1965; M.A., Arkansas, 1967; Ed.D., Massachusetts, 1972.

Robert Mackin, *Assistant Professor,* B.A., Princeton, 1967; M.A., Stanford, 1968; Ed.D., Massachusetts, 1972.

William J. Masalski, *Assistant Professor,* B.S., Central Connecticut State, 1956; M.A., Fairfield, 1960; Ed.D., Massachusetts, 1970.

Robert J. Miltz, *Assistant Professor,* B.A., Stanford, 1964; M.A., 1965; Ed.D., 1971.

Ellis G. Olim, *Associate Professor,* B.A., Harvard, 1931; M.A., Roosevelt, 1960; Ph.D., Chicago, 1965.

Howard A. Peelle, *Assistant Professor,* B.S., Swarthmore, 1965; Ed.D., Massachusetts, 1971.

Frederick R. Preston, *Assistant Professor,* B.S., Hartford, 1967; Ed.D., Massachusetts, 1971.

Mary Quilling, *Assistant Professor,* B.A., Mount Holyoke, 1958; M.S., Wisconsin, 1965; Ph.D., 1973.

Horace B. Reed, *Professor,* B.A., Antioch, 1943; M.S., Putney Graduate School of Teacher Education, 1953; Ed.D., Harvard, 1959.

Mark H. Rossman, *Assistant Professor,* B.A., Washington Square, 1963; M.S., Bridgeport, 1966; Ed.D., Massachusetts, 1971.

Masha Rudman, *Associate Professor,* B.A., Hunter, 1953; M.S., 1956; Ed.D., Massachusetts, 1970.

David M. Schimmel, *Associate Professor,* B.A., Duke, 1955; LL.B., Yale, 1958; B.H.L., Hebrew Union, 1967.

Ann B. Schumer, *Assistant Professor,* B.A., Ohio State, 1957; M.A., 1959; Ed.D., Massachusetts, 1973.

Harvey B. Scribner, *Professor,* B.A., Farmington State Teachers College, 1946; M.A., Maine, 1951; Ed.D., Boston, 1960.

Sidney B. Simon, *Professor,* B.A., Pennsylvania State, 1949; M.Ed., 1952; Ed.D., New York, 1958.

Rudine Sims, *Associate Professor,* B.S., West Chester State College, 1959; M.S., Pennsylvania, 1964; Ed.D., Wayne State, 1972.

Robert L. Sinclair, *Associate Professor,* B.S., Miami, 1960; M.E., 1961; Ed.D., University of California at Los Angeles, 1968.

Judithe D. Speidel, *Associate Professor,* B.A., Smith, 1944; M.A., San Jose State College, 1961; M.A., Stanford, 1962; Ph.D., 1969.

Donald Streets, *Assistant Professor,* B.S., Indiana, 1956; M.A., Notre Dame, 1965; Ed.D., Massachusetts, 1971.

Patrick J. Sullivan, *Associate Professor,* B.A., Georgetown, 1960; M.A., University of California at Berkeley, 1962; Ph.D., 1967.

HARIHARAN SWAMINATHAN, *Assistant Professor*, B.S., Dalhousie, 1965; M.S., Toronto, 1966; M.Ed., 1968; Ph.D., 1971.

LEVERNE J. THELEN, *Associate Professor*, B.S., Nebraska State at Wayne, 1949; M.A., Nebraska, 1956; Ed.D., 1961.

BARBARA TURNER, *Assistant Professor*, B.A., Antioch, 1962; M.A., DePauw, 1965; Ph.D., Chicago, 1969.

RICHARD O. ULIN, *Professor*, B.A., Harvard, 1938; M.A., 1942; M.Ed., 1949; Ed.D., 1958.

GEORGE E. URCH, *Associate Professor*, B.A., Western Michigan, 1953; M.A., 1959; Ph.D., Michigan, 1967.

SYLVIA VIERA, *Professor*, B.A., University of Puerto Rico, 1943; M.Ed., Columbia, 1951; Ph.D., University of Texas, 1960.

PETER H. WAGSCHAL, *Assistant Professor*, B.A., Harvard, 1966; M.A., Stanford, 1967; Ed.D., Massachusetts, 1969.

ERNEST WASHINGTON, *Associate Professor*, B.A., Minnesota, 1960; M.A., Illinois, 1965; Ph.D., 1968.

KENNETH WASHINGTON, *Associate Professor*, B.A., Michigan State, 1961; M.A., 1967; Ph.D., 1970.

GERALD WEINSTEIN, *Professor*, B.S., Temple, 1954; M.Ed., 1959.

ROBERT R. WELLMAN, *Associate Professor*, B.A., Dartmouth, 1954; M.A., Western Reserve, 1959; Ph.D., Ohio State, 1962.

JOHN W. WIDEMAN, *Assistant Professor*, B.A., Williams College, 1950; M.Ed., Harvard, 1956; Ed.D., 1970.

ROLAND A. WIGGINS, *Assistant Professor*, B.A., 1960; M.A., 1962; Mus.D., Combs College of Music, 1965.

WILLIAM C. WOLF, JR., *Professor*, B.S., Pennsylvania State at Kutzman, 1955; M.Ed., Ohio, 1956; Ph.D., Iowa, 1959.

ROBERT L. WOODBURY, *Professor*, B.A., Amherst, 1960; M.A., Yale, 1962; Ph.D., 1966.

ROBERT H. WUERTHNER, *Assistant Professor*, B.A., Wesleyan, 1958; M.A., Colgate, 1963; Ph.D., Cornell, 1971.

RAYMOND WYMAN, *Professor*, B.S., Massachusetts, 1937; M.Ed., Boston, 1947; D.Ed., 1956.

THE DOCTOR OF EDUCATION DEGREE PROGRAM

Typically an Ed.D. candidate spends at least three years beyond the bachelor's degree in full-time study. Within the framework of Graduate School regulations, each student plans his own doctoral program with the advice of and subject to the approval of a Guidance Committee. Students are expected to spend at least two consecutive semesters under direct supervision of their committees, participate in conceptual or quantitative research efforts, engage in teaching and/or some form of field experience, become familiar with contemporary problems in education, and take a comprehensive examination prior to writing a dissertation.

THE MASTER OF EDUCATION DEGREE PROGRAM

The Master of Education degree is offered for prospective elementary teachers, for professional improvement of elementary and secondary teachers, and for the training of educational specialists in any of the Areas of Concentration listed below. Each candidate prepares a 33-credit program in consultation with an adviser.

CERTIFICATE OF ADVANCED GRADUATE STUDY (C.A.G.S.)

Programs leading to a Certificate of Advanced Graduate Study, individually prepared in consultation with a member of the instructional staff, are designed for those persons who seek post-master's degree work in any of the areas listed below, but who are not committed to the more lengthy and rigorous requirements of a doctoral program. These are not degree programs, but require a minimum of 30 credit hours beyond the master's degree (the master's degree must not be more than 10 years old). All 30 credits must be taken at the University of Massachusetts within a four-year period, and at least 15 credits must be taken in the School of Education. Of all the course work leading to the Certificate, at least 18 credits must be in 700-900 courses.

THE SCHOOL OF EDUCATION

The School of Education is committed to developing and evaluating new structures, programs, and perspectives which hopefully will lead to major reforms in education. It is a school that is attempting to become a powerful force for changing education to meet more effectively students' needs for living in today's world and society's needs for education to improve the quality of life for all its members.

LEARNING CLUSTERS

The general academic program is characterized by a diversity of learning and teaching resources, alternative educational paths and an emphasis on active involvement in the field. The School of Education has just completed a reorganization incorporating its previous Learning Centers and programs into academic Clusters which operate as focal points for the various academic experiences and courses. A student typically will belong to the Cluster of his major adviser but may have other members of his Guidance Committee and Dissertation Committee from other Clusters. The degree is not awarded through any Cluster but through the School and the Graduate School as a general education degree. Current Clusters are:

1. Division of Humanistic Applications of Social and Behavioral Sciences in Education
2. Designs for Effective Learning
3. Division of Educational Planning and Management
4. Transdisciplinary Explorations in Education
5. Educational Policy Studies

For a more detailed description of the academic focus which each Cluster provides, please contact the School of Education.

The School operates under a pass/fail grading system. (Master's degree candidates, however, are required to earn at least 18 of the required 33 credits on a graded basis.)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN EDUCATION.
A critical study of some problem in the educational field. *Credit, 1-4.*

701. PRACTICUM FOR SCHOOL GUIDANCE.
Prerequisites, Education 577, 910, and 911. *Credit, 1-4.*

702. INDEPENDENT STUDY. *Credit, 1-12.*

705. SEMINAR IN EDUCATION.
An intensive analytical study of some phase of education. *Credit, 3-12.*

706. SEMINAR IN GUIDANCE.
(Master's Section)

707. SEMINAR IN GUIDANCE.
(Doctoral Section)

708. SEMINAR IN GIFTED STUDENTS.

709. SEMINAR IN READING.

710. SEMINAR IN MATHEMATICS EDUCATION.

711. SEMINAR IN SOCIAL STUDIES EDUCATION.

712. ENGLISH FOR THE DISADVANTAGED.
The special problems in teaching English in secondary schools where students come largely from culturally and economically disadvantaged backgrounds.

713. HUMAN APPRAISALS AND EVALUATION.
Analysis of statistical procedures; review of achievement, aptitude, and interest tests, and their interpretation, selection, and administration; case-study procedures; ethical consideration; and problems in human assessment.
Prerequisite, permission of instructor.

714. SEMINAR IN ENGLISH EDUCATION.

715. WORKSHOP IN EDUCATION.
Group study of practical problems in curriculum, instruction, and administration for school personnel in service. *Credit, 2-6.*

716. WORKSHOP IN REMEDIAL READING.

717. WORKSHOP IN GIFTED STUDENTS.

718. COUNSELING AND GUIDANCE THEORY AND PROCEDURE.
The general nature of theory construction; levels of explanation; relationships of philosophy, psychology, and sociology; and various methods of facilitating human growth and development.
Prerequisite, permission of instructor.

719. WORKSHOP IN KINDERGARTEN.

720. WORKSHOP IN GUIDANCE.

721. WORKSHOP IN LANGUAGE ARTS.

722. WORKSHOP IN EDUCATIONAL ADMINISTRATION (PRINCIPALS).

723. WORKSHOP IN EDUCATIONAL ADMINISTRATION (ADMINISTRATORS).

724. DOCTORAL SEMINAR IN INTERNATIONAL EDUCATION.
An integrating core experience for doctoral students in international education. Current issues and areas of competency needed in the field.

725. EXTERNSHIP IN BUSINESS AND INDUSTRY.
Supervised field experience in industry, business, research organizations, or public agencies relevant to the student's area of specialization. Planned individually by student, cooperating business and vocational-technical education staff prior to enrollment.

727. PHOTOGRAPHY IN EDUCATION.
Theory and practice of taking and processing photographs for use in educational activities.

728. AUDIOVISUAL TECHNOLOGY.
Applications of acoustics, electricity, magnetism, mechanics, and optics to audio-visual equipment and techniques.
Prerequisite, Educ 667.

729. RESEARCH METHODOLOGY IN INTERNATIONAL EDUCATION.
An introduction to research methods; students enabled to design and carry out field studies in international education. Techniques used in the various social sciences and examples of their application to problems in international education. Survey methods, attitude and value analysis, interviewing and participant-observation techniques, and research design. Models of design and techniques presented for critique. Each student sets up a research design and method outline for a specific project.

730. MEASUREMENT FOR GUIDANCE.
Analysis of measurement devices in school guidance, including sociometrics, value scales, inventories, and other tests.

731. INTRODUCTION TO FACTOR ANALYSIS.
An introductory treatment of the linear factor model consideration of the basic problems of factor analysis and a discussion of various factor-analytic solutions. Problems of design and interpretation discussed.
Prerequisite, permission of instructor.

735. TEST THEORY.
The theory of mental tests beginning with the classical test theory model and including such topics as reliability, validity, item analysis, and latent structure models.
Prerequisite, permission of instructor.

736. SEMINAR IN CURRICULUM DEVELOPMENT IN VOCATIONAL-TECHNICAL EDUCATION.
Curriculum development approached from the standpoint of problem areas and embodying current research and reponse to social or technical changes.

738. ADVANCED MEDIA PRODUCTION.
Professionals preparation in the area of education media and technology.

739. VISUAL COMMUNICATIONS AND LITERACY.
The elements of visual literacy and of programs of visual education.

743. HISTORY OF EUROPEAN EDUCATION.
Educational movements and institutions traced from early Greece to the present in Europe, in an attempt to understand modern problems better.

744. HISTORY OF HIGHER EDUCATION IN AMERICA.
An inquiry into the role of the college and university in American society in the past as well as the present. Special attention to the meaning of a college education at various periods in American life.

745. INQUIRY INTO AMERICAN SCHOOLING.
Contemporary educational practices. Emphasis on promising developments in curriculum, staffing, and organization of public schools, past and future innovations.

748. THE TWO-YEAR COLLEGIATE INSTITUTION IN AMERICAN EDUCATION.
The evolution of variant forms of two-year degree-granting institutions with attention to related philosophical and social issues.

750. THE UNIVERSITY: AN ORGANIZATIONAL ANALYSIS.
The effects of institutional organization in higher education on human behavior.

751. INDIVIDUAL ALIENATION AND CONTEMPORARY HIGHER EDUCATION.
An analysis based on interdisciplinary readings on student alienation in contemporary institutions of higher education.

765. ORGANIZATION FOR CURRICULUM DEVELOPMENT: BASIC PRINCIPLES IN CURRICULUM AND INSTRUCTION.
The procedures and criteria for curriculum development. Determining goals, creating and organizing learning opportunities, and evaluating the effectiveness of curricula, considered in a small group setting.

766. CURRICULUM DEVELOPMENT: THEORY AND RESEARCH.
The needs of children and society; modern programs; procedures for developing curricula and improving present offerings in a school. Includes clinical involvement in curriculum development in schools cooperating with the Center for Study of Educational Innovations.

768. DEVELOPMENTS IN ELEMENTARY SCIENCE EDUCATION.
A survey of recent research in elementary science education and the resultant implications for practice in the school.
Prerequisite, Educ 562 or 661.

769. EVALUATION OF CURRICULUM PROGRAMS.
The role of evaluation in curriculum development and the development of evaluative instruments. The nature of the educational environment of schools and the need for determining what makes a compelling curricular program.
Prerequisites, Educ 765 and 766.

780. RESEARCH IN READING.
Discussion and review of relevant research and development activities in reading, past, present, and future, including an analysis of the research-to-implementation process and an investigation into possible breakthroughs in reading instruction.
Prerequisite, permission of instructor.

781. TEACHING OF READING ON SECONDARY AND ADULT LEVELS.
Principles, methods, and materials for the teaching of developmental, remedial, and accelerated reading programs. For teachers at the junior and senior high school level and for leaders of adult and college reading programs.

782. CHILDREN'S LITERATURE.
Lectures, demonstrations, discussions, practicum and readings surveying the field. Investigates various content areas (such as comparative folklore, poetry, and non-fiction), approaches for classroom use, contemporary problems, and the needs of specific populations.

783. DIAGNOSIS OF READING DIFFICULTIES.
Develops a background of information in the diagnosis and treatment of reading difficulties. Theory and interpretation of diagnostic procedures.
Prerequisite, Educ 561.

784. INDIVIDUAL CASE STUDIES OF READING PROBLEMS.
Practical experience in the gathering and summation of information to form a case study of a child that may be used to determine the seriousness and the underlying causes of the reading problem and to make recommendations for correction or remediation.
Prerequisite, Educ 783.

785. TECHNIQUES IN REMEDIAL READING.
Methods and materials in diagnosis and remedial instruction.
Prerequisite, Educ 561.

811. RECENT DEVELOPMENTS IN SECONDARY SCIENCE.
The scope and sequence of the science curriculum; the rationale, content, and implications for different student populations of selected curricula.
Prerequisite, teaching experience.

812. RECENT DEVELOPMENTS IN SECONDARY ENGLISH.
A critical evaluation of the current literature, research, yearbooks, and experiments in the curriculum and teaching of English.
Prerequisite, Educ 609.

813. RECENT DEVELOPMENTS IN SECONDARY SOCIAL STUDIES.
A comparative study and evaluation of recent programs and practices in secondary school social studies.

814. RECENT DEVELOPMENTS IN SECONDARY MATHEMATICS.
A critical evaluation of the current literature, research, and studies in the curriculum and teaching of secondary school mathematics.
Prerequisites, Educ 611 and teaching experience.

815. SECONDARY SCHOOL CURRICULUM.
The factors influencing the secondary school curriculum, the organization of the curriculum, and the goals of the secondary school, and current developments and elements desirable in the curriculum of typical secondary schools.
Prerequisite, teaching experience or permission of instructor.

816. TECHNOLOGY AND EDUCATIONAL DEVELOPMENT.
Modern technology and educational innovations and their adaptations to problems of developing countries. Students expected to design a project for implementing given innovations in the context of a particular country.

817. TECHNIQUES OF EDUCATIONAL PLANNING FOR DEVELOPING COUNTRIES.
For advanced doctoral majors in educational development. Some of the basic techniques of educational planning as they are currently being used in Europe and developing areas of the world. Students expected to carry out a planning exercise for a given school system.

820. RESEARCH PRACTICUM IN EDUCATION.
Educational problems examined in varied field settings. Alternative solutions contemplated in the context of schools, state agencies, and federally-sponsored projects. Consultative arrangements made for students; discussions and field work.

830. EDUCATION AND NATION BUILDING.
The educational problems facing developing nations as they endeavor to use the schools as an ameliorative agent. Economic factors and political considerations influencing educational planning in divergent cultures; the allocation of educational resources and the confrontation between old and new cultural values.

833. EDUCATIONAL KNOWLEDGE DIFFUSION AND UTILIZATION.
Efforts to diffuse and utilize research in agriculture, medicine, the military, the social sciences, and commerce. Parallels between patterns in these fields and in education. Models of educational diffusion and utilization. Discussion and field work.

835. SPECIAL SEMINAR IN HUMANISTIC EDUCATION.
A reading seminar exploring the philosophy, social psychology, and purposes of humanistic education. Discussion to clarify the objectives and goals of humanistic education.
Prerequisites, Educ 522 and 678, and permission of instructor.

839. HISTORY AND THE SOCIAL SCIENCES: AN INTERDISCIPLINARY APPROACH.
The possibilities for developing viable interrelationships in secondary school instruction between history and the various social sciences.

849. CURRENT CONCEPTS, TRENDS, AND PRACTICES IN VOCATIONAL-TECHNICAL EDUCATION.
Concepts resulting from a critical evaluation of the research and legislation involved in the development of vocational and technical education programs.

850. AUTO-INSTRUCTIONAL DEVICES AND PROGRAMMED LEARNING.
Theory and practice of programmed learning for typical school subjects. Each student sets up objectives and constructs a program for a unit of work. Implications for future use in education are considered.
Prerequisite, Educ 667.

852. ADMINISTRATION OF AUDIOVISUAL SERVICES.
To prepare audiovisual coordinators, directors, and supervisors in the operation of an audiovisual service: teacher-training, selection of materials and equipment, storage, cataloging, distribution, maintenance, and financial support.
Prerequisites, Educ 667 and teaching experience.

854. NEWER MEDIA IN EDUCATION.
To acquaint administrators, supervisors, and experienced classroom teachers with the characteristics, applications, and implications of the newer media in education such as language laboratories, motion pictures, closed circuit television, and teaching machines.
Prerequisite, Educ 667 or permission of instructor.

870. SPECIAL PROBLEMS IN INTERNATIONAL EDUCATION.
Independent work in international education.
Credit, 1-6.

880. CURRENT ISSUES IN EDUCATION.
In-depth exploration of historical antecedents, present conditions, and future alternatives. Fulfills the "Foundations" requirement for students seeking teacher certification.

881. COMPARATIVE EDUCATION.
The processes and problems of educational development in selected areas throughout the world. The interrelationship between education and culture explored in a multicultural context. While historical antecedents are recognized, major emphasis is on the cultural forces responsible for contemporary educational practices. Fulfills "Foundations" requirement for students seeking teacher certification.

884. EDUCATIONAL SOCIOLOGY.
The American public schools examined as one of many social institutions in the American culture. Emphasis on population, pressure groups, and the social structure of the schools within the community. Optional field experience. Fulfills "Foundations" requirement for students seeking teacher certification.

890. ANCIENT AND MEDIEVAL EDUCATIONAL THOUGHT.
Representative educational thinkers during the ancient and medieval periods.

891. MODERN EDUCATIONAL THOUGHT.
Representative educational thinkers of this era.
Credit, 15-30.

900. DOCTORAL DISSERTATION.

910. SCHOOL COUNSELING THEORY.
Counseling theory and research evaluation. Methodology, philosophies, ethics, problems, and issues of school counseling.
Prerequisites, Educ 577 and at least one hour of credit in Educ 701.

911. SCHOOL COUNSELING PROCEDURES.
Instruments and techniques of guidance, such as observation, individual appraisal, and record-keeping, and school-community liaison practices.
Prerequisites, Educ 577 and 910.

912. OCCUPATIONS AND PLACEMENT IN SCHOOL GUIDANCE.
The collection and evaluation of occupational, educational, and placement information, and its use with individuals and groups of students in school guidance.
Prerequisite, Educ 577.

913. ADMINISTRATION OF SCHOOL GUIDANCE SERVICES.
Operative framework of guidance programs in terms of personnel, functions, physical facilities, institutional integration, finance, and data processing. To be taken near completion of master's degree.
Prerequisite, Educ 577.

914. STUDENT PERSONNEL SERVICES IN HIGHER EDUCATION.
Origin, growth, and operation of student personnel services in American colleges and universities. Specific personnel services such as selection and admission of students, orientation to college life; student financial aid, student activities, and discipline.
Prerequisite, Educ 577.

915. GROUP ACTIVITIES IN GUIDANCE.
A guidance study of school groups. Group dynamics, discussion techniques, group counseling, sociometric methods, and other school group activities.
Prerequisites, Educ 577, 910, and 911.

916. CLINICAL STUDIES IN SCHOOL GUIDANCE.
Intensive case studies of youth.
Prerequisite, Educ 911 or 730.

918. SEMINAR IN RESEARCH METHODOLOGY FOR INTERNATIONAL EDUCATION.
An advanced seminar in research methods for doctoral candidates about to begin field work. Discussion and analysis of dissertation proposals. Normally taken by second and third year doctoral students in international education.

928. INTERNSHIP IN SCHOOL GUIDANCE AND COUNSELING.
Supervised on-the-job counseling experience including direct counseling, individual supervisory conferences, writing of case reports, and analysis of taped counseling sessions. To be taken near completion of CAGS or doctoral program.
Prerequisite, permission of instructor. *Credit, 3-6.*

929. ADJUSTMENT COUNSELING CASEWORK.
Supervised experience with children having special adjustment problems. May not be taken in addition to Educ 928.

949. CAREER DEVELOPMENT.
Intensive study of theories of vocational choice, related literature and research. Analysis of world of work and impact of such factors as technology, demography, social structure, geography, automation, age, and sex on career and personal development; implications for educational institutions.

950. FUNDAMENTALS OF EDUCATIONAL ADMINISTRATION.
Introduction to general school administration, the relation of public education to the cultural pattern, and organization and practices in school administration.

951. PRINCIPLES OF SUPERVISION.
Principles and problems of supervision and the exercise of educational leadership to improve instruction in the elementary curriculum and in secondary school content fields.

952. ADMINISTERING ELEMENTARY SCHOOLS.
The principal's responsibilities, organization of the school office, scheduling, use of school facilities, curriculum organiza-

tion, staff relationships, and the place of the school in the community.
Prerequisite, teaching experience.

953. ADMINISTERING SECONDARY SCHOOLS.
Housing, finance, scheduling, the library, guidance, cafeteria, public relations, etc.
Prerequisite, teaching experience.

954. PUBLIC SCHOOL FINANCE.
The economics of public education, sources of school revenue, taxation, and federal, state and local plans of school fiscal support.
Prerequisite, Educ 950.

955. COMMUNITY RELATIONS FOR SCHOOL PERSONNEL.
The development of good public-relations policies and techniques for assisting lay people in interpreting school activities, policies, and objectives.
Prerequisite, permission of instructor.

956. PRINCIPLES OF SCHOOL LAW.
Review of the legal relations of school personnel in school and community. A series of selected cases.

957. LEGAL BASIS OF SCHOOL ADMINISTRATION.
The legal basis of school operation, cases in school law, the role of the attorney general and school solicitor in school law interpretation, and school operation in relation to federal, state, and local environment.
Prerequisite, Educ 950.

958. SCHOOL PERSONNEL ADMINISTRATION.
The leadership role in staff performance and duties, the planning and promotion of continuous programs of in-service training, and personnel recruitment and development.
Prerequisite, Educ 950.

959. SCHOOL BUSINESS ADMINISTRATION.
The business aspects of school administration as related to the attainment of educational objectives. The nature of the problems involved and the skills needed in directing school business affairs.
Prerequisite, Educ 950.

960. SCHOOL PLANT PLANNING.
A comprehensive study of school plant needs, site selection, bonding, building planning, and standards, architectural service, and furniture and equipment selection practices.
Prerequisite, Educ 950.

961. CASE STUDIES IN EDUCATIONAL ADMINISTRATION.
A series of situations involving the role of the school administrator in a democracy.
Prerequisites, Educ 950 and 958.

962. EDUCATIONAL PLANNING AND EVALUATION.
Participation in a school survey to give advanced graduate students practical field experience in inspection evaluation and recommendations for future action in the educational operation.
Prerequisites, Educ 950, 959, 960, and permission of instructor. Taught in two consecutive semesters.
Credit, 6.

963. INTERNSHIP IN EDUCATIONAL ADMINISTRATION.
For advanced graduate students in educational administration. Placement on assignment in actual school administration positions on the basis of cooperative school system-university selection, assignment, and supervision.
Prerequisites, 18 semester hours in educational administration and permission of instructor. *Credit, 6-12.*

964. ADMINISTRATION OF ADULT EDUCATION.
Role of the public schools in continuing community service and planning and directing programs in adult education; adult needs in preparation for job procurement, retraining, job advancement, and community service.
Prerequisite, Educ 950.

965. THEORY AND RESEARCH IN EDUCATIONAL LEADERSHIP.
The historical development of administrative theory. Emphasis on its contribution to research and development in educational administration.
Prerequisite, Educ 950.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

516. EVALUATION MODELS.
Seminar utilizing the writings of Guba, Stufflebeam, Stake, Pace, Serevin, Bloom, and Hammond. Emphasis on philosophies of evaluation, variables employed in the various models, and the generation of new evaluation designs.
Meets twice weekly for six weeks, three hours per meeting.

518. RESEARCH METHODS IN EDUCATION.
An interdisciplinary course on research methods and scholarship in psychological, sociological, economic, political, historical, and philosophical studies of education.
Prerequisites, study in a discipline and permission of instructor.

520. PERFORMANCE CURRICULUM IN HUMAN RELATIONS FOR THE ELEMENTARY TEACHER.
To provide prospective elementary teachers with several basic human relations skills. Exercises in attention, flexibility, and decision-making in human relations. Individualized instruction with use of videotape materials and programmed texts.
One classroom hour, four laboratory hours per week.

521. EFFECTIVE CLASSROOM COMMUNICATION: "STRENGTH TRAINING."
A way of working with teacher, counselor, and administrator performance through simulation and videotape feedback. Stress on what kind of school the personnel project to their students. School personnel (pre- and in-service) are taught to evaluate the responses, feelings, and perceptions of students. A laboratory course with assigned readings, meeting once a week for three hours.
Prerequisite, student teaching.

522. THE EDUCATION OF THE SELF.
Educational strategies for increasing self-knowledge. A laboratory approach trains the student in those processes, concepts, and skills leading toward self-observation, pattern clarification, and the development of personal designs for response-experimentation are pursued. Journals and final papers document experiences.
Prerequisite, permission of instructor.

525. EDUCATION IN AFRICA.
Major trends in education on the developing African continent. Emphasis on the changes since independence. The impact of cross-cultural forces at work in education.

526. CURRICULUM DEVELOPMENT IN INTERNATIONAL EDUCATION.
The resources and concepts of curriculum development in international education. Students expected to develop units that can be taught in elementary or secondary schools.

527. CURRICULUM DEVELOPMENTS IN MUSIC AND SOUND IN EDUCATION.
A survey of methods, materials, techniques, and problems related to the innovative use of music and sound in the classroom as an aesthetic medium for enhancing learning of all kinds. Development of experimental innovations and their applications.

528. LABORATORY COURSE IN CROSS-CULTURAL STUDIES.
To develop a sensitivity to cultural differences by examining the elements of cross-cultural communication in an educational context. Primarily for teachers and those working in other educational fields. Experientially based (employing field work, role-playing, and gaming), and balanced by analytical readings, discussions, and independent study. Fulfills "Foundations" requirement for students seeking Teacher Certification.

529. INTERNATIONAL EDUCATION.
An introduction to certain portions of international education. The issues surrounding education as a tool of development, education in a cross-cultural context, and education through international exchange of persons and ideas. Substantial foreign-student participation. Readings, class discussions, learning games, and individual study projects. Fulfills "Foundations" requirement for students seeking Teacher Certification.

530. CURRICULUM INNOVATIONS IN MOVEMENT AND DANCE IN EDUCATION.
A survey of methods, materials, techniques, problems, and relevant research literature related to the use of movement and dance in the classroom as an aesthetic medium for enhancing learning of all kinds. Experimental application of innovations developed in the course.

531. ISSUES OF FREEDOM AND RESTRAINT IN ACADEMIC POLICY.
The sociological, philosophical, economic, and anthropological considerations found in freedom and restraint conflict, via readings in periodicals and discussions.

535. EDUCATIONAL MEDIA, TECHNOLOGY, AND SYSTEMS.
The characteristics, capabilities, applications, and implications of a variety of media to a variety of educational strategies. An introductory survey course for media specialists, and a basic course in modern communications media and techniques for other educators. Presentations, laboratory, and project.

536. AUDIOVISUAL INFORMATION TRANSMISSION.
Available knowledge and technology useful in the design of audiovisual materials. A search for principles useful in planning materials to aid in cognitive and effective experiences in educational contexts.

537. MEDIA PRODUCTION SURVEY.
Students prepare slides, graphics, recordings, and still and motion pictures for use in an educational program. Designed for teachers, trainees, and specialists.

541. EDUCATIONAL FILM PRODUCTION.
Theoretical data and project applications: students produce educational messages in a motion picture film format through the use of portable video tape.
Two 2-hour lectures per week.

542. CONTEMPORARY EDUCATIONAL PHILOSOPHIES.
Critical examination of selected contemporary philosophies of education. Special attention to social implications and to relevance to educational practice. Fulfills the "Foundations" requirement for students seeking Teacher Certification.

550. CONCEPTIONS OF LIBERAL EDUCATION.
Traditional and modern conceptions of liberal education analyzed with regard to their relevance to contemporary societies and education.

551. FOUNDATIONS OF EDUCATION.
Selected problems and issues in modern education studied through the discipline of educational sociology, educational history, educational philosophy, comparative education, or social psychology. Independent study or field experience optional. Possible foci are educational aims, societal expectations of the schools, church-state relations, professionalism, academic freedom, curriculum and methodological emphasis, urban education, and educational innovation. Fulfills "Foundations" requirement for students seeking Teacher Certification.

553. EDUCATIONAL TESTS AND MEASUREMENTS.
The most serviceable tests for measuring achievement. Test construction, administration, scoring, and interpretation of results studied and applied to the classroom.

554. EDUCATIONAL ANTHROPOLOGY.
Relevant concepts from cultural anthropology (such as change, human behavior and interaction, and cultural determinants within American culture) applied to education. The culture of the schools and the role of this subculture in the culture as a whole.

557. INTRODUCTION TO URBAN EDUCATION.
Discussion groups survey urban and suburban schools, discuss the process of learning in urban classrooms, study the effects of the present curriculum, and survey various innovative techniques as they apply to urban schools.

558. BLACK AND AFRICAN STUDIES CURRICULUM FOR PUBLIC SCHOOLS.
Four class hours weekly plus assigned demonstrations and observations of certain Black cultural centers and other ethnic settings and situations.

559. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SOCIAL STUDIES.
Students evaluate various state, commercial, and project social-studies curricula in terms of instructional strategies. Practical experience in creating a social studies unit.

560. THE ELEMENTARY SCHOOL CURRICULUM.
The content and methodology of the elementary school curriculum. Emphasis on the unit method and activity programs.
Prerequisites, electives in Foundations of Education and Child Psychology, Educational Psychology, or Human Development.

561. PRINCIPLES AND METHODS OF TEACHING READING AND LANGUAGE ARTS IN THE ELEMENTARY SCHOOLS.
Approaches to the teaching of reading and language arts in the elementary schools. Innovations in methods and materials demonstrated and discussed.

562. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SCIENCE.
Provides aid in preparing pre-service students for teaching science in elementary schools. Methods, materials, and latest curriculum work.

563. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY MATHEMATICS.
An introduction to the structure of mathematics, and to the role, methods, material, and curricular aspects of mathematics education in the school.

564. PRINCIPLES OF ELEMENTARY EDUCATION.
Aim, organization, program, and pupil population of the elementary school, and the relationship between elementary and secondary school education.

565. EDUCATING THE DISADVANTAGED CHILD.
The issues and problems in educating disadvantaged children. Emphasis on urban elementary education; rural education problems also addressed.

567. URBAN COMMUNITY RELATIONS.
The relationships between urban communities and the programs, agencies, and institutions that serve them. On-site field experiences involving various community organizations.

568. CURRICULUM DEVELOPMENT IN URBAN EDUCATION.
Students develop new and innovative curricula for urban schools and investigate what kinds of curriculum development are relevant to inner-city environments. A post-urban internship consisting of lectures, seminars, and field experience.

572. TEACHING READING TO SPECIAL POPULATIONS.
Approaches to the teaching of reading to such special populations as the disadvantaged, the gifted, and the emotionally disturbed, with stress on the individualized and experience approaches. One group studied intensively.

574. READING CLINIC.
Students assume supervised assignments in the roles for which they are preparing (for example, clinician, director of instructor) in the School of Education Reading Clinic and in special schools in the area.

575. DIAGNOSIS OF READING DISABILITIES.
Identification and diagnosis of reading disabilities and analysis of case studies. Each student participates in interviews and individual diagnosis, and writes a case study. Evaluation techniques and current theories of diagnostic procedures discussed. Required for certification in most states.

576. DEVELOPMENTAL READING AT THE HIGH SCHOOL, COLLEGE, AND ADULT LEVELS.
Evaluation of trends, techniques, programs, and materials in teaching developmental reading and study skills. Work in the college reading-study program with individuals and groups. Preparation for reading certification at high school and adult levels.

577. PRINCIPLES OF SCHOOL GUIDANCE.
The nature of guidance and its need in the schools with an overview of an adequate guidance service for a school system.

582. PRE-PRACTICUM IN EDUCATION.
Practicum experience in teaching prior to Student Teaching. Includes such experiences as microteaching, "strength training," and tutoring. Required for students seeking Teacher Certification.

584. ORGANIZATION AND ADMINISTRATION OF A DISTRIBUTIVE EDUCATION PROGRAM.
Activities necessary to initiate, maintain, and improve a Distributive Education Program. Focus on organization and administration at the secondary level.

585. OBSERVATION AND PRACTICE TEACHING.
A 16-week field experience under the tutelage of a cooperating teacher and University supervisor in an approved school system. No graduate credit given for students majoring in Education except for M.A.T. candidates.
Prerequisite, Educ 582. *Credit, 6-12.*

586. COORDINATION TECHNIQUES FOR COOPERATIVE PROGRAMS.
Coordination principles, techniques, and supervisory practices of a distributive education coordinator. Integrated classroom instruction and field work under the supervision of a cooperating teacher.

587. VOCATIONAL ADULT EDUCATION.
Organization and administration of vocational adult classes; the interrelationships between secondary and adult education.

588. DIRECTED OCCUPATIONAL EXPERIENCES (EXTERNSHIP PROGRAM).
Eight weeks of directed occupational experience in each of the three major fields of distribution (retail, wholesale, service) planned individually by student, cooperating business, and vocational-technical education staff prior to enrolling.

589. METHODS AND MATERIALS FOR DISTRIBUTIVE EDUCATION.
Information on securing, evaluating, organizing, and presenting instructional materials and experiences. Designed for prospective distributive-education personnel.

590. OBSERVATIONAL TECHNIQUES IN EARLY CHILDHOOD EDUCATION.
Observation of early childhood educational programs of various kinds serving disadvantaged as well as middle-class children. Four laboratory hours per week during the first four weeks of the first semester. *Credit, 1.*

591. EARLY CHILDHOOD EDUCATION MOVEMENT.
Contemporary purposes, programs, and problems of early childhood education, from an historical and philosophical perspective. A one-semester graduate seminar. Meets state requirements for Teacher Certification.

592. SEMINAR IN CURRICULUM DEVELOPMENT FOR EARLY CHILDHOOD EDUCATION.
Curriculum components for children in early-education programs designed to follow each field-teaching experience. Limited to students specializing in early childhood education.

593 (I), 594 (II). LABORATORY COURSE IN USING HUMAN DEVELOPMENT KNOWLEDGE IN EDUCATION.
A year-long laboratory course paralleling both field-teaching experiences for students concentrating on early childhood education. Factors such as sex, environment, social status, and culture examined in terms of their relation to growth rates and patterns. Data taken from the community in which each teaching experience takes place.

598. THE INDIVIDUAL AND THE ORGANIZATION OF HIGHER EDUCATION.
Analysis of the effects of institutional and organizational structure and values on individual development.

599. ALTERNATIVE STRUCTURES IN HIGHER EDUCATION.
Review and analysis of organizational structures of institutions of higher education; design of alternative models for governance and learning.

609. PRINCIPLES AND METHODS OF TEACHING SECONDARY ENGLISH.
An analysis of purposes, problems, issues, methods, and materials in the teaching of English at the secondary level. Discussion, lectures, case studies, projects.
Prerequisite for student teaching in English.

610. PRINCIPLES AND METHODS OF TEACHING SECONDARY SOCIAL SCIENCES.
A critical examination of various possible goals and strategies for secondary-school social-studies instruction, to help the prospective teacher develop a defensible rationale for his teaching. Designed as a pre-service offering.

611. PRINCIPLES AND METHODS IN TEACHING SECONDARY MATHEMATICS.
The nature and content of mathematics, learning strategies, and values of self and society; to help the pre-service mathematics teacher formulate his own philosophy and rationale for education in mathematics.

612. PRINCIPLES AND METHODS IN TEACHING SECONDARY SCIENCE.
The nature and content of science, learning strategies, and values of self and society, to help the pre-service science teacher formulate his own philosophy and rationale for education in science.

616. AMERICAN SECONDARY EDUCATION.
Learning materials and activities and their organization in various teaching fields.
Prerequisite, an elective in Foundations of Education and Psych 793. *Credit, 2.*

619. EDUCATION AND PUBLIC POLICY.
Selected issues and problems concerning the interaction between education and politics at the local, state, and national levels.

620. INTRODUCTION TO COMPENSATORY EDUCATION.
The ways in which various cultures differentially prepare students for successful performance in public school; translating this into curriculum development, appropriate teaching techniques, and sound educational procedures. A cross-section of current compensatory programs examined and discussed.

621. PROBLEMS IN RURAL EDUCATION.
Problems peculiar to students living in rural areas and educational systems and to teachers serving rural areas. Ways to compensate for the lack of various kinds of technological supports available in urban areas; practical means of guaranteeing adequate levels of sophistication in curriculum content and basic educational experiences. May be taken with or without the practicum which involves the application and evaluation of principles in field work.

622. READINGS IN EVALUATION IN COMPENSATORY EDUCATION.
The assessment of needs, identification of resources, specification of program objectives in behavioral terms, staffing requirements and techniques, and proposal writing. Review of many different proposals for compensatory education programs, and site visits to several area programs.

624. DESIGN AND MANAGEMENT OF SCHOOL INFORMATION SYSTEMS.
Systems analysis, problem definition, hardware selection, site preparation, systems design, staff selection, information collection and display, programming and procedure documentation standards, and user-training for various types of information systems. Concurrent internship in an appropriate school information center expected.
Prerequisite, a knowledge of computer programming.

630. ECONOMICS OF EDUCATION.
An introduction to economists' approaches to education as an investment in human capital. Review of the literature. Topics such as cost-benefit ratios for individuals and society, manpower forecasts, and resource allocation for invention and new knowledge. Changing requirements for American education from an economic perspective for urban schools, on-the-job training, informal schooling, etc.

632. INTRODUCTION TO MEASUREMENT AND EVALUATION.
Basic principles of measurement. Topics include descriptive statistics, reliability, validity, principles of test-construction, item analysis and a review of standardized tests.

655 (I), 656 (II). INTRODUCTION TO STATISTICS AND COMPUTER ANALYSIS IN EDUCATION.
Methods for reducing masses of data to a few convenient descriptive terms, and drawing inferences from them. First semester includes elementary descriptive statistics, control of the computer terminal (use of packaged programs), and the beginning of inferential statistics. Second semester includes inferential statistics, some programming concepts with a computer language (FORTRAN) for unique solutions of problems. Two lectures and two laboratory sessions each week. First semester (or consent of instructor) prerequisite for second semester.

657. TEACHING THE HANDICAPPED THROUGH MEDIA.
Professional preparation in educational media and technology. Partially fulfills requirements for the educational media and technology program.

658 (I), 659 (II). INTRODUCTION TO SCHOOL ADMINISTRATION.
To introduce each of the many disciplines on which an administrator calls. Members of the faculty of the University and the Five Colleges lecture on their own disciplines.

660. EDUCATIONAL BROADCASTING.
A history of educational broadcasting. The current status, development, and availability of radio and television programming for educational purposes. Evaluation of radio and television in accordance with instructional objectives.

661. SCIENCE EDUCATION IN THE ELEMENTARY SCHOOLS.
For teachers or other interested persons who wish to bring their knowledge of methods, materials, and curriculum up to date. Laboratory approach.

662. EDUCATIONAL TV WORKSHOP.
For teachers and teacher interns. The hardware of television; experimental use of television in solving educational problems.

663. EDUCATION IN ASIA.
The relationship between education and society in the major nations of the Far East. The process of change in educational thought and institutions; the conflict between tradition and contemporary forces.

665. EDUCATION IN LATIN AMERICA.
The developmental history of the educational structures and systems of Latin America. Emphasis on the effectiveness of the various educational models. Analysis based on related case studies.

666. EDUCATION AND DEVELOPMENT.
The relationship between the development of national and regional areas and education. Systems analysis introduced; areas for potential research projects identified.

667. PREPARATION AND USE OF AUDIO-VISUAL MATERIALS.
Machines, materials, and techniques for teaching groups of students.

669. PRACTICUM IN INTERNATIONAL EDUCATION.
Supervised practical experience in various areas of international education.

672. PRINCIPLES AND PRACTICES IN VOCATIONAL EDUCATION.
Emphasis on secondary and post-secondary programs and the relationship of vocational education to the total educational program.

673. APPRENTICE TEACHING IN AGRICULTURE.
A full year (in absentia) teaching agriculture, horticulture, and related subjects under a supervising teacher in a selected school. *Credit, 6.*

675. METHODOLOGY AND MATERIALS ON TEACHING IN OCCUPATIONAL EDUCATION.
A seminar approach to special methodology in occupational education. Content based on experiences of students in teaching. Laboratory section in microteaching.

676. PREPROFESSIONAL LABORATORY EXPERIENCE IN OCCUPATIONAL EDUCATION.
Participatory experience in teaching in occupational education programs, including directed observation of instructional activities, teaching individuals and conducting occupational placement, and/or off-farm instruction.

678. PRACTICUM IN HUMANISTIC CURRICULUM DEVELOPMENT.
Models for the development of humanistic curricula. Students will employ one or more models in writing their own curricula,

and evaluate their efforts in light of existing curricula in the field.
Prerequisites, Educ 522 and permission of instructor.

685. PRACTICUM IN EDUCATION.
Each semester a group of experimental courses will be offered dealing with practical experiences in some phases of education. *Credit, 1-6.*

686. SPECIAL PROBLEMS IN EDUCATION.
A group of experimental courses offered each semester.

Electrical and Computer Engineering

GRADUATE FACULTY

JACK K. WOLF, *Professor and Chairman of the Department of Electrical and Computer Engineering,* B.S., University of Pennsylvania, 1956; M.S., Princeton University, 1957; M.A., 1958; Ph.D., 1960.

LEWIS E. FRANKS, *Professor and Graduate Program Director,* B.S., Oregon State University, 1952; M.S., Stanford, 1953; Ph.D., 1957.

MICHAEL A. ARBIB, *Professor of Computer and Information Science.*

LEONARD S. BOBROW, *Associate Professor,* B.S., University of Miami, 1962; M.S., Northwestern University, 1964; Ph.D., 1968.

ROGER W. EHRICH, *Assistant Professor,* B.S., University of Rochester, 1965; M.S., Northwestern University, 1967; Ph.D., 1969.

CAXTON C. FOSTER, *Professor of Computer and Information Science.*

ROBERT M. GLORIOSO, *Associate Professor,* B.S., Northeastern, 1962; M.S., Connecticut, 1964; Ph.D., 1967.

HERBERT A. HERCHENREDER, *Assistant Professor,* B.S., University of Missouri, 1951; M.S., Connecticut, 1957.

FRANCIS S. HILL, JR., *Assistant Professor,* B.E., Yale, 1962; M.E., 1964; Ph.D., 1968.

CHARLES E. HUTCHINSON, *Professor,* B.S., Illinois Institute of Technology, 1957; M.S., Stanford, 1961; Ph.D., 1963.

DARRELL R. JACKSON, *Associate Professor,* B.S., University of Washington, 1960; M.S., 1963; Ph.D., 1966.

WALTER H. KOHLER, *Assistant Professor,* B.S., Princeton University, 1967; M.S., 1968; Ph.D., 1972.

ROBERT E. MCINTOSH, *Professor,* B.S., Worcester Polytechnic Institute, 1962; M.S., Harvard, 1963; Ph.D., University of Iowa, 1967.

JOHN W. MOHN, *Associate Professor,* M.E., Stevens Institute of Technology, 1941; B.S., Worcester Polytechnic Institute, 1947; M.S., Stanford, 1952.

RICHARD V. MONOPOLI, *Professor,* B.S., U.S. Naval Academy, 1952; M.S., Brown, 1960; Ph.D., Connecticut, 1965.

DAVID H. NAVON, *Professor,* B.E.E., City College of New York, 1947; M.S., New York University, 1950; Ph.D., Purdue, 1953.

EDWARD M. RISEMAN, *Associate Professor of Computer and Information Science.*

DONALD E. SCOTT, *Associate Professor,* B.S., Connecticut, 1957; M.S., 1959; Ph.D., Worcester Polytechnic Institute, 1968.

G. DALE SHECKELS, *Professor,* B.S., University of Washington, 1938; M.S., Massachusetts Institute of Technology, 1940; Ph.D., Iowa State University, 1955.

TING-WEI TANG, *Associate Professor,* B.S., National Taiwan University, 1957; M.S., Brown, 1961; Ph.D., 1964.

IAN B. THOMAS, *Professor,* B.E., University of Queensland, 1958; B.S., 1959; M.S., University of Illinois, 1961; Ph.D., 1966.

LESTER C. VAN ATTA, *Adjunct Professor,* B.S., Reed College, 1927; Ph.D., Washington University, 1931.

CONRAD A. WORGRIN, *Professor of Computer and Information Science.*

SIGFRID YNGVESSON, *Associate Professor,* Teknologie Licentiat, Chalmers Institute of Technology, Sweden, 1964; Teknologie Doktor, 1968.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

In addition to the residency, dissertation, and examination requirements described in the General Information section of this bulletin, the following departmental requirements must be satisfied:

There is no formal course requirement for the Ph.D. degree. Typical programs include approximately 24 credits of course work beyond the course requirements for the master's degree.

All doctoral students are required to pass a qualifying examination. This examination is administered every January, and all students are encouraged to take this examination in their first year of graduate study.

A written foreign language examination, normally in French, Russian, or German, is required of each candidate to determine whether he has a reading knowledge of a foreign language sufficient to understand technical-journal material. This examination is administered by the Electrical and Computer Engineering Department.

A brochure containing detailed information on the Ph.D. degree in Electrical and Computer Engineering is available from the Departmental Graduate Committee.

THE MASTER OF SCIENCE DEGREE PROGRAM

Required are:

1. ECE 800, Thesis, six credits.
2. At least four ECE 700-series courses.
3. Additional graduate courses chosen by the student with the approval of his adviser, to constitute a unified program and to satisfy the 30-credit requirement for the M.S. degree. These courses are normally chosen from the fields of engineering, mathematics, physics, and computer science.
4. Supporting courses as required to remove background deficiencies.
5. University-wide requirements as described in the General Information section of this bulletin.

6. The student is assigned a temporary program adviser by the Departmental Graduate Committee. The student is encouraged to select a major thesis adviser after one semester of study. In consultation with his major thesis adviser, the student prepares a proposal for thesis research to be submitted for approval to the Departmental Graduate Committee.

A brochure containing detailed information on the requirements for the M.S. degree in Electrical and Computer Engineering is available from the Departmental Graduate Committee.

RESEARCH IN ELECTRICAL AND COMPUTER ENGINEERING

The Electrical and Computer Engineering Department is conducting active research and has supporting academic programs in the following areas:

1. Computer Systems Engineering.
2. Communications and Signal Processing.
3. Systems and Control Theory.
4. Man-Machine Systems.
5. Solid State Devices and Microelectronics.
6. Electrodynamics and Plasma Physics.
7. Ocean Engineering.
8. Masers and Lasers.
9. Radio Astronomy and Antenna Systems.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Recent advances and current problems in a specialized field of electrical engineering.
Prerequisite, permission of instructor.

702. ALGEBRA AND CODING.
Groups, homomorphisms, kernels, parity check matrices and codes, isomorphism theorems and decoding. Rings, ideals, residue class rings and cyclic codes. Galois fields and BCH codes. Encoding and decoding with shift registers.
Mr. Bobrow, Mr. Wolf.

703. PROBABILITY AND INFORMATION THEORY.
Elementary probability theory including probability density and distribution functions, joint random variables, and the law of large numbers. Information measure and entropy concepts, channel capacity, Shannon's noiseless and noisy coding theorems. Mr. Bobrow, Mr. Wolf.

704. STATE VARIABLE ANALYSIS.
Matrix analysis, state variables and state space techniques. Concepts of controllability and observability. Stability analysis via Liapunov's and Popov's method, phase plane and describing function. Mr. Hutchinson, Mr. Monopoli.

705. ANALYSIS OF LINEAR SYSTEMS.
Complex variables, modern systems analysis basic to network synthesis, control systems, and communication systems; including Laplace, Fourier, and z transforms and convolution. Mr. McIntosh, Mr. Tang.

706. ELECTROMAGNETIC FIELD THEORY.
Microscopic and macroscopic properties of magnetic and insulating materials; gyromagnetism and the permeability tensor; reflection and refraction; skin effect; antenna analysis; relativistic electrodynamics.
Prerequisite, ECE 257 or equivalent.
Mr. McIntosh, Mr. Tang.

707. MODERN SOLID-STATE ENGINEERING.
Fundamental quantum mechanical principles, a basis for advanced courses in semiconductor electronics, microwave magnetics, quantum electronics, etc. Solutions of Schrodinger's equation pertinent for electrical engineers.
Prerequisite, ECE 201 or equivalent.
Mr. Navon, Mr. Yngvesson.

708. SIGNAL THEORY I.
Unified treatment of techniques for representation of signals and signal processing operations. Emphasis on physical interpretation of vector spaces, linear operators, transform theory, and optimal design of signals.
Mr. Franks, Mr. Hill.

711. ADVANCED MICROWAVE ENGINEERING.
Analysis of waveguides, gyrators, antennas, and other microwave circuit elements; electron ballistics; ionospheric reflection; and refraction, and the permittivity tensor; microwave generators; masers and lasers.
Prerequisites, ECE 294 and 706 or equivalent.
Mr. McIntosh, Mr. Yngvesson

712. INTRODUCTION TO PLASMA DYNAMICS.
Fundamentals of plasma physics: motion of a charged particle in electromagnetic fields, magnetoionic theory, the Boltzmann and Vlasov equations for plasmas, and wave propagation through a plasma medium.
Prerequisite, ECE 706. Mr. McIntosh, Mr. Tang.

713. ADVANCED PLASMA DYNAMICS.
Review of classical kinetic theory. The BBGKY hierarchy and other kinetic equations for plasmas. Applications to waves in cold and hot plasmas, plasma radiations and instabilities.
Prerequisite, ECE 712. Mr. McIntosh, Mr. Tang.

721. MODERN ENGINEERING MAGNETICS.
Paramagnetism, paramagnetic resonance, solid-state masers, ferro- and ferrimagnetism, magnetic domains, Ising model, spin waves, ferromagnetic resonance, magneto-elastic, coupling, instability phenomena, resonance devices, power limiters, microwave ultrasonics in magnetic materials.
Prerequisite, ECE 707. Mr. Jackson.

722. PHYSICAL SEMICONDUCTOR ELECTRONICS.
Crystallography of solids, band theory of solids, quantum theory of electrons in a periodic lattice, dynamics of lattice vibrations, semiconductors—equilibrium and transient behavior, modern quantum electronic devices.
Prerequisite, ECE 707. Mr. Navon.

723. PRINCIPLES OF MASERS AND LASERS.
Quantum-mechanical description of typical maser and laser materials, fundamentals of maser amplification, analysis of maser and laser devices, review of applications.
Prerequisite, ECE 707. Mr. Yngvesson.

725. ENERGY STORAGE AND PROCESSING (OE 721).
Methods of energy generation, conversion, and control, with emphasis on the utilization for deep-sea submersible vehicles.
Mr. Monopoli, Mr. Navon, Mr. Sheckels.

733. DIGITAL CONTROL SYSTEMS.
Pulse transfer functions and state transition analysis applied to discrete-data sysems. Nonconventional sampling. Nonlinear sampled data systems. Dynamic programming and computer control.
Prerequisite, ECE 704. Mr. Monopoli, Mr. Hutchinson.

734. OPTIMUM CONTROL SYSTEMS.
Analytical design of optimum linear systems. Calculus of variations. Pontryagin's Maximum Principle, and applications to design of optimum systems. Minimum mean square estimation and control.
Prerequisite, ECE 704. Mr. Hutchinson, Mr. Monopoli.

735. ADAPTIVE CONTROL.
The problem of system identification, performance criteria and decision-making, and the implementation of adaptive techniques. Application of adaptive techniques to aircraft flight control.
Prerequisite, ECE 733, 734.
Mr. Hutchinson, Mr. Monopoli.

736. DYNAMICS AND CONTROL OF MARINE VEHICLES (OE 752).
The equations of motion for a marine vehicle; the stability and dynamics for control. Mr. Hutchinson.

741. SIGNAL THEORY II.
Signal Space methods applied to random processes, giving the modern interpretation of optimum filtering, signal parameter estimation, and signal detection. Many examples of practical applications. Mr. Franks, Mr. Hill.

743. NAVIGATION (OE 751).
A survey of the principles of navigation. Emphasis on the information-processing involved and error analysis.
Mr. Hutchinson.

745. INFORMATION TRANSMISSION SYSTEMS.
Practical topics in the design of digital and analog data communication systems. Modulation and coding. Diversity systems and multiplexing of signals. Channel equalization. Information capacity of channels and error-rate performance.
Prerequisite, ECE 741. Mr. Franks, Mr. Hill, Mr. Wolf.

746. STATISTICAL COMMUNICATION THEORY.
Review of probability and random process theory; series expansions of random processes, shot noise; the Gaussian process; optimum smoothing and prediction; random signals through nonlinear devices; introduction to decision theory.
Prerequisite, ECE 703. Mr. Franks, Mr. Hill, Mr. Wolf.

748. NETWORK SYNTHESIS.
A survey of practical methods for design of filter networks Passive LC and active RC design techniques. Distributed-element filters. Variable-parameter filters. Digital filters.
Prerequisite, ECE 204 or equivalent. Mr. Franks.

750. GRAPH THEORY AND ITS APPLICATIONS.
Fundamental concepts of graph theory including circuits, cut-sets, paths, and duality. Application to network analysis and synthesis, switching theory, variable-length and error-correcting codes, and communication networks.
Mr. Bobrow.

751. SWITCHING AND AUTOMATA THEORY.
Homing and diagnosis of sequential machines, fault detection and diagnosis of combinatorial and sequential networks. State assignment in sequential machines, linear sequential machines, universal modules, and related decision problems.
Prerequisites, ECE 510, CS 570, or equivalent.
Mr. Ehrich.

752. OPTIMIZATION THEORY AND PRACTICE.
Mathematical formulation and techniques of optimization problems; constrained extremization of functions of several variables; inequality constraints; geometric and linear programming; the calculus of variations; dynamic programming; search techniques for computers; game theory; specific applications to electrical engineering. Mr. Hill.

762. INTRODUCTION TO SPEECH ANALYSIS.
The acoustics of speech production and the engineering analysis techniques employed in speech processing.
Mr. Thomas.

763. ADVANCED SPEECH PROCESSING.
Advanced studies of speech-processing techniques with emphasis on current literature in speech analysis, transmission, synthesis, and recognition by machine.
Prerequisite, ECE 762. Mr. Thomas.

764. UNDERWATER ACOUSTICS (OE 701).
The principles, effects, and phenomena of underwater sound and its application to practical problems.
Prerequisite, ECE 306, 606.
Mr. Hutchinson, Mr. Thomas, Mr. Russell.

785. SELECTED TOPICS IN CONTROL SYSTEMS.
Topics selected from the current literature. An investigation in depth of problems relating to particular aspects of automatic control theory. *Credit, 1-3.*

786. SELECTED TOPICS IN COMMUNICATIONS.
Topics for various aspects of present interest in the field of communications with emphasis on concurrent reading of the literature. *Credit, 1-3.*

787. SELECTED TOPICS IN COMPUTER ENGINEERING.
Topics of current interest in computers, automata, and related areas. Specific topics selected from the literature.
Credit, 1-3.

793, 794. SEMINAR IN ELECTRICAL ENGINEERING.
Presentations of current research activities and literature by faculty and graduate students.
Credit, 1 each semester.

800. MASTER'S THESIS.
An individual theoretical and/or experimental investigation or a design problem terminating with an acceptable thesis. The research proposal is to be approved at least five months before graduation.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit).

510. DIGITAL CIRCUIT THEORY.
An introduction to the theory of digital circuits stressing general techniques for the analysis and synthesis of combinational and sequential logic systems.
Prerequisite, junior standing.

566. SIGNAL PROCESSING AND COMMUNICATION SYSTEMS I.
Principles of design of modern communication systems. Mathematical description of digital and analog signals. Basic limitations of modulation techniques and information capacity of transmission systems.
Prerequisites, ECE 202, 204. Mr. Franks, Mr. Hill.

567. SIGNAL PROCESSING AND COMMUNICATION SYSTEMS II.
Techniques for evaluating performance of modulation and information transmission systems. Extraction of signals from noise. Minimum error signal estimation and detection.
Prerequisites, ECE 266, 265 or permission of instructor.
Mr. Franks, Mr. Hill.

570. SOLID STATE DEVICES.
Power rectifiers, power transistors, high frequency, high power transistors, thyristors, power circuits: regulators, inverters, converters and cyclo-converting, phase-control circuits, motor control circuits.
Prerequisites, ECE 201, 202. Mr. Navon, Mr. Yngvesson.

571. MICROELECTRONICS.
Principles and applications of microelectronics with particular emphasis on silicon nomolithic integrated circuits. Fundamental limitations of microminiaturization, design constraints imposed by the monolithic technique, planar technology, digital and linear microcircuits.
Prerequisite, ECE 201. Mr. Navon.

578. DIGITAL SYSTEM DESIGN.
The design of a digital system by the interface of submits described in terms of register sets. The subunits are interfaced at the architectural level by a set of instructions and at the logic level by the Boolean equations derived from the corresponding register transfers.
Prerequisite, ECE 210.
Mr. Edwards, Mr. Ehrich, Mr. Glorioso.

587. MARINE INSTRUMENTATION.
A survey of the oceanographic parameters of interest to ocean engineers; the theory of measurement for those parameters. Typical examples of existing measuring equipment.
Mr. Hutchinson.

592. FEEDBACK CONTROL SYSTEMS I.
Time domain and frequency domain analysis and synthesis techniques for linear continuous control systems. The relationships between these techniques.
Prerequisites, ECE 142 or permission of instructor.
Mr. Hutchinson, Mr. Monopoli, Mr. Scott.

593. FEEDBACK CONTROL SYSTEMS II.
The analysis of nonlinear continuous control systems and an introduction to digital control systems and optimization techniques.
Prerequisite, ECE 290.
Mr. Hutchinson, Mr. Monopoli, Mr. Scott.

594. MICROWAVE ENGINEERING I.
Electromagnetic theory applied to microwave propagation in waveguides and coaxial lines. Microwave circuit theory with applications to passive microwave networks.
Prerequisite, ECE 258.
Mr. McIntosh, Mr. Tang, Mr. Yngvesson.

595. MICROWAVE ENGINEERING II.
Continuation of ECE 594, selected topics in the areas of solid state devices, wave propagation, antennas, and plasmas.
Prerequisite, ECE 594.
Mr. McIntosh, Mr. Tang, Mr. Yngvesson.

598. BIOMEDICAL ENGINEERING I.
Techniques and concepts from control and communication theory useful in biological, medical, and psychophysical research.
Prerequisite, permission of instructor. Mr. Scott.

599. BIOMEDICAL ENGINEERING II.
Engineering analysis of the visual, position-motion sensing, taste and smell biological communication channels; human tracking capabilities, analog and hybrid modeling.
Prerequisite, ECE 598. Mr. Scott.

606. ACOUSTICS.
The fundamentals of sound generation, propagation, and detection. Applications of theory to underwater sound and human speech. Mr. Thomas.

611. APPLIED NONLINEAR ANALYSIS.
The analysis of nonlinear mechanical and electrical systems. Numerical, graphical, and analytical methods used to determine the behavior of modern nonlinear devices.
Prerequisite, Math 174. Mr. McIntosh

642. NON-NUMERICAL PROCESSING.
Introduction to basic mathematical and logical concepts relevant to description and manipulation of information structures such as lists, trees, and graphs in LISP.
Prerequisite, COINS 233. Mr. Glorioso, Mr. Kohler.

644. PROGRAMMING STRUCTURES.
Introduction to basic structures of algorithms and programming languages. Convergence of algorithms. Introduction to logic and programming languages for description and implementation of algorithms.
Prerequisite, COINS 223. Mr. Ehrich, Mr. Kohler.

654. COMPUTER SYSTEMS LABORATORY III.
Project laboratory in advanced computer systems engineering including designs of integrated hardware/software systems and studies of current computer techniques.
Nine laboratory hours.
Prerequisite, permission of instructor. Staff.

656. INTRODUCTION TO AUTOMATA THEORY.
An introduction to formal processes of computation. Computability, automata, algorithms, recursive functions. Formal systems, computing power of machines, and automata as examples of formal systems.
Prerequisite, permission of instructor.
Mr. Ehrich, Mr. Kohler.

660. COMPUTER GRAPHICS.
Basic organization of computer-driven graphical display systems. Methods for generation and manipulation of vectors and characters for real-time display. Data structures for picture and text processing.
Prerequisites, COINS 233, ECE 642.
Mr. Ehrich, Mr. Glorioso.

662. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION.
Several aspects of self-organizing systems and pattern recognition including machine intelligence, adaptation, learning, and self-repair. Mr. Glorioso.

666. ANALOG AND HYBRID COMPUTERS.
Designed for computer science or engineering students interested in the hybrid computer as a computational tool. Review of analog and digital computers and their combination.
Prerequisite, permission of instructor.
Mr. Hutchinson, Mr. Monopoli.

668. ADVANCED SWITCHING THEORY.
Topics of contemporary interest in digital switching theory and logical design. State-of-the-art techniques in computer hardware design.
Prerequisite, ECE 510.
Mr. Ehrich, Mr. Glorioso, Mr. Kohler.

English

GRADUATE FACULTY

Joseph Frank, *Professor and Head of the Department of English,* B.A., Harvard, 1939; M.A., 1947; Ph.D., 1953.

Richard Noland, *Associate Professor and Graduate Program Director,* B.A., Emory, 1954; M.D., 1958; M.A., Columbia, 1961; Ph.D., 1968.

Chinua Achebe, *Visiting Professor,* B.A., London, 1952.

Tamas Aczel, *Associate Professor,* B.A., University of Budapest, 1948; M.A., 1950.

Gary L. Aho, *Assistant Professor,* B.A., Portland State College, 1959; Ph.D., University of Oregon, 1966.

Jeremiah Allen, *Professor and Dean of Humanities and Fine Arts,* B.A., Duke University, 1947; M.A., Tufts University, 1948; Ph.D., University of Colorado, 1956.

Thomas W. Ashton, *Assistant Professor,* B.A., City College of New York, 1963; M.A., Columbia, 1964; Ph.D., 1969.

Robert E. Bagg, *Associate Professor,* B.A., Amherst College, 1957; M.A., University of Connecticut, 1961; Ph.D., 1965.

Leon Barron, *Associate Professor,* B.A., University of Massachusetts, 1947; M.A., University of Minnesota, 1947; Ph.D., Harvard, 1960.

Nancy Lee Beaty, *Assistant Professor,* B.A., Wellesley, 1943; M.A., Yale, 1947; Ph.D., 1956.

Bernard Bell, *Assistant Professor,* B.A., Howard University, 1962; M.A., 1966; Ph.D., University of Massachusetts, 1970.

Normand Berlin, *Associate Professor,* B.A., New York University, 1953; M.A., Columbia, 1956; Ph.D., California at Berkeley, 1964.

Howard O. Brogan, *Commonwealth Professor,* B.A., Grinnell College, 1936; M.A., State University of Iowa, 1938; Ph.D., Yale, 1941.

George Carey, *Associate Professor,* B.A., Middlebury College, 1958; M.A., Indiana University, 1962; Ph.D., 1966.

Jules Chametzky, *Professor,* B.A., Brooklyn College, 1950; M.A., Minnesota, 1952; Ph.D., 1958.

Donald S. Cheney, *Associate Professor,* B.A., Yale, 1954; M.A., 1957; Ph.D., 1961.

David R. Clark, *Professor,* B.A., Wesleyan University, 1947; M.A., Yale, 1950; Ph.D., 1961.

John Clayton, *Associate Professor,* B.A., Columbia College, 1956; M.A., New York University, 1959; Ph.D., Indiana University, 1966.

Daniel Collins, *Assistant Professor,* B.A., University of Pennsylvania, 1941; M.A., University of North Carolina, 1951; Ph.D., 1962.

Thomas W. Copeland, *Commonwealth Professor,* B.A., Yale, 1928; Ph.D., 1933.

Robert P. Creed, *Professor,* B.A., Swarthmore College, 1948; M.A., Harvard, 1949; Ph.D., 1956.

Margaret Culley, *Assistant Professor,* B.A., Manhattanville College, 1964; M.A., Rutgers University, 1965; Ph.D., University of Michigan, 1972.

Randall Current, *Assistant Professor,* B.A., U.C.L.A., 1965; M.A., 1967; Ph.D., 1971.

Arlyn Diamond, *Assistant Professor,* B.A., University of California, 1961; Columbia University, 1962; Ph.D., University of California, Berkeley, 1970.

Vincent DiMarco, *Assistant Professor,* B.A., State University of New York at Buffalo, 1966; M.A., University of Pennsylvania, 1967; Ph.D., 1972.

Joseph W. Donohue, Jr., *Associate Professor,* B.A., Johns Hopkins University; M.A., Georgetown University, 1961; Ph.D., Princeton University, 1965.

Audrey R. Duckert, *Professor,* B.A., Wisconsin, 1948; M.A., 1949; Ph.D., Radcliffe College, 1959.

Lee R. Edwards, *Assistant Professor,* B.A., Swarthmore College, 1962; M.A., University of California, Berkeley, 1965; Ph.D., 1969.

Charles Eidsvik, *Assistant Professor,* B.A., University of South Dakota, 1965; M.A., 1966; Ph.D., University of Illinois, 1970.

Everett H. Emerson, *Professor,* B.A., Harvard, 1948; M.A., Duke, 1949; Ph.D., Louisiana State, 1955.

Kirby Farrell, *Assistant Professor,* B.A., Clark University, 1964; M.A., Rutgers University, 1968; Ph.D., 1972.

Andrew Fetler, *Associate Professor,* B.S., Loyola, 1959; M.F.A., State University of Iowa, 1964.

James A. Freeman, *Assistant Professor,* B.A., Amherst College, 1956; Ph.D., University of Minnesota, 1968.

Roberts W. French, *Associate Professor,* B.A., Dartmouth College; M.A., Yale, 1959; Ph.D., Brown University, 1964.

Ernest Gallo, *Associate Professor,* B.A., St. John's University, 1954; M.A., New York University, 1957; Ph.D., 1965.

Walker Gibson, *Professor,* B.A., Yale, 1940; M.A., University of Iowa, 1946.

Morris Golden, *Professor,* B.A., City College of New York, 1948; M.A., New York University, 1949; Ph.D., 1953.

Raymond Gozzi, *Associate Professor,* B.A., Amherst College, 1942; M.A., Columbia University, 1947; Ph.D., New York University, 1957.

Rayna Greeen, *Assistant Professor,* B.A., Southern Methodist University, 1963; M.A., 1966; Ph.D., Indiana University, 1972.

John Harrington, *Assistant Professor,* B.A., Washington State University, 1964; M.A., 1966; Ph.D., University of Illinois, 1970.

Richard Haven, *Professor,* B.A., Harvard, 1948; M.A., Princeton, 1952; Ph.D., 1958.

Vernon P. Helming, *Professor,* B.A., Carleton, 1925; Ph.D., Yale, 1937.

John H. Hicks, *Professor,* B.A., Middlebury, 1941; M.A., Boston University, 1952; Ph.D., 1961.

Priscilla G. Hicks, *Assistant Professor,* B.A., Wellesley, 1948; M.A., University of Michigan, 1949; Ph.D., Boston University, 1960.

Ernest H. Hofer, *Associate Professor,* B.A., Brown, 1945; M.A., 1947; Ph.D., Cornell, 1959.

Floriana T. Hogan, *Associate Professor,* B.S., Boston University, 1940; M.A., 1941; Ph.D., 1955.

Robert Hoopes, *Professor,* A.B., Cornell College, 1941; A.M., Boston University, 1942; M.A., Harvard University, 1948; Ph.D., 1949.

Betty A. Hunt, *Assistant Professor,* B.A., University of Georgia, 1950; M.A., Indiana University, 1953; Ph.D., Shakespeare Institute of the University of Birmingham, England, 1964.

John A. Hunt, *Associate Professor,* B.A., Washington & Lee University, 1952; Ph.D., Shakespeare Institute, Stratford-on-Avon, England, 1965.

Edward Jayne, *Assistant Professor,* B.A., University of California at Berkeley, 1957; M.A., 1962; Ph.D., State University of New York at Buffalo, 1970.

Paul Jenkins, *Assistant Professor,* B.A., Grinnell College, 1964; Ph.D., University of Washington, 1970.

Jack J. Jorgens, *Assistant Professor,* B.A., Carleton College, 1965; M.A., City College of New York, 1967; Ph.D., New York University, 1970.

Donald Junkins, *Associate Professor,* B.A., University of Massachusetts, 1953; S.T.B., Boston University, 1955; S.T.M., 1957; M.A., 1959; Ph.D., 1963.

Sidney Kaplan, *Professor,* B.A., College of the City of New York, 1942; M.A., Boston University, 1948; Ph.D., Harvard, 1960.

Robert Keefe, *Associate Professor,* B.A., Brandeis University, 1964; M.A., Princeton, 1966; Ph.D., 1968.

Arthur Kinney, *Associate Professor,* B.A., Syracuse, 1955; M.S., Columbia, 1956; Ph.D., University of Michigan, 1963.

G. Stanley Koehler, *Professor,* B.A., Princeton, 1936; M.A., Harvard, 1937; M.A., Princeton, 1938; Ph.D., 1942.

Joseph Langland, *Professor,* B.A., State University of Iowa, 1940; M.A., 1941.

James Leheny, *Associate Professor,* B.A., University of Connecticut, 1961; M.A., Washington University, 1963; Ph.D., 1968.

Simon O. Lesser, *Professor,* Ph.B., Chicago, 1929.

Mason I. Lowance, Jr., *Associate Professor,* B.A., Princeton University, 1960; B.A., Oxford University, 1964; M.A., 1966; Ph.D., Emory University, 1967.

Paul L. Mariani, *Associate Professor,* B.A., Manhattan College, 1962; M.A., Colgate University, 1964; Ph.D., City University of New York, 1967.

James Matlack, *Assistant Professor,* B.A., Princeton, 1960; B.A., M.A., Oxford University, 1962; M.A., Yale, 1964; Ph.D., 1967.

Milton Mayer, *Professor.*

Harold McCarthy, *Professor,* B.A., Massachusetts, 1941; M.A., Harvard, 1942; Ph.D., 1950.

John H. Mitchell, *Professor,* B.S., Bowdoin, 1943; M.A., Harvard, 1947.

Charles Moran, *Associate Professor,* A.B., Princeton University, 1958; A.M., Brown University, 1962; Ph.D., 1967.

Arthur B. Musgrave, *Professor and Director of Fellowship Program for Journalists,* B.S., Boston University, 1951; M.S., 1951; Ph.D., Minnesota, 1961.

John R. Nelson, Jr., *Assistant Professor,* B.A., Hamilton College, 1959; M.A., University of Maine, 1962; Ph.D., University of Oregon, 1967.

Jay Neugeboren, *Assistant Professor,* B.A., Columbia College, 1959; M.A., Indiana University, 1963.

William G. O'Donnell, *Professor,* B.S., Massachusetts, 1938; M.A., Yale, 1940; Ph.D., 1942.

Alex Page, *Professor,* B.A., Vermont, 1948; M.A., Harvard, 1949; Ph.D., 1953.

David H. Paroissien, *Assistant Professor,* B.A., University of Hull, England, 1961; M.A., New Mexico Highlands University, 1965; Ph.D., University of California, Los Angeles, 1968.

Lawrence Pinkham, *Associate Professor,* B.A., University of Maine, 1950; M.S., Columbia University, 1951.

Arthur W. Plumstead, *Professor,* B.A., Western Ontario, 1955; M.A., Rochester, 1957; Ph.D., 1965.

Dario Politella, *Associate Professor,* B.A., Massachusetts, 1947; M.A., Syracuse, 1949; Ph.D., 1965.

David T. Porter, *Professor,* B.A., Hamilton, 1950; Ph.D., Rochester, 1963.

Jonathan Quick, *Assistant Professor,* B.A., Rutgers, 1963; M.A., Yale, 1966; Ph.D., 1968.

Meredith B. Raymond, *Associate Professor,* B.S., Bridgewater State College, 1939; M.A., Middlebury College, 1943; Ph.D., Boston University, 1964.

James D. Reed, *Assistant Professor,* B.A., Michigan State University; M.F.A., University of Montana, 1970.

Frederick Robinson, *Assistant Professor,* B.A., University of Redlands, 1964; M.A., University of Washington, 1966; Ph.D., 1972.

Seymour Rudin, *Professor,* B.A., City College of New York, 1941; M.S., 1943; Ph.D., Cornell, 1953.

Paul F. Saagpakk, *Associate Professor,* Ph.D., Columbia, 1966.

Jack Shadoian, *Assistant Professor,* B.A., City College of New York, 1963; M.A., University of Connecticut, 1965; Ph.D., 1967.

James Shaw, *Lecturer and Associate Dean of the College of Arts and Sciences,* B.A., Otterbein College, 1954; M.A., University of Michigan, 1957; Ph.D., 1966.

Arnold J. Silver, *Associate Professor,* B.A., New York University, 1947; M.A., Columbia, 1948; Ph.D., 1958.

John E. Sitter, *Assistant Professor,* B.A., Harvard College, 1966; Ph.D., University of Minnesota, 1969.

Charles Kay Smith, *Assistant Professor,* B.A., Amherst College, 1957.

Bernard Spivack, *Professor,* B.A., Alabama, 1931; M.A., Harvard, 1932; Ph.D., Columbia, 1950.

Charlotte K. Spivack, *Professor,* B.A., New York State University at Albany, 1947; M.A., Cornell, 1948; Ph.D., University of Missouri, 1954.

Kathleen M. Swaim, *Assistant Professor,* B.A., Gettysburg College; M.A., Penn State University, 1958; M.A., Middlebury College, 1963; Ph.D., University of Pennsylvania, 1966.

James Tate, *Assistant Professor,* B.A., Kansas State College of Pittsburg, 1965; M.F.A., University of Iowa, 1967.

Robert C. Tucker, *Associate Professor,* B.A., Amherst, 1949; M.A., Harvard, 1951; Ph.D., State University of Iowa, 1961.

Frederick W. Turner, III, *Associate Professor,* B.A., Denison, 1959; M.A., Ohio State, 1961; Ph.D., Pennsylvania, 1965.

John C. Weston, Jr., *Professor,* M.A., Chicago, 1950; Ph.D., North Carolina, 1956.

Cynthia Wolff, *Assistant Professor,* B.A., Radcliffe, 1958; Ph.D., Harvard University, 1965.

Michael Wolff, *Professor,* B.A., Cambridge, 1948; M.A., St. John's College, 1955; Ph.D., Princeton University, 1958.

Howard Ziff, *Associate Professor,* B.A., Amherst College, 1952; M.A., Columbia University, 1964.

Ph.D. FOREIGN LANGUAGE REQUIREMENTS

The Department requires proficiency in one foreign language to be demonstrated by successful completion of two graduate courses in comparative literature; or by successfully completing one graduate-level course in the area of the language chosen; or proficiency in two foreign languages, to be demonstrated by passing the standard foreign-language examinations. Transfer students must fulfill this requirement according to these standards, unless they have been certified as to language proficiency before arrival; others may have partially fulfilled the requirement while earning the master's degree.

All graduate students should secure from the Department of English detailed information on requirements for the degrees.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.
For students wishing to do special work not covered by other courses. Permission of the Graduate Program Director and the instructor required. The instructor supervises and evaluates the work. *Credit, 3-12.*

701. HISTORY OF THE ENGLISH LANGUAGE.
Development of the English language. Continuing as well as accomplished changes and variations in sounds, forms, and usage. Survey of dictionaries and grammar in context of teaching. Ms. Duckert.

702. OLD ENGLISH.
Introduction to Old English.
Mr. Creed, Ms. Duckert, Mr. Aho.

703. MIDDLE ENGLISH.
The language and documents representing the chief dialects. Mr. Helming.

705. OLD ENGLISH LITERATURE.
Reading of various Old English works, stressing Beowulf.
Prerequisite, English 702, or equivalent.
Mr. Creed, Ms. Duckert.

706. MIDDLE ENGLISH LITERATURE.
Representative poems, verse plays, and selected prose, exclusive of Chaucer.
Prerequisite, English 703 or equivalent.
Mr. Helming, Ms. Diamond.

708. CHAUCER.
Chaucer's *Canterbury Tales* and the critical problems implicit in his works. Mr. DiMarco, Mr. Gallo.

709. THE WORKS OF CHAUCER'S FRENCH AND ITALIAN PERIODS.
The complaints, the dream-visions, the later short poems, Boethius, and Troilus as combinations of medieval art and thought with pre-Renaissance motifs. Mr. Gallo.

710. HISTORICAL STUDIES IN THE LANGUAGE OF LITERATURE.
The linguistic milieu in which monuments of British and American literature were created. Emphasis on matters critical to accurate reading, *e.g.*, semantic shifts, changes in syntax and rhyme, regional and social variations. Examination of selected works according to interests of the class.
Ms. Duckert.

712. STUDIES IN RHETORIC AND PROSE STYLE.
Brief readings in Plato and Aristotle as well as in the "new rhetorics" of our own time. Detailed problems in the study of style: words and meanings, the implications of sentence structures, irony, metaphor, the cliche.
Credit, 3 for two semesters. Mr. Gibson, Mr. Smith.

713. STUDIES IN FILM.
The uses of film in an English Department. The application of film terminology, theory, and aesthetics. The rhetorical elements of film and their relationship to other forms of communication. The relationship of film to print literature. Procedures for setting up film-related courses, obtaining films, and teaching film as film and as an extension of traditional literature.
Prerequisite, teacher of Rhetoric 180 or permission of instructor. Mr. Harrington, Mr. Eidsvik.

718. THE ENGLISH LITERARY PROFESSION.
An introduction to the professional standards, aims, and procedures of scholarship and criticism. Mr. Kinney.

721. THE DEVELOPMENT OF THE ENGLISH NOVEL.
Readings in the English novel to the late 19th century, from Richardson to Conrad, with attention to some ten representative novels. Mr. Page, Mr. Golden, Ms. Wolff.

730. LITERATURE OF THE 16TH CENTURY.
Christian and Humanist ideals reflected in the poetry of Skelton, Wyatt, Surrey, Sackville, Raleigh, Sidney, and Spenser. Mr. Spivack, Mr. Kinney.

731. THE ENGLISH BIBLE AS LITERATURE.
The several main genres of Biblical literature in their historical setting. Principles in interpretation; the literary influence of the Authorized Version. Mr. Freeman.

732. SHAKESPEARE.
Close examination of Shakespearian plays representing the characteristics of his dramatic art.
Mr. Spivack, Ms. Spivack, Mr. Berlin, Mr. Donohue, Mr. Farrell, Mr. Jorgens.

734. ELIZABETHAN AND JACOBEAN DRAMA.
Representative plays by Shakespeare's contemporaries, 1580-1642; emphasis on works by Marlowe, Jonson, Beaumont and Fletcher, and Ford.
Ms. Spivack, Mr. Berlin.

737. LITERATURE OF THE 17TH CENTURY.
Readings in 17th century prose and poetry from Donne to Marvell; analysis of the more significant areas of thought and style.
Ms. Beaty, Mr. Cheney, Mr. Collins, Mr. Current, Mr. Frank, Mr. Harrington, Mr. Jenkins, Mr. Koehler, Mr. Shadoian.

738. MILTON.
The major and some of the minor works; related studies in Milton scholarship and criticism.
Ms. Beaty, Mr. Collins, Mr. Current, Mr. Koehler, Mr. Freeman, Ms. Swaim.

740. LITERATURE OF THE RESTORATION AND 18TH CENTURY.
Readings in English poetry and prose from Dryden to Burns, emphasizing the major writers and including representative plays.
Mr. Barron, Mr. Golden, Mr. Leheny, Mr. Shaw, Mr. Smith, Mr. Weston, Ms. Wolff.

745. LITERATURE OF THE ROMANTIC PERIOD.
Readings in the major poetry, representative essays, and selected critical writings, including Blake, Coleridge, Wordsworth, Keats, Shelley, Byron, and Hazlitt.
Mr. Haven, Mr. Brogan, Mr. Bagg, Mr. Barnard, Mr. Ashton.

746. LITERATURE OF THE VICTORIAN AGE.
Readings in the chief poets and prophets of the Victorian Age. Emphasis on Browning, Tennyson, Carlyle, Newman, Mill, Ruskin, Arnold, and Pater.
Mr. Wolff, Mr. Silver, Mr. Noland, Ms. Raymond, Mr. Keefe.

750. EARLY AMERICAN LITERATURE.
The major writers and intellectual movements in America during the 17th and 18th centuries.
Mr. Emerson, Mr. Lowance.

753. AMERICAN ROMANTICISM.
The development of American romanticism, under European influence, stressing Cooper, Emerson, Thoreau, Poe, Hawthorne, Whitman, and Melville.
Mr. Kaplan, Mr. McCarthy, Mr. Emerson, Mr. Plumstead, Mr. Gozzi, Mr. Matlack, Mr. Robinson, Ms. Cully.

755. AMERICAN REALISM.
The development of American realism from 1865 to 1914, stressing Twain, Henry James, Howells, and Henry Adams.
Mr. O'Donnell, Mr. Turner, Mr. Gozzi, Mr. Matlack, Mr. Robinson, Ms. Cully.

770. CONTEMPORARY DRAMA.
British and American Drama from 1950 to the present.
Mr. Rudin.

771. CONTEMPORARY FICTION.
British and American fiction from 1945 to the present.
Mr. Moran, Mr. Powers, Mr. Nelson.

772. CONTEMPORARY POETRY.
British and American poetry from 1945 to the present.
Mr. Langland, Mr. Tucker, Mr. Junkins.

774. LITERARY CRITICISM.
Critical theory and practice with emphasis on the major philosophical critics beginning with Plato and Aristotle.
Mr. Copeland, Mr. Clark, Mr. Jayne.

775. MODERN DRAMA.
Modern British, Irish, and American drama from 1890 to

1950. Emphasis on major figures: Shaw, Synge, O'Neill.
Mr. Rudin, Ms. Hogan, Mr. Donohue.

776. MODERN FICTION.
Intensive study, including papers and oral reports of important works by Henry James, Joseph Conrad, James Joyce, D. H. Lawrence, William Faulkner and other masters of the modern novel between about 1900 and 1940.
Mr. Chametzky, Mr. Clayton, Mr. Hicks, Mr. Quick.

777. MODERN POETRY.
The growth and development of modern poetry in English from 1912 to WW II, including those poets who came to prominence during that period: Yeats, Stevens, Frost, Eliot, Pound, Williams; also Cummings, L. Hughes, Moore, Ransom, Auden, Crane, Robinson. Brief background materials out of Hopkins, Dickinson, and Hardy.
Mr. Clark, Mr. Koehler, Mr. Mariani.

780. IMAGINATIVE WRITING: POETRY.
Writer's workshop with emphasis on poetry. May be repeated by candidates for the M.F.A. for a total of 12 credits.
Mr. Langland, Mr. Tucker, Mr. Junkins.

781. IMAGINATIVE WRITING: PROSE.
Writer's workshop with emphasis on fiction. May be repeated by M.F.A. candidates for a total of 12 credits.
Mr. Fetler, Mr. Swados, Mr. Aczel, Mr. Neugeboren.

790. FOLKLORE.
Folk narrative: tale, myth, and legend in relation to written literature.
Ms. Campbell, Mr. Carey, Mr. Turner, Ms. Green.

810—819. SEMINARS IN ENGLISH LITERATURE.
Credit, 3 each semester.

820—829. SEMINARS IN THE ENGLISH LANGUAGE. *Credit, 3 each semester.*

830—839. SEMINARS IN AMERICAN LITERATURE. *Credit, 3 each semester.*

840—849. SEMINARS IN CRITICISM.
Credit, 3 each semester.

850—859. SEMINARS IN EDITING.
Credit, 3 each semester.

860—869. SEMINARS IN WRITING.
Credit, 3 each semester.

870—879. SEMINARS IN LINGUISTICS.
Credit, 3 each semester.

800. MASTER'S THESIS.
May be repeated by M.F.A. candidates for a total of 12 credits. *Credit, 3-9.*

900. DOCTORAL DISSERTATION. *Credit, 15-30.*

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

634. ADVANCED TECHNICAL WRITING.
Case studies in engineering and industrial reporting, advertising, and promotional literature, scientific journalism, and graphic techniques. Given in alternate years.
Prerequisite, permission of instructor. Mr. Mitchell.

RELATED COURSES

See Comparative Literature.

Entomology

GRADUATE FACULTY

T. Michael Peters, *Associate Professor, Head of the Department of Entomology, and Graduate Program Director,* B.S., Long Beach State College, 1959; M.S., Minnesota, 1961; Ph.D., 1964.

Pedro Barbosa, *Assistant Professor,* B.S., City College of New York, 1966; M.S., University of Massachusetts, 1969; Ph.D., 1971.

William B. Becker, *Professor,* B.S., New York State College of Forestry at Syracuse University, 1934; M.S., Massachusetts, 1937; Ph.D., 1945.

Adrian G. Gentile, *Assistant Professor,* Doctor of Agriculture, University of Naples, 1950; M.Sc., University of California, 1956; Ph.D., 1966.

Henry H. Hagedorn, *Assistant Professor,* B.S., University of Wisconsin, 1965; M.S., 1966; Ph.D., University of California, 1970.

Donald W. Hall, *Assistant Professor,* B.S., Purdue University, 1964; M.S., 1967; Ph.D., University of Florida, 1970.

John F. Hanson, *Professor,* B.S., Massachusetts, 1937; M.S., 1938; Ph.D., 1943.

Gary L. Jensen, *Assistant Professor,* B.S., Brigham Young University, 1962; M.S., 1963; Ph.D., University of California, Berkeley, 1968.

John H. Lilly, *Professor,* B.S., Wisconsin, 1931; Ph.D., 1935.

William D. McEnroe, *Associate Professor,* B.S., Connecticut, 1950; M.S., 1952; Ph.D., Rutgers, 1956.

John A. Naegele, *Professor,* B.S., Cornell, 1949; Ph.D., 1952.

John G. Stoffolano, *Assistant Professor,* B.S., State University of New York at Oneonta, 1962; M.S., Cornell, 1967; Ph.D., Connecticut, 1970.

William E. Tomlinson, Jr., *Professor,* B.S., Tufts, 1936; M.S., Massachusetts, 1938.

William D. Tunis, *Professor,* B.S., Massachusetts, 1949; M.S., Minnesota, 1951; Ph.D., Massachusetts, 1959.

A candidate for the Master of Science degree in Entomology, in addition to meeting the requirements of the Graduate School must ordinarily complete the course requirements of Entomology 655, 656, 680, 682, and related sciences or their equivalents, plus Entomology 579, 770, and other courses assigned by the student's adviser. A thesis is usually required, but in special cases course credits in the 700-800 series, including at least three credits in Ent. 700, may be substituted.

Requirements for the Doctor of Philosophy degree include the course requirements for the M.S. degree, as well as those established by the Graduate School and by the student's Guidance Committee. Journal-level reading competency in one foreign language will be determined by a Departmental committee.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

(Most graduate-level courses in the department are given on a rotating basis, subject to change on student demand.)

700. SPECIAL PROBLEMS.
Research on some problem in Entomology. If submitted in lieu of a thesis, original research is expected; and two copies

of a written report, approved by two members of the staff, are required by the Department. *Credit, 1-6 per semester.*

705. PRINCIPLES OF PLANT PROTECTION.
Fundamentals of insecticidal action, natural factors governing insect abundance and activity, infection and disease development, chemical control, cultural practices, quarantine and eradication, host resistance and pathogen variability and weed control. Offered only at the Waltham Field Station.

745. HISTORICAL ENTOMOLOGY.
Lives and works of outstanding entomologists of the world, history of entomology.
Prerequisite, permission of instructor. *Credit, 2.* Mr. Lilly.

770. RESEARCH METHODS.
An orientation course for incoming graduate students. Stresses research principles, methods of analysis, including the use of analytical laboratory equipment, and presentation of results. *Credit, 1.* Mr. Edwards, Mr. Stoffolano.

790. SEMINAR.
Reports on the current literature of entomology; special reports by resident and visiting speakers. Participation by all graduate students is expected.
One class hour.
(May be repeated by M.S. candidates for a maximum of 2 credits; by Ph.D. candidates for 4.) *Credit, 1 each semester.*

803. INSECT DEVELOPMENT.
Introduction to reproductive systems, gametogenesis, fertilization, unusual methods of reproduction, adaptations of the insect egg and embryo to survival, and the biological success of insects. Recent advances in entomology related to pre- and postembryonic regulation of development by interactions at all levels of organization; molecular, organelle, cellular, and tissue.
Prerequisite, permission of instructor. Mr. Stoffolano.

814. ADVANCED ANIMAL ECOLOGY.
Basic principles of terrestrial, limnological, and marine ecology; emphasis on the influence of causal factors, both physical and biotic, that regulate the activities of all organisms.
Prerequisite, Ent 579 or equivalent. Mr. Peters.

821. INSECT TOXICOLOGY.
The chemistry of insecticides and their physiological effects on insects, man, and other animals.
Prerequisite, permission of instructor.

822. INSECT MICROBIOLOGY AND PATHOLOGY.
The diseases of insects including the classification and biology of the pathogens involved. Emphasis on bacterial, fungal, protozoan, and viral pathogens of insects, and the research techniques used to study them.
Prerequisite, permission of instructor. Mr. Hall.

823. ADVANCED BIOLOGICAL CONTROL.
The basic principles and practical application of biological control of insects. A section devoted to control of pest weeds with insects.
Prerequisite, Ent 680 or equivalent.

842. ADVANCED ARTHROPOD TAXONOMY.
Classification of selected insects and insect allies, including latest methods in taxonomy and principles of classification.
Prerequisite, permission of instructor. *Credit, 1-9.*

A. Immature stages of insects.

B. Minor order of insects. Mr. Hanson.

C. Arthropods other than insects. Mr. Hanson.

D. Other groups of insects.

848. PRINCIPLES OF SYSTEMATIC ENTOMOLOGY.
The species concept; type categories; the Zoological Code. The preparation of a taxonomic paper of publication quality, including drawing, required.
Prerequisites, Ent 655, 656. Mr. Hanson.

850. ADVANCED MEDICAL ENTOMOLOGY.
Detailed studies of insects as parasites of man and animals. Biology, vector-relationship, taxonomy, and control.
Prerequisite, Ent 674 or equivalent. Mr. Hall.

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Maximum Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

566. APICULTURE.
Honeybees and their relatives; structure, behavior, and biology of bees; bee management, diseases, queen rearing, and honey production; history of apiculture.
Two class hours. One 2-hour laboratory period.
Prerequisite, Ent 126 or permission of instructor.
Mr. Hagedorn.

572. FOREST AND SHADE-TREE INSECTS.
The principles and methods of controlling insects which attack shade trees, forests, and forest products. The more important species, their identification, biology, and specific control measures.
Two class hours, two 2-hour laboratory periods.
Credit, 4. Mr. Becker.

579A, B. ANIMAL ECOLOGY.
Basic principles and concepts operative at the various levels of biological organization (organismic, population, community, and ecosystem). Topics covered: ecology and natural selection, behavioral ecology, human ecology, and current ecological problems such as pollution, overpopulation, etc. An optional 3-hour, 1-credit laboratory for an independent ecology research project. *Credit, 3 (or 4).* Mr. Stoffolano.

595. EVOLUTION.
The course and dynamics of both inorganic and organic evolution; the implications of evolutionary concept on human philosophy, behavior, and welfare. Mr. Hanson.

611A, B. INSECT BEHAVIOR.
The specific behaviors of insects, analyzed in view of current experimental research, and used to demonstrate various neurobiological principles. The behavioral dynamics of a specific insect; how that organism's behavior insures survival under diverse environmental stresses. An optional 3-hour, 1-credit lab for an independent research project. Lab period also includes several formal sessions introducing various techniques and equipment involved in behavioral research.
Credit, 3 (or 4). Mr. Stoffolano.

655 (I), 656 (II). CLASSIFICATION OF INSECTS.
The identification of insects, including immature stages. First semester: Orthoptera, Hemiptera, Coloeoptera; second semester: other orders. Either semester may be elected independently.
Three 2-hour laboratory periods.
Prerequisite, permission of instructor; Ent 126 desirable.
Credit, 3 each semester.

657. INSECT MORPHOLOGY.
The external and internal anatomy of the major orders, with stress on phylogenetic relationships, as background for subsequent work in taxonomy and physiology of insects.
One class hour, three 2-hour laboratory periods.
Prerequisite, permission of instructor, Ent 126 desirable.
Credit, 4. Mr. Hanson.

674. MEDICAL AND VETERINARY ENTOMOLOGY.
Relationships of insects and their allies to the health of man and animals. The classification, biology, and control of these pests.
One class hour, two 2-hour laboratory periods.
Prerequisite, Ent 126 or permission of instructor. Mr. Hall.

680. INSECT CONTROL.
The science of pest control. Biological control, and the need, economics, effectiveness, and hazards from insecticides are emphasized.
Prerequisite, Ent 126; Ent 579 and 682 desirable. Mr. Lilly.

681. INSECT PEST MANAGEMENT.
Application of the principles of insect pest management with emphasis on pest recognition, properties of available control agents and their correct use in planning control programs.
Prerequisite, Ent 680 and 126, or permission of instructor.
Mr. Jensen.

682. INSECT PHYSIOLOGY.
Detailed consideration of the organ systems, showing their functions in nutrition, reproduction, respiration, and growth, and the relationship of physiology to behavior.
One class hour, two 2-hour laboratory periods.
Prerequisites, Ent 126 and permission of instructor.
Mr. Hagedorn.

COURSE NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in Entomology)

560. FOOD AND STRUCTURAL PESTS.
Biology, recognition, damage, and principles of control relating to those insects and other pests which damage foods, fabrics, and buildings. A prior course in zoology or entomology desirable. Mr. Lilly.

Environmental Sciences

(Not a degree-granting program)

GRADUATE FACULTY

Warren Litsky, *Commonwealth Professor and Chairman of the Department of Environmental Sciences,* B.S., Clark University, 1945; M.S., Massachusetts, 1948; Ph.D., Michigan State, 1951.

Haim B. Gunner, *Professor and Graduate Program Director,* B.Sc., University of Toronto, 1946; M.Sc., University of Manitoba, 1948; Ph.D., Cornell, 1962.

Robert A. Coler, *Assistant Professor,* B.A., State University of New York, 1952; M.A., 1954; Ph.D., Syracuse University, 1960.

Karl Deubert, *Associate Professor,* Ph.D., Martin Luther University, Halle-Wittenberg, Germany, 1954.

William Feder, *Professor,* A.B., John Hopkins University, 1941; Ph.D., University of California, Berkeley, 1950.

Linda G. Lockwood, *Associate Professor,* B.S., Columbia University, 1960; M.A., 1961; M.A., 1965; Ph.D., 1969.

John T. Reynolds, *Adjunct Professor,* Biology Department, Clark University, Worcester, Mass.

Robert W. Walker, *Assistant Professor,* B.S., Massachusetts, 1955; M.S., 1959; Ph.D., Michigan State, 1963.

The Department of Environmental Sciences, while offering the courses listed below, attempts to structure course sequences which are suited to the needs of individual students. As such, it encourages interaction with other departments offering related material in environmental studies. While this is not an independent degree-granting program, the M.S. and Ph.D. are offered through the Department of Plant and Soil Sciences and the M.Ed. and the Ed.D. in Environmental Sciences Education are awarded through the School of Education.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

710, 711. GRADUATE SEMINAR IN ENVIRONMENTAL STUDIES.
Reading reports and discussions of the current literature in the area of Environmental Sciences. *Maximum credit, 6.*

745. MICROBIAL ECOLOGY OF THE SOIL.
The biochemistry and physiology of interaction among microorganisms in the soil environment, and their relationship with the soil environment. Lectures, discussions, and a critical review of current literature.
Prerequisite, Plant and Soil Sci 585 or permission of instructor.
Mr. Gunner.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

501. INTRODUCTORY ENVIRONMENTAL BIOLOGY.
The response of the biota to environmental stress induced by air, water, and soil pollutants.
Prerequisites, Botany 101, Zool 101, or equivalent. Three class hours, demonstrations, field trips. Mr. Gunner.

550. MICROBIAL ECOLOGY OF MARINE ENVIRONMENT.
The ecology, function, and importance of microorganisms in the marine environment including the underlying sediments, their role in the food chain and productivity of the seas and estuaries, and the factors influencing seasonal and geographical population dynamics. *Credit, 2.* Mr. Litsky.

585. MICROBIOLOGY OF THE SOIL.
Soil microorganisms; their distribution, ecology, and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium.
Prerequisite, Microbiol 250 or permission of instructor.
Mr. Gunner.

602. ADVANCED POLLUTION BIOLOGY.
The measurement and evaluation of the biotic response to environmental stress of the terrestrial and aquatic biocoenoses induced by air, water and soil pollutants.
Prerequisites: Introductory Environmental Biology or equivalent, 1 year of Introductory Chem and Zool or Botany.
Two 1-hour lectures, two 3-hour laboratory, field trips, demonstrations. *Credit, 4.* Mr. Coler.

603. AIR POLLUTION BIOLOGY.
A detailed description of the biological input used for the determination of air quality criteria, including organism/environment interaction and dose/response phenomena in adapted and stressed systems. No laboratory. Mr. Feder.

700. SPECIAL PROBLEMS.
Individual work on an assigned problem or project in the field of environmental sciences. *Credit, 1-3.*

(Master's Thesis and Doctoral Dissertation credits can be earned through the Plant and Soil Sciences Department and through the School of Education.)

Exercise Science

(See also Physical Education)

GRADUATE FACULTY

David C. Bischoff, *Professor of Physical Education and Dean of the School of Physical Education.*

Harry K. Campney, Jr., *Professor, Head of the Department of Exercise Science, and Graduate Program Director,* B.S., Pittsburgh, 1952; M.S., Illinois, 1953; Ph.D., Iowa, 1960.

DEE W. EDINGTON, *Assistant Professor*, B.S., Michigan State, 1959; M.S., Florida State, 1963; Ph.D., Michigan State, 1968.

ROBERT J. JAMES, *Associate Professor*, B.S., Springfield College, 1954; M.S., 1957; B.S., Connecticut, 1964; Ph.D., University of Wisconsin, 1973.

WALTER KROLL, *Professor*, B.S., Northern Illinois, 1952; M.S., Illinois, 1953; P.E.D., Indiana, 1959.

STANLEY PLAGENHOEF, *Professor*, B.S., Michigan, 1949; M.S., 1951; Ph.D., 1962.

BENJAMIN RICCI, JR., *Professor*, B.S., Springfield College, 1949; M.Ed., 1950; D.P.E., 1958.

The Department of Exercise Science (motor integration, biomechanics, exercise biochemistry, exercise physiology, and sensorimotor dysfunction) offers programs of study leading to a Master of Science degree in physical education (see Physical Education) and a Doctor of Philosophy degree in Human Movement. Students in the M.S. program may concentrate their studies in exercise science or they may opt to follow a general program of study in physical education which may include several courses in exercise science. Doctoral students specialize in exercise science.

In addition to the requirements for admission to the Graduate School, the department requires an applicant to present certain undergraduate courses. The undergraduate preparation needed for admission varies with the degree program. However, in the event that any of these entrance requirements have not been satisfied, the applicant will be required to remove his deficiencies without graduate credit.

The degree requirements include 31 graduate credits for the M.S. degree and approximately 90 graduate credits for the Ph.D. degree. In both degree programs the majority of these credits are earned in exercise science courses. The credits earned in the department come from both required and elective courses in both degree programs.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Individual research on a topic not covered by other courses. Normally confined to an extension of the content of an existing course rather than an introduction to a new area of study.
Prerequisite, permission of instructor. *Credit, 1-6.*

711. INTRODUCTION TO RESEARCH IN HUMAN MOVEMENT.
The nature of research; methods of acquiring knowledge; research and social progress; general concepts concerning the scientific method. *Credit, 1.* Mr. Campney.

712. DATA ANALYSIS AND INTERPRETATION IN HUMAN MOVEMENT RESEARCH.
Theory and techniques involved in the analysis and interpretation of data pertinent to research in human movement. Parametric and non-parametric inference statistics applied to data encountered in human movement research.
Prerequisite, Stat 121. Mr. Campney.

722. EXERCISE-PHYSIOLOGY INSTRUMENTATION THEORY.
Instrumentation theory relative to the equipment utilized in estimating parameters in exercise physiology.
Prerequisites, Zool 135, Ex Sci 278 and 621. Mr. Ricci.

732. BIOMECHANICS.
Physical and biological considerations applied to the teaching of motor skills.
Prerequisites, Ex Sci 204, 205, and 631. Mr. Plagenhoef.

742. MOTOR INTEGRATION PRACTICUM.
Theory and practice in laboratory analysis of gross motor functions. Topics include nerve conduction velocity, reflex latency, response and reaction time, and electromyographic analysis of local muscular fatigue as related to skilled and unskilled gross motor performance.
Prerequisites, Ex Sci 204, 205, 278, 641, Zool 135. Mr. Kroll.

813. MEASUREMENT THEORY AND HUMAN MOVEMENT RESEARCH.
The theory of the construction of evaluative instruments in human movement. Emphasis on a critical examination of existing measurement devices.
Prerequisites, Ex Sci 274 and 712. Mr. Campney.

823. EXPERIMENTAL PHYSIOLOGY OF EXERCISE.
Experimental investigation of the physiological effects of exercise.
Prerequisite, Ex Sci 621. Mr. Ricci.

824. TISSUE RESPIRATORY RESPONSES TO EXERCISE.
Tissue respiration in response to selected stress conditions.
Prerequisite, Ex Sci 621. Mr. Edington.

825. EXERCISE METABOLISM.
The factors affecting human metabolism under exercise conditions. Emphasis on endocrine function.
Prerequisite, Ex Sci 621. Mr. Edington.

833. FORCES AND MOMENTS OF FORCE IN HUMAN MOTION.
The analysis of whole body muscle action during movement and impact.
Prerequisite, Ex Sci 732. Mr. Plagenhoef.

843. NEUROMUSCULAR FATIGUE.
Analysis of fatigue and recovery processes in gross human motor activity.
Prerequisites, Ex Sci 621, 742, 813, and Stat 561. Mr. Kroll.

844. KINESTHESIA.
Anatomical and functional analysis of the kinesthetic phenomena in gross human motor activity.
Prerequisites, Ex Sci 641, Psych 511, and Stat 581. Mr. Kroll.

899. SEMINAR IN HUMAN MOVEMENT.
Topics in human movement not covered in other courses. *Credit, 1 per semester; Maximum credit, 6.*

800. MASTER'S THESIS. *Credit, 3-6.*

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

621. PHYSIOLOGICAL BASIS OF HUMAN PERFORMANCE.
Analysis and interpretation of cardiovascular-pulmonary adjustment, metabolic requirement, and heat regulation during exercise.
Prerequisite, Ex Sci 278. Mr. Ricci.

631. MECHANICAL ANALYSIS OF HUMAN MOTION.
Application of the principles of mechanics to the analysis of human motion.
Prerequisites, Ex Sci 204 and 205. Mr. Plagenhoef.

641. MOTOR INTEGRATION.
The control of muscular activity by the nervous system. Topics include basic motor-system reflexes, cross transfer, fatigue, kinesthetic sense, lateral dominance, and neuromuscular facilitation techniques.
Prerequisites, Ex Sci 204, 205, 278, and Zool 135. Mr. Kroll.

651. THEORY OF THERAPEUTIC EXERCISE.
Theory of therapeutic exercise for the mentally retarded, physically handicapped, and normal.
Prerequisite, Ex Sci 259. Mr. James.

652. PHYSICAL ACTIVITY AND MENTAL RETARDATION.
Physical activity relative to the behavior of the mentally retarded.
Prerequisite, Ex Sci 259. Mr. James.

Food and Agricultural Engineering

GRADUATE FACULTY

Joe T. Clayton, *Professor, Head of the Department of Food and Agricultural Engineering, and Graduate Program Director,* B.S.A.E., Tennessee, 1949; M.S., Illinois, 1951; Ph.D., Cornell, 1962.

Chin Shu Chen, *Assistant Professor,* B.S., National Taiwan University, 1960; M.S., Massachusetts, 1965; Ph.D., North Carolina State, 1968.

Tsuan H. Feng, *Professor of Civil Engineering.*

Stevenson W. Fletcher, *Associate Professor,* B.S., Pennsylvania State, 1960; M.S., 1964; Ph.D., Massachusetts, 1970.

Curtis A. Johnson, *Associate Professor,* B.S.A.E., Nebraska, 1940; M.S., Iowa State, 1955.

Ernest A. Johnson, *Associate Professor,* B.S., Massachusetts, 1953; M.S., Purdue, 1959.

Robert G. Light, *Associate Professor,* B.S., Maine, 1953; M.S., Pennsylvania State, 1958.

John S. Norton, *Associate Professor,* B.S., Pennsylvania State, 1948; M.S., Louisiana State, 1950.

ChoKyun Rha, *Assistant Professor,* B.S., Massachusetts Institute of Technology, 1962; M.S., 1964; M.S., 1966; Ph.D., 1967.

John R. Rosenau, *Associate Professor,* B.S.A., Wisconsin, 1965; B.S.M.E., 1966; Ph.D., Michigan State, 1970.

Henry G. Schwartzberg, *Professor,* B.Ch.E., Cooper Union, 1949; M.Ch.E., New York University, 1959; Ph.D., 1966.

Lester F. Whitney, *Associate Professor,* B.S., Maine, 1949; M.S., Michigan State, 1951; Ph.D., 1963.

Master of Science and Doctor of Philosophy programs in Food and Agricultural Engineering involve studies of the engineering aspects of the production, preservation, storage, processing, and distribution of food. Academic backgrounds, as well as programs of study, may differ markedly depending upon the aims of the student and the area of emphasis he selects. Students working in any emphasis-area must have a background in the physical and engineering sciences and have, or

be prepared to acquire, a basic knowledge of the biological sciences.

Requirements for both the M.S. and Ph.D. degrees include courses offered by the Department of Food and Agricultural Engineering and courses in supporting areas, such as food science, mechanical, chemical, and civil engineering; mathematics; and the biological and microbiological sciences. A typical Ph.D. program includes approximately one-third major department offerings, one-third course work in supporting areas, and one-third dissertation. The department imposes no foreign language requirements for the doctoral degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHRWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN FOOD AND AGRICULTURAL ENGINEERING.
Current topics pertinent to students' interests and departmental goals. Includes analysis, experimentation, and/or literature review. The special problem culminates with an unbound written report, often of publishable quality.
Credit, 1-6.

740. PHYSICAL PROPERTIES OF BIOLOGICAL MATERIALS.
The physical characteristics and mechanical, rheological, thermal, electrical, and optical properties of biological materials. Emphasis on the application of fundamental concepts of mechanical and thermal behavior in actual handling, storage, processing, quality-evaluation and manipulation.
2 class hours, one 2-hour period.
Prerequisite, permission of instructor. Ms. Rha.

756. ENGINEERING ANALYSIS OF BIOLOGICAL SYSTEMS.
Methods of mathematical modeling as a supplement to laboratory experiments. Analysis of biological problems in an engineering context, and the physical and mathematical interpretation of the results. Non-equilibrium thermodynamics, diffusional processes, and selected mathematical models of biological systems.
Prerequisite, Math 585 or approval of department. Mr. Chen.

760. PHYSICAL AND PHYSIOLOGICAL RELATIONSHIPS IN ANIMAL ENVIRONMENTS.
(In cooperation with Department of Veterinary and Animal Sciences)
Functional environment contrasted to the generalized environment. The action of the environment on the animal and the reaction of the animal on the environment in terms of several parameters: radiant energy, light, temperature, atmospheric composition, air flow, ambient pressure, etc. Modification of natural environments to vary physiological response.
Prerequisite, permission of instructor.
Mr. Clayton, Mr. Mellen.

766. CONTROL OF HEAT AND VAPOR FLOW IN BUILDINGS AND PROCESSES.
Application of mass flow theory to heat and vapor transfer. Thermal and gaseous interchange between animals and biological products and their environments. The application of instruments and controls.
Prerequisite, Mech Eng 582 or equivalent. Mr. Chen.

776. ADVANCED FOOD-MACHINERY DESIGN.
Food machinery component design problems. Analysis, such as finite differences, energy, and graphic methods, as well as conventional approaches. The interrelation of the physical properties of biological material, with problems related to the food industry. Shell theory and vessel design. A design problem is required of each student.

Prerequisite, permission of the department, or Mech Eng 283 and Math 285 or equivalents. Mr. Whitney.

780. BIOPHYSICS IN AGRICULTURAL ENGINEERING.
The properties of certain living systems in terms of the concepts of physics and engineering; includes the biophysical concept of the living cell; the theory of controlling regimes and biological rate processes; scalar problems pertaining to industrial applications; the instrumentation for kinetic studies involving heat and pressure in biological systems.
Prerequisite, Food and Ag Eng 781. *Credit, 4.*

781. BIOLOGICAL PROCESS ENGINEERING.
Dimensional analysis and reaction kinetics as applied to pilot plant procedures and the scale-up of biological processes for system design.
Prerequisite, Food and Ag Eng 681. Ms. Rha.

786. ADVANCED PROCESS ENGINEERING.
A comparative engineering evaluation and analysis of agricultural product processes including: thermal processing, ionizing radiation processing, freeze drying, dehydration, fermentation, and controlled atmospheres.
Mr. Schwartzberg.

791. SEMINAR.
Research methods in Food and Agricultural Engineering.
Credit, 1.

792. SEMINAR.
Research accomplishments in Food and Agricultural Engineering. *Credit, 1.*

891. PROFESSIONAL TOPICS IN FOOD AND AGRICULTURAL ENGINEERING.
Credit, 1 each semester. Maximum credit, 2.

892. TECHNICAL TOPICS IN FOOD AND AGRICULTURAL ENGINEERING.
Credit, 1 each semester. Maximum credit, 2.

800. MASTER'S THESIS. *Credit, 4-8.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

555. AQUACULTURAL ENGINEERING SYSTEMS (OE 591).
Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering systems design relationships for the culture of mollusks. A bio-engineering comparison of several systems used in aquaculture. A field trip to inspect an aquacultural project in operation.

631. INSTRUMENTATION IN FOOD AND AGRICULTURAL ENGINEERING.
Instrumentation applied to research, covering recorders, indicators, controllers and transducers in general. Emphasis on applications and limitations.
Prerequisite, permission of instructor. Mr. E. Johnson.

665. PHYSIOLOGICAL UNIT OPERATIONS.
Introduction to physiological systems, studies of thermodynamics, fluid dynamics, heat transfer and mass transfer in biological systems, concepts in biological regulatory systems and biological engineering design with specific examples. Ms. Rha.

675. FOOD PROCESSING SYSTEMS ANALYSIS.
Continuous and batch processing systems for food and biological products. Flow analysis; systems analysis, scale-up, and simulation techniques. Machine operating principles, sanitary requirements, fabrication limitation and machine interactions. Laboratory exercises directed towards flow analysis, plant layout, and systems analysis for existing plant operations.
Prerequisite, permission of instructor. Mr. Whitney.

681. ELEMENTS OF FOOD UNIT OPERATIONS.
The fundamental engineering principles involved in the processing of biological materials. Emphasis on heat transfer, mass and energy balances, refrigeration, psychrometry, properties of fluids and fluid flow. Mr. Rosenau.

684. APPLICATIONS OF FOOD ENGINEERING.
Application of engineering concepts to the processing and handling of biological materials, including evaporation, dehydration, irradiation, freeze drying, cost analysis, materials handling, manual motion, economy, and packaging.
Mr. Rosenau.

Food Science and Nutrition

GRADUATE FACULTY

Frederick J. Francis, *Professor, Head of the Department of Food Science and Nutrition, and Graduate Program Director,* B.A., University of Toronto, 1946; M.A., 1948; Ph.D., Massachusetts, 1954.

Virginia A. Beal, *Associate Professor,* B.S., Simmons College, 1939; M.P.H., Harvard School of Public Health, 1945.

Mark H. Bert, *Associate Professor,* B.S., Lima University, Peru, 1939; M.S., Illinois, 1948; Ph.D., 1955.

Peter M. Bluestein, *Assistant Professor,* B.Ch.E., Rensselaer Polytechnic Institute, 1966; Ph.D., Massachusetts Institute of Technology, 1971.

Ernest M. Buck, *Professor,* B.S., University of Connecticut, 1955; M.S., North Carolina State, 1957; Ph.D., Massachusetts, 1966.

Fergus M. Clydesdale, *Associate Professor,* B.A., Toronto, 1960; M.S., 1962; Ph.D., Massachusetts, 1966.

William B. Esselen, *Professor,* B.S., Massachusetts, 1934; M.S., 1935; Ph.D., 1938.

David A. Evans, *Associate Professor,* B.S., Pennsylvania State, 1953; M.S., 1955; Ph.D., Massachusetts, 1968.

Irving S. Fagerson, *Professor,* B.S., Massachusetts Institute of Technology, 1942; M.S., Massachusetts, 1948; Ph.D., 1950.

Denzel J. Hankinson, *Professor,* B.S., Michigan State, 1937; M.S., Connecticut, 1939; Ph.D., Pennsylvania State, 1942.

Kirby M. Hayes, *Professor,* B.S., Massachusetts, 1947; M.S., 1948.

Herbert O. Hultin, *Professor,* B.S., Massachusetts Institute of Technology, 1956; M.S., 1956; Ph.D., 1959.

Ward M. Hunting, *Associate Professor,* B.S., Houghton College, 1947; M.S., Massachusetts, 1949; Ph.D., 1963.

Robert E. Levin, *Associate Professor,* B.S., Los Angeles State College, 1952; M.S., Southern California, 1954; Ph.D., California, 1963.

Wassef W. Nawar, *Professor,* B.S., University of Cairo, 1947; M.S., 1950; Ph.D., Illinois, 1960.

Peter L. Pellett, *Associate Professor and Director of Nutrition Option*, B.S., Borough Polytechnic, London, 1952; Ph.D., London School of Hygiene and Tropical Medicine, 1956.

Frank E. Potter, *Associate Professor*, B.S., Maine, 1942; M.S., Maryland, 1948; Ph.D., Pennsylvania State, 1955.

F. Miles Sawyer, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1948; M.S., California, 1951; Ph.D., 1958.

Charles R. Stumbo, *Professor*, B.S., Kansas State, 1936; M.S., 1937; Ph.D., 1941.

Willard M. Weatherholtz, *Assistant Professor*, B.S., Berea College, 1963; M.S., Virginia Polytechnic Institute and State University, 1966; Ph.D., 1969.

INSTITUTE OF AGRICULTURAL AND INDUSTRIAL MICROBIOLOGY

Warren Litsky, *Commonwealth Professor of Environmental Sciences and Director of Agricultural and Industrial Microbiology*, B.S., Clark University, 1945; M.S., Massachusetts, 1948; Ph.D., Michigan State, 1951.

Robert A. Coler, *Assistant Professor*, B.A., State University of New York, 1952; M.A., 1954; Ph.D., Syracuse University, 1960.

Haim B. Gunner, *Associate Professor*, B.S., University of Toronto, 1946; M.S., University of Manitoba, 1948; Ph.D., Cornell, 1962.

Robert W. Walker, *Assistant Professor*, B.S., Massachusetts, 1955; M.S., 1959; Ph.D., Michigan State, 1963.

The department offers two options: food science, and nutrition. Industrial microbiology is offered as an area of concentration for the Ph.D. degree in the Department of Food Science and Nutrition in cooperation with the Institute of Agricultural and Industrial Microbiology.

FOOD SCIENCE OPTION

Graduate students who wish to major in food science may not be admitted to candidacy for an advanced degree until such time as the undergraduate requirements in basic sciences and department courses have been met substantially. Work in the area of dairy technology is included in the offerings of the Department of Food Science and Nutrition.

All general Graduate School requirements for admission and for the degree must be met with the following additional requirements:

1. All Ph.D. candidates will offer as a minimum, 15 credits of departmental 800-level courses, three credits of seminar, and nine credits outside the department in certain courses more advanced than those recommended for undergraduate majors.
2. Competency in computer usage and programming is required of all Ph.D. candidates.
3. The Department of Food Science and Nutrition requires no foreign language competency for the doctoral degree.
4. Candidates for the M.S. degree may select one of three options, in order to fulfill the Graduate School requirements.
   a. M.S. degree with thesis. Ten credits may be allowed for the thesis.
   b. M.S. degree with research problem. Up to six credits may be allowed for the problem.
   c. M.S. degree with course credits only.
5. Candidates for the non-thesis M.S. degree in options b. and c. above must submit at least nine credits of departmental 800-courses and two credits of seminar. The non-thesis options b. and c. are not open to candidates holding a departmental research assistantship.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. RESEARCH PROBLEM.
Mainly for candidates for the Master of Science degree who do not write a thesis. Original research expected. Two bound copies of a written report of the study are required by the Department. *Credit, 3-6.*

701. RESEARCH PROJECT.
Research on problems not related to the thesis. *Credit, 1-4.*

802. ADVANCED DAIRY CHEMISTRY.
The physical, colloidal and chemical properties of dairy products and the role of milk fat, salts, proteins, carbohydrates and enzyme systems.
Two class hours.
Prerequisite, premission of instructor. Mr. Potter.

809. MICROBIOLOGY AND FOOD PROCESSING.
Relationship of Yeasts, molds and bacteria to foods. Invasion of plant tissue by microorganisms. Microbiology of frozen and refrigerated foods. Ionizing radiation preservation. Alcohol and lactic acid fermentations and vinegar production.
Two class hours, one 3-hour laboratory period.
Prerequisites, food processing, basic biochemistry and microbiology, and permission of instructor. Mr. Levin.

810. THERMOBACTERIOLOGY AND FOOD PROCESSING.
Bacteria of importance in spoilage of canned foods. Bacterial contamination and its control. Thermal resistance of bacteria. Heat transfer in thermally processed foods. Calculation and evaluation of sterilization processes.
Prerequisites, FS&N 809 and calculus. Mr. Stumbo.

816. FOOD PACKAGING.
Characteristics of packaging materials and how they meet the packaging requirements of various food products. Methods of testing for structural quality and performance including moisture and gas transmission. Evaluation and case studies of current food packages and products. Plant visits in non-scheduled hours.
One or more class hours, one 4-hour laboratory period.
Prerequisite, FS&N 661. Mr. Hayes.

821. LIPID CHEMISTRY.
Composition and chemical properties of edible fats and oils. Physical characteristics—plasticity, polymorphism, melting, solidification. Technology of industrial fats—extraction, refining, hydrogenation, inter-esterification. Deteriorative reactions—oxidation, thermal degradation. Biological significance. New methods of analysis. Review of current literature.
Two class hours, one 2-hour laboratory period.
Prerequisite, permission of instructor. Mr. Nawar.

841. ADVANCED FOOD ANALYSIS.
Instrumental methods. Infrared mass spectrometry, gas chromatography and spectrometry. Theory, techniques and applications.
Two class hours, one 2-hour laboratory period.
Prerequisites, FS&N 671 and 684. Mr. Fagerson.

850. COLORIMETRY AND APPEARANCE.
Color theory encompassing the physics and psychophysics of color matching and measurement along with the physiology of vision. Development of color solids and scales. Interpretation of reflection and transmission data in terms of Munsell, C.I.E., Hunter, MacAdam and other color solids, color tolerances and color differences. Visual and instrumental characterization of color and appearance.
Total of 20 lecture hours and 12 laboratory hours.
Prerequisite, permission of instructor. Not open to FS&N majors. *Credit, 2.* Mr. Francis, Mr. Clydesdale.
Two class hours, one 3-hour laboratory period weekly.
Prerequisite, permission of instructor.
The extra lectures and laboratory classes are devoted to color and quality changes with emphasis on foods. *Credit, 2.* Mr. Francis, Mr. Clydesdale.

860. PIGMENTS IN FOODS.
Chemistry, analysis and processing implications of the anthocyanins, flavonoids, chlorophylls, carotenoids, betacyanins, meat pigments and nonenzymatic browning systems. Heavily weighted on chemistry but also includes interpretations in terms of appearance, nutritive value and general quality. Complements FS&N 850.
Two class hours, one 3-hour laboratory period.
Prerequisite, permission of instructor.
Mr. Clydesdale, Mr. Francis.

871 (I), 872 (II). SEMINAR.
Review of current literature and research. Visiting lecturers.
One class hour. *Credit, 1; maximum credit, 6.*

895. BIOLOGICAL AND TOXILOGICAL ASSAY OF FOODS.
Laboratory training in making biological assays of good constituents important in human and animal nutrition. Added chemicals in foods.
Credit, 2-5. Mr. Sawyer.

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

558. ANIMAL PRODUCTS.
Introduction to the processing, purchasing, handling and storage of meats and other protein products.
Two class hours, one 2-hour lecture-demonstration.
Mr. Buck, Mr. Hayes.

652. FOOD CHEMISTRY I.
The chemistry of food products. Chemical, physical, and biological changes in foods at the cellular and molecular levels during storage and processing. Emphasizes water, cell structure, carbohydrates and lipids of foods.
Prerequisite, Organic Chemistry or permission of instructor.
Mr. Hultin.

653. FOOD CHEMISTRY II.
The chemistry of food products. Chemical, physical and biological changes in foods at the cellular and molecular levels during storage and processing. Emphasizes food proteins, enzymes, vitamins and flavor chemistry. May be taken separately from FS&N 652.
Prerequisite, Organic Chemistry or permission of instructor.
Mr. Nawar.

661. FOOD PROCESSING.
Introduction to the food industry, principles of processing and preservation in current usage. Statistical quality-control procedures. Mr. Bluestein.

662. FOOD PROCESSING LABORATORY.
Application and utilization of pilot plant equipment to study and evaluate principles of commercial practice in the food industry. Introduction to advanced techniques of food processing.
One class hour, one 4-hour laboratory period.
Prerequisite, FS&N 661. Mr. Bluestein.

665. UNIT OPERATIONS.
Technical principles involved in the handling and processing of milk and dairy products.
Two class hours, one 2-hour laboratory period.
Mr. Hankinson.

666. HYGIENIC PRINCIPLES OF FOOD HANDLING.
Application of hygienic principles to the preparation, processing and handling of foods. Emphasis on the training of supervisory personnel. *Credit, 4.* Mr. Evans, Mr. Stumbo.

671. ANALYSIS OF FOOD PRODUCTS.
Physical, chemical, microbiological and microscopical methods.
Two class hours, one 4-hour laboratory period.
Prerequisite, analytical chemistry. Mr. Hunting.

672. OBJECTIVE ANALYTICAL METHODS AND INSTRUMENTATION.
Continuance of 671.
Two class hours, one 4-hour laboratory period.
Prerequisite, FS&N 671. Mr. Hunting.

680. SPECIAL TOPICS IN WORLD FOOD TECHNOLOGY.
Selected problems in applications of food technology to solution of world food problems in developing countries.
Mr. Esselen.

684. SENSORY EVALUATION METHODS.
An introduction to sensory measurements in the evaluation and acceptance of foods. Panel tests and their statistical interpretation; taste, odor, color, and texture measurements.
One class hour, one 2-hour laboratory period.
Credit, 2. Mr. Sawyer.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in Food Science and Nutrition)

551. INTRODUCTORY FOOD SCIENCE.
Food manufacture, processing, distribution and spoilage problems. Mr. Hayes.

575. SURVEY OF FOOD TECHNOLOGY.
Not open to department majors.
Two class hours, one 2-hour laboratory period.
Mr. Esselen, Mr. Hayes.

NUTRITION OPTION

The degree of Master of Science or Doctor of Philosophy may be earned in the Department by candidates who hold an accredited baccalaureate degree in natural sciences with emphasis on chemistry or biology or an accredited baccalaureate in home economics with a major in dietetics or nutrition and food. Other students must be prepared to remedy undergraduate deficiencies without earning graduate credit.

Candidates must satisfy the M.S. or Ph.D. degree requirements established by the University. The program for each candidate for the M.S. degree is designed to meet the needs and interests of the student; it includes course work in the major field and in a minor area such as physiology, food science, biochemistry, public health or food economics and either a thesis or a written report on his work on a special problem.

The program for each candidate for the Ph.D. degree is designed with sufficient flexibility to meet the needs and interests of the student; it includes course work in the major field and in areas related to the major field, a written preliminary comprehensive examination and a dissertation. The Department requires no foreign language reading competency for the Ph.D. degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Prerequisite, permission of department head.
Credit, 3-6. Graduate Faculty.

703. ADVANCED NUTRITION—CARBOHYDRATES, LIPIDS AND AMINO ACIDS.
Metabolic role of carbohydrates, lipids, proteins and amino acids: biological oxidations, mechanisms of energy production and utilization.
Prerequisite, Biochem 520 or permission of instructor.
Mr. Bert, Mr. Pellett.

704. ADVANCED NUTRITION—VITAMINS.
Metabolic role of vitamins, specific functions, requirements, sources, assay methods, effects of deficiencies and excesses.
Prerequisites, FS&N 703 or permission of instructor.
Mr. Bert, Mr. Weatherholtz.

705. ADVANCED NUTRITION—MINERALS.
Metabolic role of minerals, specific functions, requirements, sources, assay methods, effects of deficiencies and excesses.
Prerequisites, FS&N 703 or permission of instructor.
Mr. Weatherholtz.

710. SEMINAR.
Readings, reports and discussions on the current literature in the area of Food or Nutrition.
Credit, 1 per semester; maximum credit, 3.

800. MASTER'S THESIS.
Individual research. *Credit, 6-10.*

801. RESEARCH PROJECT.
Prerequisite, permission of graduate instructor. (Not thesis, for Ph.D. candidates only.) *Credit, 1-4.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

612. EXPERIMENTAL FOODS.
Fundamental principles of food quality evaluation, development of an independent research problem.
One class hour, two 3-hour laboratory periods.
Prerequisites, FS&N 251 or equivalent, Chem 160 or permission of instructor. Ms. Davis.

640. NUTRITION IN THE LIFE CYCLE.
Nutritional needs at various stages in the life cycle, *i.e.*, pregnancy and lactation, infancy, childhood, adolescence, adult life and the aged.
Prerequisite, FS&N 240 or permission of instructor.
Ms. Beal.

642. COMMUNITY NUTRITION.
Study of community response through its agencies and institutions, public, private and voluntary, in providing nutrition care, services and education. Guest lecturers and field trips included.
Prerequisite, FS&N 340/640 or permission of instructor.
Ms. Wright.

643. NUTRITIONAL PROBLEMS OF THE UNITED STATES.
Examination of the factors within the United States resulting from and causing malnutrition. Will include obesity, coronary heart disease, diabetes, alcoholism, food fads and quackery, food additives and unintentional residues.
Prerequisites, FS&N 340/640 or permission of instructor.
Ms. Beal, Mr. Pellett, Mr. Weatherholtz.

644. NUTRITIONAL PROBLEMS OF DEVELOPING NATIONS.
Malnutrition as it exists in developing countries and its socio-economic background. Protein-energy malnutrition, famine, vitamin and mineral deficiency diseases, synergism between nutrition and infection and the role of international agencies in fighting malnutrition.
Prerequisites, FS&N 340/640 or permission of instructor.
Mr. Pellett.

645. NUTRITION IN DISEASE.
Physiological basis for therapeutic diets in certain diseases. Current medical and nutrition literature used.
Prerequisite, FS&N 340, Biochem 220, Zool 135 or permission of instructor. Ms. Wright.

660. ADVANCED METHODS OF COMPUTERIZATION IN NUTRITION AND FOOD SERVICE.
The mathematical foundations of computations with food nutrients and recipe data. The data file structure of computerized food and nutrient accounting systems. The principle of mathematical optimization techniques and its utilization in computerized menu planning and scheduling models. Laboratory work with computer applications.
Prerequisites, FS&N 340/640, Mgt 110, Math 115 or equivalents. Mr. Balintfy.

Forestry and Wood Technology

GRADUATE FACULTY

Donald R. Proculske, *Professor and Head of the Department of Forestry and Wildlife Management*, B.S., University of Massachusetts, 1950; M.S., Virginia Polytechnic Institute, 1952; Ph.D., University of Missouri, 1956.

Harold B. Gatslick, *Professor of Wood Technology and Graduate Program Director in Wood Technology*, B.S., State University of N.Y., 1944; M.S., 1948; Ph.D., 1954.

Donald L. Mader, *Professor of Forestry and Graduate Program Director in Forestry*, B.S., State University of N.Y., 1950; M.S., Wisconsin, 1954; Ph.D., 1956.

Herschel G. Abbott, *Professor of Forestry*, B.S., Maine, 1943; M.F., Harvard, 1952; M.A., 1959.

Robert S. Bond, *Associate Professor of Forestry*, B.S., Massachusetts, 1951; M.F., Yale, 1952; Ph.D., State University of N.Y., 1966.

Carl A. Carlozzi, *Associate Professor of Resource Planning*, B.S., Kent State, 1955; M.A., 1957; Ph.D., Michigan, 1965.

R. Bruce Hoadley, *Associate Professor of Wood Technology*, B.S., Connecticut, 1955; M.F., Yale, 1957; D.F., 1962.

William P. MacConnell, *Professor of Forestry*, B.S., Massachusetts, 1943; M.F., Yale, 1948.

Joseph C. Mawson, *Assistant Professor of Forestry*, B.S., Maine, 1956; M.F., Duke, 1958; M.A., University of California, Berkeley, 1966.

William S. McNamara, *Assistant Professor of Wood Technology*, B.S., Massachusetts, 1962; M.S., Idaho, 1964; Ph.D., North Carolina State, 1968.

John H. Noyes, *Professor of Forestry*, B.S., Connecticut, 1937; M.F., Yale, 1939.

Brian Payne, *Adjunct Assistant Professor of Forestry*, B.S., University of California, Berkeley, 1961; M.F., Duke, 1962; Ph.D., University of California, Berkeley, 1969.

Arnold D. Rhodes, *Professor of Forestry*, B.S., New Hampshire, 1934; M.F., Yale, 1937.

WILLIAM W. RICE, *Associate Professor of Wood Technology,* B.S., University of Maine, 1948; M.F., Yale, 1949; D.F., Duke, 1964.

BRAYTON F. WILSON, *Associate Professor of Forestry,* B.A., Harvard, 1955; M.F., 1957; Ph.D., University of California, Berkeley, 1961.

Degrees offered are the Master of Science (with thesis and non-thesis options) and the Doctor of Philosophy.

Areas of program specialization include forest soils and ecology, physiology, silviculture, forest management, resource economics and planning, forest recreation, forest hydrology, wood science and technology, product development and processing, operations research, and marketing, with emphasis on structural elements, components, and systems for housing. Programs of instructor and related research in forestry place more than ordinary emphasis on urban-generated problems of land-use and environmental quality. Because of the interdisciplinary nature of these subjects, programs of study usually draw heavily upon courses in other departments, especially in Landscape Architecture.

Completion of a master's level program requires from four to five semesters depending upon the student's background and educational objectives; and an additional two, or more likely, three years are needed to attain the doctorate. A reading knowledge of one or more foreign languages sufficient to understand journal material may be required of doctoral students in certain areas of specialization.

An applicant's undergraduate preparation preferably should have focused on forestry, wood science and technology, engineering, planning, or a closely related field in natural resource management, conservation, natural science, or social science and economics. Students from other backgrounds can be accommodated but longer-than-typical programs will be required to qualify for a degree which is normally based on a non-thesis program with a professional, rather than research, orientation. The non-thesis, professional approach is available for the more conventionally-prepared student also.

Applicants are required to take the Graduate Record Examination Aptitude Test.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

FORESTRY COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROJECT.
Selected research problem in forestry not related to the candidate's thesis. *Credit, 2-4.*

701. ADVANCED FOREST SOILS.
The relation of soils to tree growth and other environmental factors with emphasis on research methods, site-evaluation, water relationships, and fertility; laboratory and field exercises.
Prerequisite, For 524 or equivalent. Mr. Mader.

702. AERIAL PHOTO-INTERPRETATION.
Advanced aerial photo-interpretation emphasizing the analysis of natural vegetation and land use in natural resource studies and planning.
Prerequisite, For 530 or equivalent. Mr. MacConnell.

703. ADVANCED FOREST ECOLOGY.
Methods for describing and analyzing forest ecosystem structure; effects of environmental factors on forest ecosystems; forest ecosystem processes and development.
Prerequisite, For 523 or equivalent. Mr. Mader.

704. ADVANCED SILVICULTURE.
Growth and reproductive characteristics and requirements of trees and forest stands as they affect silvicultural management, particularly in relation to thinning and the establishment of forest regeneration.
Prerequisites, For 523, 524, and 526, or equivalents. Mr. Rhodes.

705. RESEARCH CONCEPTS IN FOREST BIOLOGY.
The development of biological knowledge relating to forestry from both the historical and philosophical points of view with emphasis on contributions of contemporary scientific research.
Given in alternate years. Mr. Abbott.

706. ADVANCED FOREST MENSURATION.
Regression analysis applied to stand and tree volume determination, stand growth and yield, forest site evaluation, and related measurement problems. Computer techniques used to solve some of the problems.
Prerequisites, For 525 and 534, or equivalents. Mr. Mawson.

707. ADVANCED FOREST MANAGEMENT.
Economic evaluation of forest enterprises; appraisal of rates of return, damage, and stumpage values.
Prerequisite, For 540 or equivalent. Mr. MacConnell.

708. MICROECONOMICS OF FORESTRY.
Principles of microeconomics as applied to forestry problems with emphasis on marginal analysis in regard to land, labor, and capital.
Prerequisite, For 535 or equivalent. Mr. Bond.

709. ECONOMICS OF FOREST RESOURCE USE DECISIONS.
An examination of models and simulation techniques employed in forest resource use decision-making. Mr. Bond.

791, 792. SEMINAR.
Specialized study in a selected area of forestry. *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, 6-10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

FORESTRY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

523. SILVICS (ECOLOGY AND GROWTH OF TREES).
Forest ecology and tree growth as a foundation for silviculture and other uses of the forest; interactions of environment and forests; development and classification of forest communities. *Credit, 4.* Mr. Mader, Mr. Wilson.

524. FOREST SOILS.
Effects of soil properties on tree growth; relationship of soils to silviculture, harvesting, watersheds, wildlife, and range management; forest soil description, classification, and mapping. Mr. Mader.

525. THE ELEMENTS OF FOREST MENSURATION.
The measurement of trees, stands, and forest products; field and office practice in timber-estimating and log-scaling; collection and compilation of forest inventory data. Mr. Mawson.

526. THE PRINCIPLES OF SILVICULTURE.
Forest culture of wood crops; regeneration and intermediate cuttings, silvicides, prescribed burning, site-treatment, slash disposal, nursery management, forest planting and direct seeding; interactions with management for water, wildlife, recreation, and esthetics.
For 523 recommended. *Credit, 4.* Mr. Rhodes, Mr. Abbott.

527. TREE PHYSIOLOGY.
Growth and development during the life cycle of trees, emphasizing the whole-plant approach and phenomena best-studied in trees; the physiological basis of silviculture.
Prerequisite, Botany 211 or equivalent. Mr. Wilson.

528. FOREST HYDROLOGY.
Principles and factors controlling the hydrological cycle on forest lands. Review of forest watershed management research on the influence of soils, vegetation, and management practices on water yields and water quality. Watershed management as a part of integrated forest land management.
Mr. Mader.

529. FOREST PROTECTION.
Principles of protecting forests from fire, insects, diseases, domestic animals, wildlife, and atmospheric agencies with emphasis on the prevention and control of forest fires.
Mr. Abbott.

531. AERIAL PHOTOGRAMMETRY.
Principles of photo-interpretation and cartography for foresters, wildlife biologists, natural-resource planners and others concerned with large land surfaces. Photo-interpretation and map making are laboratory activities. Mr. MacConnell.

532. FOREST-TREE IMPROVEMENT.
Tree introduction, geographic variation, tree selection, vegetative propagation, controlled pollination and hybridization, seed-orchard management. Mr. Abbott.

534. FOREST SURVEY AND SAMPLING DESIGN.
The theory and application of sampling techniques in forest survey and research problems including simple random, stratified, subsampling, representative, and probability sampling. Mr. Mawson.

535. FOREST ECONOMICS.
The application of economic principles to the allocation of land, labor, and capital in forest enterprises; market and pricing theory of forest products.
Prerequisite, introductory economics. Mr. Bond.

536. FOREST RESOURCES POLICY.
Forest policy in the United States—its history and the influences and processes of forest resource policy formulation.
Mr. Bond.

539. THE FOREST RESOURCES OF NORTH AMERICA.
The forest resources of North America and their management for multi-purpose economic and social benefits; regional physiography, climate, vegetation, demography, and economic base; environmental, economic, and socio-political constraints affecting management.
Prerequisite, natural resource, regional-planning, or similar backgrounds. Mr. Rhodes.

540. PRINCIPLES OF FOREST MANAGEMENT.
Multiple-use management of forest land, organization of the forest for sustained-yield management; preparation of a management plan for a 10,000-acre forest.
Laboratory period optional for non-forestry majors.
Prerequisite for the laboratory, For 525.
Credit, 3 or 5. Mr. MacConnell.

602. ECOLOGICAL PRINCIPLES IN RESOURCE PLANNING.
Analysis of ecological principles and their relationship and importance to resource planning. State and federal conservation programs chosen for critical case study.
Prerequisite, permission of instructor. Mr. Carlozzi.

WOOD TECHNOLOGY COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROJECT.
Selected research problem in wood technology not related to the candidate's thesis. *Credit, 2-4.*

710. CHEMICAL MODIFICATION OF WOOD.
Basic concepts and techniques concerning the chemical modification of wood; the potential and limitations of physical and chemical treatments as they affect the dimensional stability and durability of wood.
Prerequisites, organic chemistry and Wood Tech 504.
Mr. Gatslick.

711. POLYSACCHARIDE AND LIGNIN CHEMISTRY.
The chemistry of lignin, hemicelluloses and cellulose in regard to the wood as a chemical raw material.
Prerequisites, organic chemistry, Wood Tech 538, or equivalent. Mr. McNamara.

791, 792. SEMINAR.
Specialized study in a selected segment of wood-products marketing or wood technology.
Credit, 1-3 each semester.

800. MASTER'S THESIS. *Credit, 6-10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

WOOD TECHNOLOGY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

501. WOOD ANATOMY AND IDENTIFICATION.
A basic anatomical study of wood elements, their structural characteristics and function; identification of woods.
Mr. Hoadley.

502. PRIMARY TIMBER CONVERSION.
Survey of systems used to convert logs into lumber and allied by-products; drying, grading and distribution of primary wood products. Mr. Rice.

503. FOREST PRODUCTS.
A survey of the principal forest products, their manufacture and distribution. Mr. Gatslick.

504. PROPERTIES OF WOOD.
The physical and mechanical properties of wood in relation to its use; methods and apparatus for measurement and testing.
Mr. Hoadley.

506. WOOD MACHINING TECHNOLOGY.
Fundamentals of cutting action as applied to wood; survey of commercial wood-machining equipment and processes.
Prerequisites, Wood Tech 501 and 504, or permission of instructor. Mr. Rice.

508. WOOD SEASONING ND PRESERVATION.
Wood-liquid relationships and the processes used to dry wood and/or impregnate it with preservatives.
Mr. Rice.

511. WOOD ADHESIVE TECHNOLOGY.
Basic concepts, theories, and the applied techniques of gluing wood and fibrous composites.
Prerequisites, Wood Tech 501, 504, and organic chemistry; or permission of instructor. Mr. McNamara.

512. DENDROLOGY.
Taxonomic features, silvical characteristics, and distribution of the principal tree species of temperate North America; a description of the forests of the world, their distribution and economic importance.
Three class hours, two 2-hour laboratory periods.
Credit, 4. Mr. Abbott, Mr. A.B. Cole.

538. WOOD CHEMISTRY.
Introduction to the chemistry and surface phenomena of the principal products found in wood.
Prerequisite, organic chemistry. Mr. McNamara.

French

GRADUATE FACULTY

Micheline Dufau, *Professor of French and Chairman of the Department of French and Italian,* B.-ès-L., Paris, 1945; B.S., New York University, 1951; Ph.D., 1960.

BENJAMIN ROUNTREE, *Associate Professor and Graduate Program Director in French*, B.A., Georgia, 1953; M.A., 1955; Ph.D., Yale, 1960.

JOHN P. BERWALD, *Assistant Professor and Director of the M.A.T. Program in French*, B.A., Michigan, 1956; M.A., Middlebury, 1964; Ph.D., Ohio State, 1971.

FREDERICK A. BUSI, *Associate Professor*, B.A., American International College, 1960; M.A., Connecticut, 1963; Ph.D., 1965.

MARIE-ROSE CARRE, *Associate Professor*, B.-ès-L., Alger, 1938; L.-ès-L., 1940; D. de l'U., Paris, 1963.

THOMAS CASSIRER, *Professor*, B.A., McGill, 1945; Ph.D., Yale, 1953.

URSULA F. CHEN, *Assistant Professor*, B.A., Cologne, 1950; M.A., Cornell, 1958; Ph.D., 1968.

CHRISTIAN GARAUD, *Assistant Professor*, B.-ès-L., Poitiers, 1954; L.-ès-L., 1958; D. de 3e cycle, 1961 (in Classics); D. de 3e cycle, 1969 (in French).

WILLIAM V. GUGLI, *Assistant Professor*, B.A., Brown, 1954; B.S.F.S., Georgetown, 1955; M.A., Brown, 1959; Ph.D., Syracuse, 1967.

AGNES G. RAYMOND (HOWARD), *Associate Professor*, B.A., Wilson College, 1937; M.A., Syracuse, 1945; D.M.L., Middlebury, 1956.

PATRICIA J. JOHNSON, *Associate Professor*, B.A., Minnesota, 1953; M.A., 1956; Ph.D., 1960.

ROBERT B. JOHNSON, *Professor*, B.A., Ohio, 1940; M.A., Wisconsin, 1946; Ph.D., 1949.

NANCY E. LAMB, *Assistant Professor*, B.A., Mt. Holyoke, 1959; M.A. (French), Middlebury, 1960; M.A. (Spanish), 1964; D.M.L., 1971.

SARAH N. LAWALL, *Associate Professor*, B.A., Oberlin, 1956; Ph.D., Yale, 1961.

PAUL A. MANKIN, *Associate Professor*, B.A., University of California, Los Angeles, 1948; M.A., 1953; Ph.D., Yale, 1959.

DAVID O'CONNELL, *Assistant Professor*, B.A., St. Peter's College, 1962; M.A., Princeton, 1964; Ph.D., 1966.

DENNIS D. PORTER, *Associate Professor*, B.A., Cambridge, 1957; Ph.D., University of California, Berkeley, 1966.

HAROLD L. SMITH, JR., *Associate Professor*, B.-ès-L., Paris, 1940; B.A., Swarthmore, 1947; M.A., Columbia, 1950; Ph.D., Wisconsin, 1955.

SARA STURM, *Associate Professor of French and Italian*, B.A., Minnesota, 1963; M.A., 1965; Ph.D., North Carolina, 1967.

ROBERT E. TAYLOR, *Professor*, B.A., Reed College, 1943; M.A., Columbia, 1947; Ph.D., 1951.

SEYMOUR S. WEINER, *Professor*, B.A., City College of New York, 1940; M.A., University of California, Berkeley, 1941; Ph.D., Columbia, 1950.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

WILLIAM S. BELL, *Associate Professor* (Mount Holyoke College).

JEFFREY J. CARRE, *Professor of Romance Languages* (Amherst College).

ELMO GIORDANETTI, *Professor* (Amherst College).

JACQUES-HENRI PERIVIER, *Associate Professor*, (Mount Holyoke College).

MARGARET L. SWITTEN, *Professor*, (Mount Holyoke College).

COURSE REQUIREMENTS FOR THE MASTER OF ARTS DEGREE

The required minimum of 30 credit hours is distributed as follows:

1. Expository Prose (3 cr)
2. Textual and Literary Analysis (3 cr)
3. French Culture 1 (3 cr)
4. French 700 or above (12 cr)
   a. French 800 (thesis) may be elected for six credits
5. 600-level in French or related field (9 cr)

A terminal examination, both written and oral, is given upon satisfactory completion of course requirements.

THE MASTER OF ARTS IN TEACHING DEGREE

The Department of French and Italian in cooperation with the School of Education offer a program of studies in French language and literature and professional preparation leading to the degree of Master of Arts in Teaching. A total of 39 semester hours are required for the degree, of which 21 will be in French language and literature and 18 in professional education and electives. One semester of the program is to be devoted to a practicum consisting of a variety of field experiences. Students are expected to complete the M.A.T. requirements in three or four semesters, excluding summer work.

The M.A.T. is intended primarily for graduating French majors with little or no prior professional experience. Prospective Master's degree candidates who are presently teaching or who have had experience doing so are directed to the M.A. program in literature where they may still devote a great part of their work to courses related to the teaching of French at the secondary level.

Courses specifically for the teacher of French include the following:

1. Introductory and advanced methods of teaching French at the secondary level.
2. Applied Linguistics.
3. Research studies in Foreign Language Education.
4. Practicums in teaching, individualized instruction, educational technology and supervision.
5. Independent study courses of directed readings.

Candidates entering the program are expected to be fluent in all aspects of the language. Undergraduate work should have been undertaken in phonetics, advanced grammar, composition, conversation and literature. Students deficient in French grammar or phonetics may do remedial work in these areas once admitted to the program, but such work may not be counted towards the degree. Scores of the Graduate Record Examination are required by the Department. Students transferring from other institutions may be granted up to nine semester hours towards the M.A.T.

THE FIVE COLLEGE COOPERATIVE Ph.D. PROGRAM. In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. A minimum of 18 semester hours after the M.A.
2. Romance Philology or its equivalent (three credits; not to satisfy requirements 5. and 6. below).
3. Bibliography and Methods or equivalent knowledge (three credits, not to be taken simultaneously with Romance Philology).
4. Two foreign languages (i.e., in addition to French and English):
   a. One at advanced-level proficiency (determined by a score of 700 on the Princeton ETS examination, or three credits of literature at junior-senior level or above with minimum grade of B).
   b. The other at intermediate-level proficiency (either by score of 550 on Princeton ETS examination or a minimum grade of B in Language 409).
   c. Proficiency in Latin, required of candidates writing a dissertation on the Middle Ages or the Renaissance, determined by the Classics Department at the University.
   d. The language requirement must be satisfied before the preliminary examination.
5. The satisfactory completion of written and oral preliminary examinations on:
   a. Two broad chronological periods/centuries, etc. Normally they should be contiguous (19th-20th, 18th-19th, etc.).
   b. A genre.
6. Six graduate credits in each of two additional fields (*not* to be covered by preliminary examinations.)
7. Three graduate credits in each of the remaining fields (*not* to be covered by preliminary examinations.)
8. French 900—Ph.D. Dissertation.

3-FIGURE COURSE NUMBERING SYSTEM

Intermediate figure:	Terminal figure:
1 Middle Ages, 16th C.	1, 2, 3 general
2 17th C.	
3 18th C.	
4 19th C.	4 plural genres, centuries
5 20th C.	5, 6 novel
6 language	
7 general	7, 8 poetry
8 special problems	
9 seminars	9 theater

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

470. GRADUATE READING COURSE.
For graduate students in other departments preparing for their M.A. or Ph.D. reading examination. No previous knowledge of French required. *No credit.*

700. SPECIAL PROBLEMS.
Directed study in some phase of linguistics or literature.

701 (I), 702 (II). THE CRAFT OF FICTION IN THE 19TH CENTURY.
The exploration of different modes in the treatment of realism through a study of the craft of fiction of individual novelists.
Credit, 3 each semester. Mr. Smith, Mr. Weiner.

711. OLD FRENCH READINGS.
The monuments of French literature from the earliest times to the 15th century. Miss Dufau.

712. RABELAIS AND MONTAIGNE.
The changing ideas in the French Renaissance.

715. THE "ROMAN COURTOIS."
Emphasis on Chrétien de Troyes and his successors.
Prerequisite, French 710 or equivalent.
Miss Dufau, Mrs. Sturm.

717. MEDIEVAL EPIC POETRY.
Some of the outstanding chansons de geste and the development of the cylces of epic poetry.
Prerequisite, French 710 or equivalent. Mrs. Sturm.

718. PLÉIADE, "ÉCOLE LYONNAISE."
Emphasis on the Pleiade from the background of the "grands rhétoriqueurs," Marot and the "école lyonnaise."

719. THE MEDIEVAL THEATER.
The principal dramatic forms from the 12th through the 15th century.
Prerequisite, French 710 or equivalent. Miss Dufau.

720. SEVENTEENTH-CENTURY "LIBERTINAGE."
Aspects of the history of thought from Montaigne to Pierre Bayle. Mr. Taylor.

721. LAFONTAINE AND HIS TIMES.
Mr. Garaud.

722. MOLIERE.
The man and the dramatist, his ideas and his techniques. Mr. Taylor, Mr. Rountree.

723. RACINE.
A detailed analysis of the major and minor plays as drama and as poetry. Mr. Rountree, Mrs. Carre.

731. VOLTAIRE AND HIS TIMES.
Mr. Taylor.

732. MONTESQUIEU AND HIS TIMES.
Mrs. Raymond.

733. DIDEROT.
The original thinker and compiler. Mr. Taylor.

760. COURS DE STYLE.
Syntax and idiom at an advanced level.
Mr. Smith, Mrs. Carre.

761. ROMANCE PHILOLOGY AND THE HISTORY OF THE FRENCH LANGUAGE.
The development of the Romance languages, particularly French, from Vulgar Latin. Mrs. Chen.

762. PROVENCAL PHILOLOGY.
Provençal or some other language particularly; see Department announcements. Mrs. Chen, Mrs. Sturm.

763. THE HISTORY AND PRACTICE OF TRANSLATION IN FRENCH.
The practical and theoretical problems arising in translation.

770. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH.
Required of candidates for the degree of Doctor of Philosophy.
Mr. Taylor, Mr. Weiner.

799. SEMINARS.
Credit, 3 each semester. Maximum credit, 12.

800. MASTER'S THESIS. *Credit, 6.*

801. LITERARY CRITICISM: NINETEENTH CENTURY.
Development of criticism from Sainte-Beuve. Mr. Weiner.

802. LITERARY CRITICISM: 20TH CENTURY.
Critical tenets and practices in the twentieth century. Read-

ings and discussion of, for example, Thibaudet, Bachelard, Paulhan, Sartre. Mr. Weiner.

845. BALZAC AND STENDHAL.
Mr. Weiner, Mr. Porter.

846. FLAUBERT AND ZOLA.
The assimilation of the "mouvement des idées" of the period within the fictional worlds of the two novelists.
Mr. Smith, Mr. Porter.

848. BAUDELAIRE AND THE SYMBOLISTS.
Emphasis on the esthetics and poetics of Baudelaire alone; his work as an introduction to the gamut of symbolist poetry.
Mr. Johnson.

853. THE ANTI-NOVEL AND ANTI-THEATER.
The reaction against established literary form and conventions in the novels of such authors as Sarraute, Robbe-Grillet, Butor, and Simon, and in the plays of such authors as Ionesco and Adamov. Mrs. Johnson.

854. CAMUS AND SARTRE.
The novels, short stories, plays, and philosophical essays.
Mrs. Johnson.

855. PROUST AND GIDE.
Detailed analysis of parts of *A la recherche du temps perdu* and representative works of Gide's fiction. Mr. Mankin.

859. CLAUDEL AND GIRAUDOUX.
Their contribution to the literary theater of the 20th century as seen through a study of esthetic and moral values.
Mrs. Raymond, Mr. Mankin.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

561. ADVANCED GRAMMAR.
Mrs. Chen, Mrs. Carre, Mr. Rountree.

571. CIVILIZATION OF FRANCE.
Those elements which underlie the cultural contribution to world civilization. Assigned reading drawn from contemporary French literature. Miss Bragger, Mr. Cassirer, Mr. Mankin, Mr. O'Connell, Mr. Porter.

601, 602. LITERARY MOVEMENTS.
Characteristics and definitions of a selected movement or period (*e.g.*, Baroque, Romanticism).
Credit, 3 each semester.

603. EXPLICATION DE TEXTES.
The principles of textual analyses and practice in that exercise. Required of students in Teacher Training.
Miss Dufau, Mrs. Carre, Mr. Cassirer.

604. THE ART OF LITERATURE.
The structures of literary works of art; emphasis on the esthetic. The genres vary; see Department announcement.

614. RENAISSANCE PROSE.
Major French prose writers of the 16th century.

617. RENAISSANCE POETRY.
Representative poets of the 16th century. Emphasis on the Pléiade.

621. 17TH-CENTURY COMIC VISION.
Emphasis on Molière, Mme de Sévigné, La Fontaine, and La Bruyère. Mr. Garaud, Mr. Rountree.

622. 17TH-CENTURY TRAGIC VISION.
The classical tragic vision in the theater and the novel as represented by Corneille, Racine, and Mme de La Fayette.
Mrs. Carre, Mr. Rountree.

624. 17TH-CENTURY PHILOSOPHERS AND MORALISTS.
The writers most important in classical thought, especially Descartes, Pascal, and LaRochefoucauld. Mr. Garaud.

634. 18TH-CENTURY LITERATURE.
The chief writers and thinkers of the Age of Enlightenment.
Mrs. Raymond, Mr. Taylor.

635. 18TH-CENTURY NOVEL.
The satirical novel as represented by LeSage, Montesquieu, Voltaire, and Diderot; the sentimental novel as represented by Prévost, Marivaux, Rousseau, Bernardin de Saint-Pierre.
Mr. Taylor.

639. 18TH-CENTURY THEATER.
Readings in the French theater from LeSage to Beaumarchais. Mrs. Raymond.

640. 19TH-CENTURY POETRY: THEMES.
Themes vary; see Department announcement.
Mr. Gugli, Mr. Johnson, Mrs. Lawall, Mr. Weiner.

644. 19TH-CENTURY POETRY: NERVAL AND THE PARNASSIANS.
The development of poetry between Romanticism and symbolism. Mrs. Lawall, Mr. Gugli.

645. 19TH-CENTURY ROMANTIC NOVEL.
The development of the novel from the Revolution to mid-century: Constant, Chateaubriand, Balzac, Hugo, Dumas, Stendhal. Mr. Smith, Mr. Busi, Mr. Porter.

646. 19TH-CENTURY REALISTIC-NATURALISTIC NOVEL.
The novel of the second half of the century, from Flaubert to Zola. Mr. Smith, Mr. Weiner, Mr. Busi.

647. 19TH-CENTURY ROMANTIC POETRY.
The major movements in poetry from Chénier to Baudelaire. Mr. Gugli, Mr. Weiner.

648. 19TH-CENTURY SYMBOLIST POETRY.
Baudelaire, Rimbaud, Mallarmé, Verlaine. Mr. Johnson.

649. 19TH-CENTURY THEATER.
The development of the theater from Hugo to Rostand and his contemporaries. Mr. Weiner.

654. FRENCH-AFRICAN AND CARIBBEAN LITERATURE. Mr. Cassirer.

655 (I), 656 (II). 20TH-CENTURY NOVEL.
The novel of social concern, the novel of personal and esthetic concern, and the novel concerned with the human condition, tradition, and innovation.
Credit, 3 each semester. Mr. Weiner, Mr. Mankin, Mrs. Johnson, Mr. O'Connell.

657. 20TH-CENTURY POETRY I.
Major French poets from the turn of the century to surrealism: Valéry, Apollinaire, Claudel, Reverdy, Eluard, Desnos, Cendrars and the beginning of surrealism with the first manifesto of 1924. Mrs. Lawall, Mr. Johnson.

658. 20TH-CENTURY POETRY II.
French poetry from surrealism to the present: Breton, Char, Michaux, Perse, Ponge, Bonnefoy, and selected contemporaries. Surrealism as a movement in itself and as a precursor of more recent poetry. Mr. Johnson, Mrs. Lawall, Mrs. Carre.

659. 20TH-CENTURY THEATER.
The main currents of modern French theater from symbolism to the theater of the absurd as seen in about fifteen representative plays. Mr. Mankin, Mrs. Raymond.

661. APPLIED LINGUISTICS (FRENCH).
French linguistics applied to the teaching of French in secondary schools. Mrs. Chen, Mr. Berwald.

662. METHODS OF TEACHING FRENCH.
Teaching methods. Recommended for those intending to teach French in high schools or elementary schools. Mr. Berwald.

663. TEACHING METHODS FOR INTERMEDIATE AND ADVANCED FRENCH.
The teaching of Intermediate and Advanced French. Continuation of Educ 307. Mr. Berwald.

674. FRENCH-CANADIAN LITERATURE.
Contemporary Canadian poets, novelists, and dramatists writing in French.

Geology

GRADUATE FACULTY

Joseph H. Hartshorn, *Professor and Head of the Department of Geology and Geography*, B.S., Harvard, 1947; M.A., 1950; Ph.D., 1955.

Stephen E. Haggerty, *Assistant Professor and Graduate Program Director*, B.S., London University, Imperial College of Science and Technology, 1964; Ph.D., 1968.

R. W. Bromery, *Professor and Chancellor of the University*, B.S., Howard, 1956; M.S., American University, 1962; Ph.D., Johns Hopkins, 1968.

Terence Burke, *Associate Professor*, B.A., Birmingham (England), 1952; Ph.D., 1967.

D. O. Doehring, *Assistant Professor*, B.A., University of California (Berkeley), 1962; M.A., Claremont-Pomona, 1965; Ph.D., Wyoming, 1968.

Oswald C. Farquhar, *Professor*, B.A., Oxford, 1947; M.A., 1948; Ph.D., Aberdeen, 1951.

James A. Hafner, *Assistant Professor*, A.B., Miami of Ohio, 1963; M.A., Michigan, 1965; Ph.D., 1970.

Stephen E. Haggerty, *Assistant Professor*, B.S., London University, Imperial College of Science and Technology, 1964; Ph.D., 1968.

Leo M. Hall, *Associate Professor*, B.S., St. Lawrence, 1954; M.S., Cincinnati, 1956; Ph.D., Harvard, 1959.

John F. Hubert, *Professor*, B.A., Harvard, 1952; M.S., Colorado, 1954; Ph.D., Pennsylvania State University, 1958.

Howard W. Jaffe, *Professor*, B.A., Brooklyn College, 1942; D.Sc., University of Geneva, 1972.

George E. McGill, *Professor*, B.A., Carleton College, 1953; M.S., Minnesota, 1955; Ph.D., Princeton, 1958.

David R. Meyer, *Assistant Professor*, B.A., Concordia Teachers College, 1965; M.S., Southern Illinois; Ph.D., Chicago, 1970.

Stearns A. Morse, *Associate Professor*, B.A., Dartmouth, 1952; M.S., McGill, 1958; Ph.D., 1962.

Ward S. Motts, *Associate Professor*, B.A., Columbia, 1949; M.S., Minnesota, 1951; Ph.D., Illinois, 1957.

Alan W. Niedoroda, *Assistant Professor*, B.A., Queens College, CUNY, 1966; M.S., Florida State University, 1968; Ph.D., 1972.

Edward A. Perry, Jr., *Assistant Professor*, B.A., Dartmouth, 1964; Ph.D., Case Western Reserve University, 1969.

Charles W. Pitrat, *Associate Professor*, B.A., Kansas, 1949; M.S., Wisconsin, 1951; Ph.D., 1953.

Rutherford H. Platt, *Assistant Professor*, B.S., Yale, 1962; J.D., Chicago, 1967; Ph.D., 1971.

Peter Robinson, *Associate Professor*, B.A., Dartmouth, 1954; M.S., Otago University, New Zealand, 1958; Ph.D., Harvard, 1964.

Gregory W. Webb, *Professor*, B.A., Columbia, 1948; M.A., 1950; Ph.D., 1954.

Richard W. Wilkie, *Associate Professor*, B.A., Washington, 1960; M.A., 1963; Ph.D., 1968.

Donald U. Wise, *Professor*, B.S., Franklin and Marshall College, 1953; M.S., California Institute of Technology, 1955; Ph.D., Princeton, 1957.

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE IN GEOLOGY

Ordinarily the doctoral candidate is assumed to have received the master's degree or equivalent training; selected students with outstanding records may proceed more directly toward meeting doctoral requirements.

Candidates must fulfill the general Graduate School requirements in addition to the following:

1. Basic training in physics, chemistry, and mathematics.
2. At least four months of training and experience in field geology.
3. A broad knowledge of fundamental concepts, methods of investigation, and historical development of geologic science.
4. Reading-knowledge of two foreign languages sufficient to understand journal material or reading-knowledge of one foreign language and fulfillment of departmental computer-science requirement.
5. Mastery of four elected fields of specialization, three of which must be in geology.
6. A thesis representing an original contribution to geologic knowledge.
7. A final examination in defense of the thesis.

Full details may be found in departmental announcement.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE IN GEOLOGY

The general requirements for the M.S. degree are those of the Graduate School. In addition, the following are required:

1. A full year course in two of the following: biology, chemistry, physics.
2. A full year course of college mathematics or statistics, beyond the pre-calculus level, appropriate to the student's course of study.
3. Six weeks of field training.
4. Participation in each semester of residence in Geology 790, Research Seminar, and at least one oral presentation of research results in this seminar.
5. An incoming candidate is given a diagnostic interview and assigned a temporary adviser. The candidate should then propose a guidance committee of three graduate faculty, for appointment by the Department Head. The program of study must be approved by the guidance committee. The committee conducts a semesterly review of the candidate's program and progress.
6. A candidate may elect a program with or without a thesis. The former is appropriate for those with strongly focused research interests, and the latter for those wishing to emphasize breadth of geological or interdisciplinary knowledge. The content of the General Examination and the number of examiners will reflect the candidate's choice of program. The General Examination will include a presentation and defense of a research project or thesis. Further details are contained in the Departmental Announcement.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Either or both of the following options may be selected:
A. Independent study—guided reading and/or laboratory study in subjects or techniques not covered by other courses in the department.
B. Research—original library, field and/or laboratory investigation of a selected problem.
Prerequisites, 45 credits in geology and permission of Department Head and instructor. *Credit, 2-6.*

712. ADVANCED MINERALOGY.
Crystal chemistry, structure, and composition of minerals; interpretation, evaluation, and calculation of mineralogical data; precise measurement of mineralogical constants by optical microscopy, x-ray diffraction, and other methods.
Offered fall semester.
Prerequisite, Geol 611 or permission of instructor.
Mr. Jaffe or Mr. Morse.

713. CLAY MINERALOGY.
Structure of clay minerals, identification, weathering, and alteration of minerals, properties of clay surfaces, geotechnical studies of clays in geology, soil science, and soil mechanics.
Prerequisite, permission of instructor.
Mr. Jaffe or Mr. Perry.

716. GEOCHEMISTRY.
Abundance relations and principles governing the distribution, behavior, and migration of the elements and nuclides in the geochemical spheres of the earth, in meteorites, and in the universe.
Offered spring semester.
Prerequisites, Geol 192 and 520 and one year of college chemistry, or permission of instructor. Mr. Jaffe.

722. IGNEOUS PETROLOGY.
Introduction to phase equilibrium in mineral systems, with emphasis on liquidus relationships. Review of theoretical and experimental data and of natural occurrences and their bearing on problems of rock genesis.
Offered fall semester.
Prerequisite, Geol 621 or permission of instructor.
Mr. Morse.

723. SEDIMENTARY PETROLOGY.
Analysis and origin of primary sedimentary structures; petrology of sandstones; heavy-mineral analysis and interpretation. Petrology of carbonate rocks. Field applications emphasized.
Offered spring semester.
Prerequisites, Geol 550 and 611. Mr. Hubert.

724. METAMORPHIC PETROLOGY.
Introduction to phase equilibrium in mineral systems with emphasis on metamorphic reactions. Review of theoretical and experimental data and natural occurrence and their bearing on metamorphic processes and on the mapping of metamorphic mineral facies.
Offered fall semester.
Prerequisite, Geol 621 or permission of instructor.
Mr. Robinson.

731. STRUCTURAL GEOLOGY OF METAMORPHIC ROCKS.
Analysis of the geometry of intensely deformed rocks with emphasis on interpretation of structural features in the field.
Offered fall semester.
Prerequisite, Geol 531 or equivalent. Mr. Hall.

732. ADVANCED STRUCTURAL GEOLOGY.
Dynamics and mechanics of rock deformation, including theoretical and experimental studies, with field applications.
Offered spring semester.
Prerequisites, Geol 531 and calculus. Mr. McGill.

735. REGIONAL GEOLOGY OF NORTH AMERICA.
Tectonic concepts as exemplified by the stratigraphic and structural evolution of North America.
Offered spring semester.
Prerequisite, Geol 530. Mr. Wise, Mr. McGill.

741. STRATIGRAPHIC PALEONTOLOGY.
Application of selected fossils and faunal assemblages to stratigraphic correlation, and paleoecological and paleogeographic analysis, with reference to evolutionary trends.
Offered spring semester.
Prerequisites, Geol 540 and 551. Mr. Pitrat.

745. PALEOECOLOGY.
Application of ecological principles to the interpretation of fossil animal and plant communities as indicators of depositional environments. Emphasis on marine faunas.
Offered spring semester.
Prerequisites, Geol 540 and 551. *Credit,* 2. Mr. Pitrat.

747. PALEOGEOGRAPHIC ANALYSIS.
Methods of paleogeographic analysis and mapping, including problems in stratigraphic synthesis, basin analysis, and paleogeologic and palinspastic mapping.
Offered spring semester.
Prerequisites, Geol 531, 540, and 550. Mr. Webb.

751. SEDIMENTATION.
Analysis of the modes of origin of sedimentary rocks, with special reference to mudrocks, carbonates, and chemical sediments.
Offered fall semester.
Prerequisites, Geol 550 and 611. Mr. Hubert.

752. GEOLOGICAL OCEANOGRAPHY.
Physical characteristics and geological processes of the ocean basins and margins, and their bearing on interpretation of geologic history.
Offered spring semester.
Prerequisites, Geol 550 and 666. Mr. Webb.

756. COASTAL PROCESSES.
Sedimentologic and hydrographic processes of coastal environments and their relation to shoreline morphology and sediment transport and deposition. Emphasis on field studies of the estuaries and beaches along the New England shoreline.
Prerequisites, Geol 550 and 660, or permission of instructor.

761. MAP INTERPRETATION.
A laboratory study of the various types of maps used by geologists, with special reference to the identification and interpretation of landforms and structures.
Offered fall semester.
Prerequisite, Geol 530. *Credit,* 2.

762. ADVANCED GEOMORPHOLOGY.
A critical study of selected topics and current problems in geomorphology.
Offered spring semester.
Prerequisite, Geol 660. *Credit,* 2. Mr. Doehring.

769. ADVANCED PHOTOGEOLOGY.
A laboratory area of selected problems, areas, and techniques. Some emphasis on the use of surface expression as a key to subsurface phenomena.
Offered fall semester.
Prerequisites, Geol 660 and 668. *Credit,* 2.

771. PHYSICS OF THE EARTH.
Introduction to the physics of the earth as determined from seismological, heat flow, gravity, and paleomagnetic data and their relationship to observed geological phenomena.
Offered fall semester.
Prerequisites, Geol 670 and permission of instructor.
Mr. Bromery.

772. ADVANCED GEOPHYSICAL INTERPRETATION TECHNIQUES.
Numerical and graphical analyses of air-borne and ground geophysical surveys, including the use of digital computer programs, and geologically meaningful interpretations.

Offered spring semester.
Prerequisites, Geol 670 and permission of instructor.
Mr. Bromery.

781. GEOLOGY IN ENGINEERING.
Relation of geologic materials, processes, forms, and techniques to the planning and execution of engineering projects, such as river control, shoreline protection, and construction of highways, bridges, tunnels, dams, etc. Emphasis is on case histories.
Offered spring semester.
Prerequisites, Geol 520, 530, 550, and 660, or permission of instructor; Civ Eng 520 and/or other engineering courses recommended. *Credit*, 2. Mr. Farquhar.

782. PETROLEUM GEOLOGY.
Geologic occurrence of oil and gas. Laboratory work consists of problems related to reservoir and trap conditions and to methods of subsurface study.
Offered fall semester.
Prerequisites, Geol 530 and 550; 735 desirable. Mr. Webb.

783. METALLIFEROUS ECONOMIC GEOLOGY.
Nature, origin, and distribution of metalliferous ores. Criteria for recognition of ore deposits, changes in character of ore with depth, mineral associations, and types of wallrock alteration. Optical and microchemical properties of ore minerals and ore concentrates. Given in alternate years.
Offered fall semester.
Prerequisites, Geol 530 and 520; 722 desirable. Mr. Haggerty.

784. NON-METALLIFEROUS ECONOMIC GEOLOGY.
Geology, distribution, and utilization of nonmetallic mineral deposits, including coal and other solid hydrocarbons. Given in alternate years.
Offered fall semester.
Prerequisites, Geol 530, 520, 550, and 611. Mr. Farquhar.

786. HYDROGEOLOGY.
Theoretical and practical hydrogeology; ground-water hydraulics, chemistry of ground water, field methods, relation of ground water to geology, basinal, and regional groundwater problems.
Offered fall semester.
Prerequisites, one year of geology; one year of chemistry and Math 124 or equivalent recommended. Mr. Motts.

790. SEMINAR.
Review of current literature or discussion of selected topics.
Credit, 1 each semester.

805. EVOLUTION OF GEOLOGIC CONCEPTS.
Perspective on current geological thought in the light of its historical background; particular attention to controversial questions and to the rise and decline of ruling theories.
Offered spring semester.
Prerequisite, one year of graduate study.
Credit, 2. Mr. Motts.

846. CENOZOIC STRATIGRAPHY.
Occurrence, correlation, and origin of marine and terrestrial Cenozoic deposits and their relation to paleogeographic and tectonic conditions, with particular reference to North America.
Offered fall semester.
Prerequisites, Geol 550 and 660; 735 recommended.
Mr. Webb.

863. PHYSIOGRAPHY OF NORTH AMERICA.
A survey of the physiographic provinces of North America and their evolution. Emphasis on problems and the methods of approach.
Offered fall semester.
Prerequisites, Geol 660 and 735 desirable. Mr. Motts.

887. ADVANCED HYDROGEOLOGY.
Advanced ground-water hydrology, analog models, pumping tests, flow-duration curves, flow nets, Hubbert's hydrologic models, water chemistry, and geophysical methods of investigation.
Offered spring semester.
Prerequisites, Geol 786 and Math 124, or permission of instructor. Mr. Motts.

890. SEMINAR IN NORTHERN APPALACHIAN GEOLOGY.
The stratigraphy, structure, petrology, and geophysics of the Northern Appalachians and current research being conducted in the region.
Offered spring semester.
Prerequisites, Geol 531, 550, and 621 or equivalents.
Credit, 1-3. Mr. Hall, Mr. Robinson, Mr. Wise.

891. SEMINAR IN STRUCTURAL GEOLOGY.
Review and discussion of current research in structural geology.
Offered fall semester.
Prerequisite, at least one graduate course in structural geology. *Credit, 1-3.*
Mr. McGill, Mr. Hall, Mr. Wise, Mr. Robinson.

892. SEMINAR IN SEDIMENTOLOGY.
Depositional and diagenetic processes in terrigenous and carbonate environments and the interpretation of the rock record. *Credit, 1-3.* Mr. Hubert.

893. SEMINAR IN PLEISTOCENE GEOLOGY.
Current work and publications in glaciology, glacial geology, and related aspects of Quaternary history. Studies of related fields, such as archaeology, early man, geochronology, palynology, plant geography, and paleontology.
Prerequisite, permission of instructor.
Credit, 1-3. Mr. Hartshorn.

894. SEMINAR IN PETROLOGY.
The literature of igneous and metamorphic petrology and related aspects of mineralogy.
Prerequisites, Geol 611 and 671 or equivalents.
Credit, 1-3. Mr. Robinson, Mr. Morse, Mr. Jaffe, Mr. Haggerty, Mr. Hall.

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

611. OPTICAL MINERALOGY.
Principles of optics; optical properties of minerals and methods for their measurement, relationship between optical properties and crystallography; mineral identification by the immersion method; crystal chemistry of rock-forming minerals.
Offered fall semester.
Prerequisites, Geol 192. Mr. Jaffe, Mr. Hall, Mr. Morse.

621. PETROGRAPHY.
Identification of minerals in thin section; study of common igneous, sedimentary, and metamorphic rocks in thin section; routine petrographic calculations and measurements; introduction to petrogenetic theory. Examination of selected igneous and metamorphic rocks in the field.
Offered spring semester.
Prerequisites, Geol 220 and 611. Mr. Robinson.

630. TECTONICS.
Past and present mechanisms creating the broader framework of global geology; mountain-building, ocean-basin structure, continental drift, mantle processes, continental evolution, early history of the earth, structural geology of selected key regions of the globe.
Offered fall semester.
Prerequisites, Geol 531, 520; undergraduates by permission.
Mr. Wise.

632. ADVANCED GEOLOGICAL MAPPING.
Complete series of operations required for publication of a geological map: field location and drawing of contacts, collection and interpretation of field notes, automated data reduction, drafting, and methods of reproduction.
Offered fall semester.
Prerequisites, Geol 220 and 231, or equivalent training.
Mr. Robinson, Mr. Wise.

634. ASTROGEOLOGY.
Geology of the solar system with particular emphasis on the solid bodies: age, sequence of events, composition, surficial

and internal geologic processes. Photogeologic mapping of selected portions of Moon and Mars using recent imagery from the space program.
Offered fall semester.
Prerequisites, Geol 531, 520; undergraduates by permission.
Mr. Wise.

651. GEOMETRICS.
Design of geological experiments; the collection and analysis of quantitative data in geology.
Offered fall semester.
Prerequisite, permission of instructor. Mr. Hubert.

655. PHYSICAL OCEANOGRAPHY.
Physical properties of sea water and their variations; water masses and their circulation patterns; interaction between ocean and atmosphere; dynamics of waves, tides, and ocean currents; techniques of oceanographic study.
Offered fall semester.
Prerequisites, two years of college work toward a major in science or engineering: Physics 141 and 142; or 161, 162, and 163; calculus recommended. Mr. Perry.

660. GEOMORPHOLOGY.
Origin and development of landforms in relation to geological processes, climate, and tectonic history. Application of geomorphic methods to interpretation of geologic history.
Offered fall semester.
Prerequisite, Geol 230 or permission of instructor.
Mr. Doehring.

666. PLEISTOCENE GEOLOGY.
Geochronology of Pleistocene time as related to climatic changes and their influence on glaciology, erosional and depositional processes, landforms, sedimentary deposits, shifting sea level, and the paleontological record. Field trips by arrangement.
Offered spring semester.
Prerequisite, permission of instructor. Mr. Hartshorn.

668. PHOTOGEOLOGY AND REMOTE SENSING.
Laboratory study of the instruments and methods employed in making measurements and preparing base maps and geologic maps from vertical and oblique aerial photos, together with applications of other remote-sensing techniques.
Offered spring semester.
Prerequisite, Geol 531.

670. GEOPHYSICS.
The physics of the earth and the gravitational, magnetic, electrical, and seismic methods of geophysical exploration. Laboratory problems and computations.
Offered fall semester.
Prerequisites, Geol 230 and 520, or permission of instructor.
Mr. Bromery.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in Geology)

520. INTRODUCTORY PETROLOGY.
The classes of rocks with reference to manner of origin, modes of occurrence, structural features, and the chemical and petrographic distinctions within each group.
Offered spring semester.
Prerequisite, Geol 192.
Credit, 4. Mr. Jaffe, Mr. Hall, or Mr. Morse.

530. FIELD AND STRUCTURAL GEOLOGY I.
Basic methods of field geology; occurrences and recognition of geologic structure; preparation and interpretation of geologic maps; solution of simple structural problems.
Offered fall semester.
Prerequisite, an introductory geology sequence.
Mr. McGill, Mr. Hall, Mr. Wise.

531. FIELD AND STRUCTURAL GEOLOGY II.
Structural and dynamic analysis of deformed rocks; introduction to tectonics; field study of complex areas.
Offered spring semester.
Prerequisites, Geol 520, 530.
Mr. Hall, Mr. Robinson, Mr. Wise.

540. INVERTEBRATE PALEONTOLOGY.
History, development, and identification of invertebrate animal fossils. Field trips by arrangement.
Offered fall semester.
Prerequisite, an introductory geology sequence or permission of instructor. Mr. Pitrat.

550. SEDIMENTOLOGY.
Processes acting on sediments; composition, primary structures, origin, and classification of sedimentary rocks.
Offered fall semester.
Prerequisite, Geol 520. Mr. Hubert.

551. STRATIGRAPHY AND HISTORICAL GEOLOGY.
Principles of stratigraphic correlation; methods of reconstruction of earth history; tectonic evolution of selected regions.
Offered spring semester.
Prerequisites, Geol 520, 530, 540, and 550, or permission of instructor. Mr. Pitrat.

580. ENGINEERING GEOLOGY.
Materials and surface features of the earth and their relation to engineering problems; map reading as related to the phenomena of physical geology.
Offered spring semester. Mr. Farquhar.

589. FIELD PROBLEMS.
Directed field study and/or research.
One week of full-time summer work for each credit.
Prerequisites, approval of faculty adviser and department head.

Germanic Languages and Literatures

GRADUATE FACULTY

Carroll E. Reed, *Professor and Head of the Department of Germanic Languages and Literatures*, B.A., University of Washington, 1936; M.A., 1937; Ph.D., Brown University, 1941.

Friedrich Wilhelm Von Kries, *Associate Professor and Graduate Program Director*, B.A., University of British Columbia, 1957; M.A., University of Washington, 1962; Ph.D., 1965.

Sigrid Bauschinger, *Associate Professor*, Ph.D., University of Frankfurt, 1959.

E. M. Beekman, *Associate Professor*, B.S., University of California at Berkeley, 1963; Ph.D., Harvard University, 1968.

Jürgen Born, *Associate Professor*, B.A., Free University of Berlin, 1953; M.A., Harvard University, 1955; Ph.D., Northwestern University, 1963.

James E. Cathey, *Associate Professor*, B.S., Oregon State University, 1962; M.A., University of Washington, 1964; Ph.D., 1967.

Johannes Haupt, *Assistant Professor*, Ph.D., Rice University, 1968.

Frank R. Hugus, *Assistant Professor*, B.S., Pennsylvania State, 1963; M.A., 1965; Ph.D., University of Chicago, 1972.

Henry A. Lea, *Associate Professor*, B.S., (Education), University of Pennsylvania, 1942; M.A., 1951; Ph.D., 1962.

Wilfried Malsch, *Professor*, Ph.D., University of Freiburg, 1957.

Volker Meid, *Associate Professor*, Ph.D., University of Frankfurt, 1965.

Wolfgang Paulsen, *Professor*, Ph.D., University of Berne, 1934.

Peter Klaus, *Associate Professor*, Ph.D., University of Frankfurt, 1965.

Albert M. Reh, *Associate Professor*, Ph.D., University of Munich, 1957.

Lawrence Ryan, *Professor*, B.A., University of Sydney, 1953; Ph.D., University of Tübingen, 1958.

Eva Schiffer, *Associate Professor*, B.S., University of Massachusetts, 1946; M.A., Radcliffe College, 1947; Ph.D., 1962.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

Sidonie Cassirer, *Professor* (Mount Holyoke College).

Murray B. Peppard, *Professor* (Amherst College).

Willy Schumann, *Professor* (Smith College).

FIVE-COLLEGE COOPERATIVE Ph.D. REQUIREMENTS

For Candidates Specializing in Modern German literature

The following courses are required:

1. 702, Old High German, *or* 703, Gothic, *or* 704, Old Norse, *or* 705, Old Saxon, *or* English 702, Old English.
2. One course in medieval literature.
3. One course in the literature of the 15th, 16th, and 17th centuries.
4. In general, it is expected that the remaining courses will be chosen from the literature courses offered by the Department.

For Candidates specializing in Medieval Literature

The following courses are required:

1. 702, Old High German.
2. 704, Old Norse, *or* 705, Old Saxon, *or* 703, Gothic, *or* English 702, Old English, *or* French 710, Old French.
3. Two courses in German literature from the 15th century to the present.
4. Two courses in modern German literature.

In general, it is expected that the remaining courses will be chosen from the medieval literature courses offered by the Department. Recommendations for additional courses: one course in medieval history, one course in medieval philosophy.

For Candidates specializing in Germanic Philology

The normal program requires the completion of six courses in Philology, two courses in Linguistics, one course in Medieval Literature, and one course in Modern Literature.

Language requirement: Candidates for the Ph.D. will be required to show advanced proficiency in one foreign language (other than German or English) pertinent to their field of specialization.

THE MASTER OF ARTS DEGREE PROGRAM

The M.A. degree program is designed to provide both a program meaningful in itself and a foundation for further progress toward the Ph.D.

The Department reserves the right to grant the M.A. as a terminal degree; admission to candidacy for the Ph.D. requires the Department's permission and does not follow automatically upon completion of the M.A. However, a student who has shown sufficient promise in his first year's work may, after receiving special written notification from the Department, advance directly to candidacy for the Ph.D. degree. Such a student is nevertheless required to fulfill the normal M.A. course requirements. The M.A. degree in such cases is granted when the student has successfully completed the qualifying examination for the Ph.D. (i.e., Comprehensives). Prerequisites for admission include a B.A. degree with a major in German language and literature and indication of ability to do successful graduate work. Deficiencies in literary background and insufficient command of spoken or written German must be remedied.

Language requirement: For the M.A. degree the Department requires proficiency in German.

Program of study: Ten courses (30 credit hours) are required of all M.A. candidates by University regulation. Full-time students are normally expected by the Department to take a minimum of *three* courses in each semester of their first academic year. Those holding teaching assistantships in the Department are expected to complete their course requirements for the M.A. within four consecutive semesters of the regular academic year. The successful completion of the following courses is required:

585. Structure of German *or* 584, History of German.
701. Middle High German.
720. Advanced Composition and Translation.
780. Proseminar.

In addition, the following course is required of all Teaching Assistants and is strongly recommended to all who plan to teach German, especially at the college level: 583, Problems and Methods of Teaching German. Also, *five* courses selected from the Department's offerings of literature courses, including those in medieval literature; the five courses must include at least *one* course in the 18th Century, *one* course in the 19th Century, and *one* course in the 20th Century literature.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS/INDEPENDENT STUDY.
Directed study in some special area of literature or philology. Open to Ph.D. candidates only, except by special permission.
Credit, 1-3.

701. MIDDLE HIGH GERMAN.
Readings in Middle High German literature with an introduction to the grammar.

702. OLD HIGH GERMAN.
Grammar and reading of prose and poetry; an introduction to Old High German dialects.

703. GOTHIC.
Grammar and reading of texts.

704. OLD NORSE.
Grammar and reading of selections from the sagas.

705. OLD SAXON.
Grammar and reading of selections from the *Heliand*.

710. COMPARATIVE GERMANIC GRAMMAR I (Phonology).
The sound systems of the varions Germanic dialects from a synchronic and diachronic point of view.
Prerequisites, any two of the following: 701, 702, 703, 704, 705.

711. COMPARATIVE GERMANIC GRAMMAR II (Morphology).
The grammatical structure of the various Germanic dialects from a synchronic and diachronic point of view.
Prerequisite, German 710.

712. GERMAN DIALECTOLOGY.
Modern German dialects, their differentiation and structural analysis.
Prerequisite, German 701 or 702 or special permission.

715. THE HEROIC EPIC.
A detailed study of *Nibelungenlied* and *Kudrun* with reference to the pre-courtly epic and later *Dietrichsepik*.
(Offered in alternate years)
Prerequisite, German 701.

716. COURTLY LYRIC POETRY.
An introduction to the formal study of *Minnesang* and *Spruchdichtung* from the Kürenberger to Konrad von Würzburg with emphasis on Walther von der Vogelweide and the social and historical context of the period.
(Offered in alternate years)
Prerequisite, German 701.

717. THE COURTLY EPIC.
A comprehensive literary analysis of selected epics by Hartmann von Aue, Wolfram von Eschenbach, Gottfried von Strassburg.
(Offered in alternate years)

718. NARRATIVE AND DIDACTIC MHG LITERATURE.
The didactic narrative from the 11th to the 13th century.
(Offered in alternate years)
Prerequisite, German 701.

720. ADVANCED COMPOSITION AND TRANSLATION.
Required of all degree candidates. May be waived for students judged to have native speaking proficiency.

730. LITERATURE OF THE 15TH AND 16TH CENTURIES.
Humanism and Reformation.

733. 17TH-CENTURY POETRY AND PROSE.
Poetry and prose and relevant poetic theories.

734. 17TH-CENTURY DRAMA.
Drama and relevant poetic theories.

741. FROM ENLIGHTENMENT TO ROCOCO.
Literary theory and practice in the first half of the 18th Century

742. LESSING.
His Literary Theory in the context of his time. His drama.

743. VON DER EMPFINDSAMKEIT ZUM STURM UND DRANG.

749. THE CLASSICAL GOETHE.
The major works of Goethe's Weimar period; poetry, drama, fiction.

750. THE LATER GOETHE.

751. GOETHE'S *FAUST*.

752. SCHILLER.
Schiller's literary and philosophical works.

758. EARLY ROMANTICISM.
Philosophical background and literary works of the early Romantic movement.

759. LATER ROMANTICISM.
Later development of Romanticism from Brentano to Heine, including the anti-Romantic tendencies of the time.

763. 19TH-CENTURY POETRY AND PROSE.
Poetry by Heinrich Heine, Eduard Mörike, Annette von Droste-Hülshoff a.o. and of prose by Heinrich Heine and the writers of Biedermeier and Das Junge Deutschland.

764. 19TH-CENTURY DRAMA.
Kleist, Grillparzer, Büchner, Grabbe, Hebbel.

765. LITERATURE OF REALISM.
From Gotthelf to Fontane.

771. 20TH-CENTURY POETRY I.
Emphasis on George, Hofmannsthal, Rilke.

772. 20TH-CENTURY POETRY II.
Emphasis on expressionist and post-expressionist poetry.

773. 20TH-CENTURY PROSE I.
The early Thomas Mann and his generation.

774. 20TH-CENTURY PROSE II.
New trends of fiction after the First World War.

775. 20TH-CENTURY DRAMA.
From Wedekind to Brecht.

777. BIBLIOGRAPHY AND METHODOLOGY.
An introduction to tools and methods of research.

778. STRUCTURE AND HISTORY OF GERMAN VERSE.

779. POST-WORLD WAR II GERMAN LITERATURE.

780. PROSEMINAR.
Interpretation of texts and introduction to critical terminology.

782. SPECIAL TOPICS IN PHILOLOGY AND MEDIEVAL STUDIES.

783. SPECIAL TOPICS IN THE LITERATURE OF CLASSICISM.

784. SPECIAL TOPICS IN THE LITERATURE OF ROMANTICISM.

785. SPECIAL TOPICS IN THE LITERATURE OF THE 19TH CENTURY.

786. SPECIAL TOPICS IN THE LITERATURE OF THE 20TH CENTURY.

787. HISTORY OF AESTHETIC THEORIES IN GERMANY.
General trends in the history of aesthetics. Discussion of major works since Opitz.

788. HISTORY AND PROBLEMS OF LITERARY CRITICISM.

790. SEMINAR IN LITERATURE.

791. SEMINAR IN PHILOLOGY.

792. SEMINAR IN MEDIEVAL LITERATURE.

900. DOCTORAL DISSERTATION. *Credit, 1-30.*

COURSE NOT FOR MAJOR CREDIT

409, 410. GRADUATE READING COURSE.
For graduate students preparing for the M.A. or Ph.D. reading examination. No previous knowledge of German required.
No credit.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS.
(For either major or minor credit)

583. PROBLEMS AND METHODS OF TEACHING GERMAN.
Various methods of teaching a foreign language based on recent developments in applied linguistics and programmed learning. Emphasized are the development of teaching materials by the individual student and the application of textbooks to the needs of various language courses.
Prerequisite, advanced proficiency in German.

584. HISTORY OF GERMAN.
Introduction to the history of the German language.

585. STRUCTURE OF GERMAN.
An introduction to the principles of linguistics and the structure of the German language.

DUTCH STUDIES

DUTCH 551. DUTCH-FLEMISH LITERATURE.
Selections of masterpieces from the 19th and 20th centuries. Emphasis on poetry and contemporary writers.
Prerequisite: Dutch 141 or its equivalent.

SCANDINAVIAN STUDIES

DANISH 551. DANO-NORWEGIAN LITERATURE.
Masterpieces of Danish and Norwegian literature. Emphasis on Ibsen, Holberg, and some attention to modern writers.

SWEDISH 551. SWEDISH LITERATURE.
Introduction to Swedish literature. Emphasis on Strindberg and the modern authors.
Prerequisite, Swedish 140 or equivalent.

Hispanic Languages and Literatures

GRADUATE FACULTY

Harold L. Boudreau, *Professor, Chairman of the Department of Hispanic Languages and Literatures, and Graduate Program Director*, B.A., Illinois, 1948; M.A., 1950; Ph.D., Wisconsin, 1965.

Antonio Andrade, *Assistant Professor of Portuguese*, B.A., San Jose State, 1959; M.A., 1967.

Robert L. Bancroft, *Professor*, B.A., Washington, 1935; M.A., 1947; Ph.D., Columbia, 1957.

Pedro Barreda-Tomás, *Associate Professor*, M.A., State University of New York at Buffalo, 1966; Ph.D., 1969.

Blanche De Puy, *Associate Professor*, B.A., Wellesley, 1942; M.Litt., Pittsburgh, 1951; Ph.D., Stanford, 1961.

Francisco Fernández-Turienzo, *Associate Professor*, B.A., Universidad Pont. de Salamanca, 1956; M.A., University of Basilea (Switzerland), 1965; Ph.D., 1965.

Sumner M. Greenfield, *Professor*, B.A., Boston College, 1946; M.A., Boston University, 1947; M.A., Harvard, 1951; Ph.D., 1957.

William G. Milan, *Assistant Professor*, B.A., St. Peter's College, 1968; M.A., University of Delaware, 1970; Ph.D., Temple University, 1973.

Jules Piccus, *Professor*, B.A., Queens, 1942; M.A., Princeton, 1949; Ph.D., 1951.

Judith Rauchwarger, *Assistant Professor*, B.A., Queens College of CUNY, 1966; M.A., University of Michigan, 1968; Ph.D., 1973.

Irving P. Rothberg, *Professor*, B.S., Temple University, 1948; M.A., Pennsylvania State, 1951; Ph.D., 1954.

Nina M. Scott, *Assistant Professor*, B.A., Wellesley, 1959; M.A., Stanford, 1961; Ph.D., 1968.

Rosalie S. Soons, *Assistant Professor*, A.B., Bryn Mawr, 1947; M.A., University of Connecticut, 1965; Ph.D., 1967.

John J. Staczek, *Assistant Professor*, B.A., Ohio State University, 1965; M.S., Georgetown University, 1970; Ph.D., 1973.

Harlan G. Sturm, *Associate Professor*, B.A., University of Minnesota, 1963; M.A., 1965; Ph.D., University of North Carolina, 1967.

Sidney F. Wexler, *Professor*, B.S., New York University, 1932; M.A., Colorado, 1933; Ph.D., New York University, 1952.

Juan C. Zamora, *Assistant Professor*, M.A., State University of New York at Buffalo, 1966; Ph.D., 1971.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

Joan E. Ciruti, *Professor* (Mount Holyoke College).

Ernest A. Johnson, Jr., *Professor of Romance Languages* (Amherst College).

Erna R. Berndt Kelley, *Associate Professor* (Smith College).

Joaquina Navarro, *Professor* (Smith College).

Eugenio Suárez-Galbán, *Associate Professor* (Mount Holyoke).

COURSE REQUIREMENTS FOR THE MASTER OF ARTS DEGREE

Students are required to have oral and written proficiency in Spanish before admission to candidacy for advanced degrees. In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. Spanish 705 (Bibliography and Methods).
2. A reading knowledge of a second foreign language pertinent to the student's program.
3. Spanish 800 may be elected for not more than nine credits.
4. Terminal examinations as follows:
   a. Comprehensive examination.
   b. For those electing Spanish 800, oral defense of thesis.

THE FIVE-COLLEGE COOPERATIVE Ph.D. PROGRAM

The University requirements for admission to the Graduate School specify acceptance by the department. For the Cooperative Ph.D. in Spanish, acceptance is by the Spanish departments of four participating institutions—Amherst, Mount Holyoke, Smith, and the University.

In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. Required courses:
   a. Spanish 705 (Bibliography and Methods), or the equivalent knowledge.
   b. One semester each of Romance Philology and the History of the Spanish Language. (Both Spanish 710.)
   c. Spanish 900, Doctoral Dissertation.
2. A reading-knowledge at the intermediate or advanced level as determined by the department, of Latin, French, and either German or another foreign language pertinent to the student's program.
3. Oral and written comprehensive examinations demonstrating proficiency in the language, a knowledge of the whole body of Spanish and Spanish-American literature and of the history of the language, and evidence of knowledge of the history and the culture of Hispanic countries.

N.B.: Graduate programs in the Department of Hispanic Languages and Literatures are in the process of revision. Other courses are being offered experimentally and graduate degree work is available in Spanish Linguistics and in Bilingual Studies. Contact the Department for more up-to-date information.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

420. ADVANCED CONVERSATIONAL SPANISH.
Intended primarily for first-year graduate students. Intensive oral practice to insure fluency. Phonetic variants within the Hispanic World. *Credit, 2.* Mr. Wexler.

700. PROBLEM COURSE.
Directed study in some phase of linguistics or literature. *Credit, 1-6.*

705. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH.
Ms. De Puy, Mr. Piccus.

Specific topics of Spanish 710 through 799 announced in the spring of the preceding year.

710. THE SPANISH LANGUAGE.
The development of Spanish and its relationship to other Romance languages. *Credit, 3-12.* Mr. Piccus.

715. SEMINARS IN EARLY MEDIEVAL LITERATURE.
A phase of Spanish literature of the 12th and 13th centuries.
Prerequisite, a knowledge of Latin, Spanish 710, or equivalent. *Credit, 3-12.* Mr. Piccus, Mr. Sturm.

720. SEMINARS IN LATER MEDIEVAL LITERATURE.
A phase of Spanish literature of the 14th and 15th centuries. *Credit, 3-12.* Mr. Piccus, Mr. Sturm.

730. SEMINARS IN RENAISSANCE AND BAROQUE LITERATURE.
Aspects of Spanish intellectual and spiritual movements of the 16th and 17th centuries as reflected in Renaissance and Baroque literature.
Credit, 3-12. Mr. F-Turienzo, Mr. Rothberg.

735. SEMINARS IN 16TH- AND 17TH-CENTURY POETRY.
The poets and poetic currents of the Spanish Golden Age.
Credit, 3-12. Mr. F-Turienzo, Mr. Rothberg.

740. SEMINARS IN GOLDEN-AGE FICTION.
Aspects of the novel in 16th- and 17th-century Spain.
Credit, 3-12. Mr. F-Turienzo, Mr. Rothberg.

745. SEMINARS IN THE 16TH- AND 17TH-CENTURY THEATER.
The development and apogee of the Spanish *comedia* in the GoldenAge. *Credit, 3-12.* Mr. Rothberg.

755. SEMINARS IN 18TH-CENTURY LITERATURE.
Phases of Spanish thought and literature in the 18th century. *Credit, 3-12.* Mr. Greenfield.

760. SEMINARS IN 19TH-CENTURY POETRY AND DRAMA.
Aspects of the theater and poetry of 19th-century Spain.
Credit, 3-12. Mr. Boudreau, Mr. Greenfield.

765. SEMINARS IN 19TH-CENTURY PROSE.
Nineteenth-century Spanish thought or narrative literature.
Credit, 3-12.
Mr. Boudreau, Ms. De Puy, Mr. Greenfield.

770. SEMINARS IN INTELLECTUAL AND ESTHETIC MOVEMENTS.
Intellectual and esthetic developments in the modern Hispanic world. *Credit, 3-12.*
Ms. De Puy, Mr. F-Turienzo, Mr. Greenfield.

775. SEMINARS IN 20TH-CENTURY POETRY AND DRAMA.
Phases of modern Spanish poetry and theater.
Credit, 3-12. Mr. Boudreau, Mr. Greenfield.

780. SEMINARS IN 20TH-CENTURY PROSE.
The novel, short story, and essay in modern Spain.
Credit, 3-12.
Mr. Boudreau, Ms. De Puy, Mr. Greenfield.

785. SEMINARS IN SPANISH-AMERICAN POETRY AND DRAMA.
Individual Spanish-American poets or dramatists, and in groups or movements.
Credit, 3-12. Mr. Bancroft, Mr. Barreda.

790. SEMINARS IN SPANISH-AMERICAN PROSE.
The novel, short story, chronicle, and essay in Spanish America. *Credit, 3-12.* Mr. Bancroft, Mr. Barreda.

799. SEMINARS IN HISPANIC LANGUAGE AND LITERATURE.
Phases of Spanish language and Spanish and Spanish-American literature that involve two or more of the areas of courses number 710 through 790. *Credit, 3-12.*

800. MASTER'S THESIS. *Maximum credit, 9.*

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

607. THE TEACHING OF SPANISH.
A systematic analysis of the major problems anticipated in the teaching of Spanish. Mr. Zamora.

608. SPANISH PHONETICS.
Spanish phonetic theory and its application to the teaching of Spanish.
3 class hours, 1 laboratory session. Mr. Zamora.

609. ADVANCED GRAMMAR.
Finer details and shades of Spanish grammar. Mr. Zamora.

610. ADVANCED COMPOSITION.
The elements of stylistics. Mr. Barreda.

615. SPANISH LITERATURE TO 1500.
Spanish literature in the Middle Ages and Renaissance.
Mr. Piccus, Mr. Sturm.

617. SPANISH MEDIEVAL POETRY.
Spanish epic, lyric poetry and other verse of the period.
Mr. Piccus, Mr. Sturm.

618. SPANISH MEDIEVAL PROSE.
Narrative, historical, and didactic prose works of medieval Spain. Mr. Piccus, Mr. Sturm.

625. PROSE OF THE GOLDEN AGE.
Major prose works in 16th- and 17th-century Spain. Emphasis on the novel, excluding the *Quijote*.
Mr. F-Turienzo, Mr. Rothberg.

630. CERVANTES.
Intensive study of the *Quijote*. Mr. F-Turienzo.

635. LYRIC POETRY OF THE GOLDEN AGE.
Spanish poetry of the 16th and 17th centuries from Garcilaso to Gongora. Mr. F-Turienzo, Mr. Rothberg.

640. DRAMA OF THE GOLDEN AGE.
The *comedia* during the period of maximum creation, 1556-1681. Mr. Rothberg, Mr. Sturm.

655. SPANISH LITERATURE FROM 1700 THROUGH ROMANTICISM.
Spanish literature and thought in the 18th century and the Romantic movement. Mr. Greenfield.

665. 19TH-CENTURY SPANISH NOVEL.
Prose fiction in the second half of the 19th century.
Mr. Boudreau, Ms. De Puy, Mr. Greenfield, Ms. Soons.

670. SPANISH-AMERICAN LITERATURE TO 1900.
A general view, with intensive study of selected major works. Mr. Bancroft, Mr. Barreda.

671. THE MODERNISTA MOVEMENT.
Modernismo in Spanish America, including a comparative study of its manifestations in Spain.
Mr. Bancroft, Mr. Barreda, Mr. Greenfield.

672. MAJOR SPANISH-AMERICAN WRITERS.
Intensive study of major figures in Spanish-American literature. Mr. Bancroft, Mr. Barreda, Mr. Greenfield.

673. SPANISH-AMERICAN POETRY AND DRAMA SINCE MODERNISMO.
The principal authors and movements in the 20th century.
Mr. Bancroft, Mr. Barreda.

674. MODERN SPANISH-AMERICAN PROSE FICTION.
Spanish-American prose fiction in the late 19th and early 20th centuries. Mr. Bancroft, Mr. Barreda.

675. CONTEMPORARY PROSE FICTION IN SPANISH AMERICA.
The recent novel and short story.
Mr. Bancroft, Mr. Barreda.

681. MODERN SPANISH THEATER.
Development of the theater in Spain from the post-romantic period to the present. Mr. Greenfield.

682. 20TH CENTURY SPANISH PROSE FICTION.
The novel in Spain from the Generation of '98 to the present.
Mr. Boudreau, Ms. De Puy, Mr. Greenfield, Ms. Soons.

683. MODERN SPANISH POETRY.
Poetry in Spain from Becquer to the present.
Mr. Boudreau, Ms. Soons.

684. THE ESSAY IN MODERN SPAIN.
The essay as a vehicle for Spanish thought in the late 19th and 20th centuries. Ms. De Puy, Mr. F-Turienzo, Mr. Greenfield.

COURSE NOT FOR MAJOR CREDIT

409. GRADUATE READING COURSE.
For graduate students preparing for the M.A. or Ph.D. reading examination. No previous knowledge of Spanish required.
No credit.

History

GRADUATE FACULTY

Robert H. McNeal, *Professor and Chairman of the Department of History*, B.A., Yale, 1952; M.A., Columbia, 1954; Ph.D., 1958.

Winfred E. A. Bernhard, *Professor and Graduate Program Director*, B.S., Harvard, 1942; M.A., Columbia, 1948; Ph.D., 1961.

Dean Albertson, *Professor*, B.A., California at Berkeley, 1942; M.A., 1947; Ph.D., Columbia, 1955.

Hugh F. Bell, *Assistant Professor*, B.A., Princeton, 1941; J.D., Michigan, 1948; Ph.D., Cornell, 1970.

Joyce A. Berkman, *Assistant Professor*, B.A., California at Los Angeles, 1958; M.A., Yale, 1959; Ph.D., 1967.

David Biddle, *Assistant Professor*, B.A., Texas, 1966; M.A., 1967; Ph.D., 1972.

Paul S. Boyer, *Associate Professor*, B.A., Harvard, 1960; M.A., 1961; Ph.D., 1966.

Milton Cantor, *Associate Professor*, B.A., Brooklyn, 1947; M.A., Pennsylvania, 1948; Ph.D., Columbia, 1954.

Miriam U. Chrisman, *Professor*, B.A., Smith, 1941; M.A., American University, 1948; M.A., Smith, 1955; Ph.D., Yale, 1962.

William A. Davis, *Associate Professor*, B.A., Colgate, 1935; M.A., Harvard, 1938; Ph.D., 1956.

Mario S. DePillis, *Associate Professor*, B.A., Chicago, 1952; M.A., 1954; Ph.D., Yale, 1961.

Fred W. Drake, *Assistant Professor*, B.A., Stanford, 1961; M.A., 1963; M.A., Harvard, 1965; Ph.D., 1971.

Harold J. Gordon, Jr., *Professor*, B.A., Richmond, 1940; M.A., Yale, 1948; Ph.D., 1953.

Louis S. Greenbaum, *Professor*, B.A., Wisconsin, 1950; M.A., 1951; Ph.D., Harvard, 1955.

Robert W. Griffith, *Associate Professor*, B.A., DePauw, 1962; M.A., Wisconsin, 1964; Ph.D., 1967.

Lewis Hanke, *Professor*, B.S., Northwestern, 1924; M.A., 1925; Ph.D., Harvard, 1936.

Robert A. Hart, *Associate Professor*, B.A., Indiana, 1954; M.A., 1959; Ph.D., 1964.

Joseph M. Hernon, Jr., *Associate Professor*, B.A., Catholic University, 1959; Ph.D., Trinity College, Dublin, 1963.

Vincent Ilardi, *Professor*, B.A., Rutgers, 1952; M.A., Harvard, 1953; Ph.D., 1958.

William M. Johnston, *Associate Professor*, B.A., Harvard, 1958; Ph.D., 1965.

Robert E. Jones, *Assistant Professor*, B.A., Lafayette, 1963; Ph.D., Cornell, 1968.

George E. Kirk, *Professor,* B.A., Cambridge, 1932; Diploma in Classical Archaeology, 1933; M.A., 1936.

Bruce G. Laurie, *Assistant Professor,* B.A., Rutgers, 1965; M.A., Pittsburgh, 1967; Ph.D., 1971.

Archibald R. Lewis, *Professor,* B.A., Princeton, 1936; M.A., 1939; Ph.D., 1940.

Jane M. Loy, *Assistant Professor,* B.A., DePauw, 1962; M.A., Wisconsin, 1964; Ph.D., 1969.

Gerald W. McFarland, *Associate Professor,* B.A., California at Berkeley, 1960; M.A., Columbia, 1964; Ph.D., 1965.

Richard H. Minear, *Associate Professor,* B.A., Yale, 1960; M.A., Harvard, 1962; Ph.D., 1968.

Stephen Nissenbaum, *Associate Professor,* B.A., Harvard, 1961; M.A., Columbia, 1963; Ph.D., Wisconsin, 1968.

Stephen B. Oates, *Professor,* B.A., Texas, 1958; M.A., 1960; Ph.D., 1968.

Stephen E. Pelz, *Assistant Professor,* B.A., Johns Hopkins, 1964; M.A., Harvard, 1966; Ph.D., 1971.

Robert A. Potash, *Professor,* B.A., Harvard, 1942; M.A., 1947; Ph.D., 1953.

Howard H. Quint, *Professor,* B.A., Yale, 1940; M.A., Stanford, 1942; Ph.D., Johns Hopkins, 1947.

Charles W. Rearick, *Assistant Professor,* B.A., College of Idaho, 1964; M.A., Harvard, 1965; Ph.D., 1968.

Leonard L. Richards, *Associate Professor,* B.A., California at Berkeley, 1956; M.A., 1961; Ph.D., California at Davis, 1968.

Roland Sarti, *Associate Professor,* B.A., City College of New York, 1960; M.A., Rutgers, 1962; Ph.D., 1966.

Neal Shipley, *Assistant Professor,* B.S., Groves City College, 1959; M.A., Harvard, 1960; Ph.D., 1967.

E. Nancy Stepan, *Assistant Professor,* B.A., Oxford, 1961; M.A., 1965; Ph.D., California at Los Angeles, 1971.

Marvin Swartz, *Assistant Professor,* B.A., Princeton, 1963; M.A., Yale, 1964; Ph.D., 1969.

Philip Swenson, *Assistant Professor,* B.A., San Diego State, 1966; M.A., 1967; Ph.C., 1970; Ph.D., University of Washington, 1971.

Jack Tager, *Associate Professor,* B.A., Brooklyn, 1958; M.A., California at Berkeley, 1959; Ph.D., Rochester, 1965.

Jack M. Thompson, *Assistant Professor,* B.A., South Carolina, 1949; M.A., 1953; Ph.D., 1958.

John Van Steenberg, *Assistant Professor,* B.S., University of Indiana, 1944; M.A., University of Chicago, 1947; Ph.D., Harvard, 1957.

Ronald D. Ware, *Associate Professor,* B.A., Cincinnati, 1950; M.S., Wisconsin, 1956; Ph.D., 1960.

Robert White, *Assistant Professor,* B.A., Haverford, 1963; M.A., Texas, 1966; Ph.D., 1972.

Franklin B. Wickwire, *Professor,* B.A., Hanover, 1952; M.A., Indiana, 1956; Ph.D., Yale, 1961.

Mary B. Wickwire, *Assistant Professor,* B.A., Wellesley, 1956; M.A., Yale, 1957; Ph.D., 1963.

David Wyman, *Associate Professor,* B.A., Boston University, 1951; M.Ed., Plymouth Teachers College, 1961; M.A., Harvard, 1962; Ph.D., 1966.

GRADUATE PROGRAMS IN HISTORY

More complete information on graduate study in History may be found in the Departmental statement, *Graduate Program in History,* available from the History office. Because requirements are currently under revision, students are advised to consult the most recent edition of this statement.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

The Department of History offers doctoral work in six areas: Europe (including Russia), United States, Great Britain, Latin America, East Asia, Near and Middle East. Each of these areas is subdivided into a number of fields. The candidate chooses an area of specialization, and within this area a major field.

A student entering the University with previous graduate training at other institutions may be admitted to the graduate program with advanced standing at the discretion of the Department. The Department's Graduate Committee evaluates his previous graduate training, and he is informed of his exact status upon notification of admission to the Department's graduate program.

At the outset of his work, each doctoral candidate is assigned a Guidance Committee whose function it is to advise and approve courses and doctoral fields most appropriate to the student's designated major interests. Of his required course work no fewer than four courses will be graduate seminars in three fields. These seminars concentrate on research training and the techniques of historical writing. The candidate for the Ph.D. must be in full-time residence for no less than one academic year (two consecutive semesters).

All Ph.D. candidates must pass a departmental examination demonstrating reading proficiency in the literature of one foreign language. Students who plan to specialize in areas for which more than one foreign language is necessary for scholarly work must pass departmental examinations demonstrating reading proficiency in the literature of such relevant languages.

Each candidate for the Ph.D. is responsible for four fields, at least two of which are in his area of specialization. Not more than two fields may be offered which deal with the history of a particular nation.

The substitution of fields outside the Department of History may be elected upon recommendation of the student's adviser and approval by the department's Graduate Program Director. Satisfactory completion of the General Examination admits the student to formal candidacy for the Ph.D. degree. A dissertation is required of each candidate for the Ph.D.

THE MASTER OF ARTS DEGREE PROGRAM

Each graduate student entering this program selects a major field of concentration from among those offered by the History Department for doctoral work. Selection of the student's adviser is based upon the student's selection of field. All M.A. candidates must demonstrate a reading proficiency in one foreign language, for which U.S. history specialists may sub-

stitute proficiency in an alternative tool of research. Students who plan to specialize in areas for which English is not the basic language are required to demonstrate to the department a reading proficiency in the relevant foreign language during the first semester of graduate study.

Admission to seminars and topics courses in some fields may depend upon the student's ability in one or more foreign languages.

Basic Course requirements.

1. Each student must complete eight courses for the Master's degree of which at least six must be in the 700-800 series. For two of these courses the student may elect to substitute the preparation of a thesis.

2. Each student may take two courses in associated disciplines at the discretion of his adviser.

3. Four courses is the normal permissible program per semester.

4. Each student must complete a minimum of one course in historiography.

5. Each student must complete two seminars with the minimum grades of B, unless he chooses to write a thesis, in which case he may be exempted from one seminar.

The candidate must pass an oral examination on his primary field of interest, to be conducted by an examining committee of three members of the graduate faculty. The student is expected to complete his program within a six-year period.

THE MASTER OF ARTS (M.A.) PROGRAM FOR TEACHERS

This program emphasizes the special needs of secondary school teachers; it stresses breadth of knowledge rather than concentration, and critical reading more than the development of research techniques.

The student is required to complete eight courses at least four of which must be in the 700 to 800 level. His program is planned with reference to preparation for teaching. He must complete a semester course entitled "The Teaching of History," and may include three courses in associated disciplines at the discretion of the adviser.

Examinations in foreign languages are not required of students in this program, yet admission to certain courses in the history of non-English speaking countries necessitates a competence in the relevant language.

Twelve credits is the normal program per semester. The student should expect to complete his program within a six-year period.

A candidate must pass an oral examination based, in consultation with his adviser, upon an appropriate range of his graduate courses including "The Teaching of History." Three members of the graduate faculty will conduct the examination. Transfer to the regular Master of Arts program may be made with the approval of the department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN HISTORY.
Directed research and writing for qualified students.
Prerequisite, permission of instructor. *Credit, 1-6.*

701. EUROPEAN HISTORIOGRAPHY TO THE ENLIGHTENMENT.
Critical evaluation of the techniques and ideas of major historians and influential schools of historical interpretation from the Greeks through the Renaissance.
Credit, 4. Mr. Ware.

702. EUROPEAN HISTORIOGRAPHY; THE ENLIGHTENMENT TO THE PRESENT.
Techniques and ideas of major historians and influential schools of historical interpretation, and the relation of historiography to the intellectual and political history of modern Europe. *Credit, 4.* Mr. Greenbaum, Mr. Johnston.

703. AMERICAN HISTORIOGRAPHY THROUGH THE CIVIL WAR.
Interpretations of major themes as developed in the works of leading historians. *Credit, 4.* Mr. Davis.

704. AMERICAN HISTORIOGRAPHY; 1865 TO THE PRESENT.
Interpretations of major themes as developed in the works of leading historians. *Credit, 4.* Mr. McFarland.

705. PHILOSOPHY OF HISTORY.
The "philosophy of history" both as epistemology and as a method of explanation, and a comparison of the aims of history and the sciences. Analysis of the nature of history: the difference between truth and fact, the possibility of objectivity, and the theory of historical explanation. Major historians in the field are read, from Thucydides and Augustine to Croce and Toynbee. *Credit, 4.* Mr. Johnston.

706. LATIN AMERICAN HISTORIOGRAPHY.
Techniques and interpretations developed by representative historians from the conquest to the present.
Prerequisite, reading knowledge of Spanish or Portuguese, or permission of instructor. *Credit, 4.* Mr. Hanke.

707. LATE MEDIEVAL AND RENAISSANCE PALAEOGRAPHY.
Instruction in reading the scripts of original documents. Required of Ph.D. specialists in these fields.
Credit, 4. Mr. Ilardi.

708. TOPICS IN ANCIENT HISTORY I.
The Near East and Greece. Papers may obtain seminar credit with instructor's approval. *Credit, 4.* Mr. Kirk.

709. TOPICS IN ANCIENT HISTORY II.
Early Italy and Rome, to the end of the Empire in the West. Papers may obtain seminar credit with instructor's approval.
Credit, 4. Mr. Kirk.

710. TOPICS IN HISTORY.
Readings, discussions, reports. *Credit, 4.*

711. TOPICS IN EARLY MEDIEVAL HISTORY.
Continuity between ancient and medieval civilization.
Prerequisites, working knowledge of Latin and one modern language (German, French, Italian) or permission of instructor.
Credit, 4. Mr. Lewis, Mr. Ware.

712. TOPICS IN THE AGE OF THE RENAISSANCE AND REFORMATION.
European culture between 1400 and 1600. A reading knowledge of a modern European language is generally required.
Credit, 4. Mr. Ilardi.

713. TOPICS IN THE AGE OF THE ENLIGHTENMENT.
The movement of ideas in Atlantic civilization during the 18th century. The mind and writings of representative European and American thinkers. Emphasis on politics, religion, science, literature and the arts. *Credit, 4.* Mr. Greenbaum.

714. TOPICS IN TUDOR AND STUART ENGLAND.
Selected aspects of the Tudor age; the interplay of social, and political factors involved in the Stuart Revolution. Constitutional developments emphasized. *Credit, 4.* Mr. Shipley.

715. TOPICS IN RECENT EUROPEAN HISTORY.
Basic developments in diplomatic, political, social, and eco-

nomic history since 1800. Emphasis on organic growth and change. *Credit, 4.* Mr. Gordon.

716. TOPICS IN WORLD WAR II AND AFTERMATH.
Pre-nuclear total war in its military development and its political, economic, and social ramifications in modern Western society; the postwar settlements and their effects. *Credit, 4.*

717. TOPICS IN THE RECENT SOCIAL HISTORY OF EUROPE.
The social changes resulting from the industrialization of Europe since 1815 and their relationship to economic and political developments. The methods and materials needed for effective work in recent social history. A series of short problems illustrating proper utilization of the sources. *Credit, 4.* Mr. Gordon.

718. TOPICS IN NINETEENTH-CENTURY INTELLECTUAL HISTORY.
Selected major currents in European thought since the French Revolution, their origins, development, and influence. Reading knowledge of French or German is desirable. *Credit, 4.*

719. PROBLEMS IN BRITISH IMPERIAL HISTORY SINCE 1783.
Aspects of such general topics as the problems of imperial government after the American Revolution, the Durham Report and the growth of the dominions, the difficulties and effect of implantation of British institutions in Asia and Africa, the lessening of British control and the Statute of Westminster, and the political and economic importance of the Commonwealth in world affairs. *Credit, 4.* Mr. Wickwire.

720. TOPICS IN BRITAIN IN THE 19TH CENTURY.
Central themes and topics. Emphasis on the history of thought in its relation to political, economic, and social developments. *Credit, 4.* Mr. Hernon.

721. PROBLEMS IN RUSSIAN HISTORY.
Russia in the 19th and 20th centuries. Emphasis on Russian and Soviet historiography. Intensive reading and careful analyses of selected topics. *Credit, 4.* Mr. McNeal.

722. TOPICS IN MODERN SPANISH HISTORY.
Spanish history from the end of the reign of Philip II to the end of the Spanish Civil War. *Credit, 4.*

730. TOPICS IN EARLY AMERICAN HISTORY.
Colonial America from discovery and settlement of the New World through the Federalist era. *Credit, 4.* Mr. Bernhard.

731. TOPICS IN THE ERA OF THE CONFEDERATION AND THE CONSTITUTION.
The formative years of the American nation; the evolution of federal and state constitutions; basic political issues and conflicts; the pattern of economic and social development. *Credit, 4.* Mr. Davis, Mr. Bernhard.

732. TOPICS IN THE NATIONAL PERIOD.
A reading course. Basic features of American political, social, and economic history from the rise of Jeffersonianism to the Civil War. *Credit, 4.* Mr. Cantor, Mr. Richards.

733. TOPICS IN THE AMERICAN CIVIL WAR ERA.
Analysis and interpretation of slavery and abolition, Southern nationalism, the breakdown of national parties, causes of the War, wartime politics and the War's impact. *Credit, 4.* Mr. Oates.

734. TOPICS IN THE GILDED AGE.
Investigation of national re-unification, Grantism, dead center politics, genteel reform, the new industrialism and business leadership, labor and agrarian problems. *Credit, 4.* Mr. McFarland.

735. TOPICS IN THE PROGRESSIVE ERA OF THE UNITED STATES.
Emphasis on the political, social, economic, and cultural aspects of the Progressive Era, and an analysis of the interpretations of historians and others. *Credit, 4.* Mr. Quint, Mr. Griffith.

736. TOPICS IN AMERICAN DIPLOMATIC HISTORY.
Readings in the primary and secondary sources for the study of important phases in American diplomacy. *Credit, 4.* Mr. Hart.

737. TOPICS IN THE UNITED STATES BETWEEN THE WORLD WARS.
Major issues in American political, social, and economic life between the two World Wars. *Credit, 4.* Mr. Quint, Mr. Wyman.

738. TOPICS IN UNITED STATES INTELLECTUAL HISTORY.
Specific aspects of such general topics as the American adaptation of the European heritage, the growth of the concept of Americanism, the emergence of patrician leadership, the achievement of realistic democracy, the triumph of nationalism, the assertion of individualism in a corporate society, and the scientific-humanistic culture conflict. *Credit, 4.* Mr. Quint, Mr. Cantor.

739. TOPICS IN MASSACHUSETTS HISTORY.
Development of the Commonwealth and its relationship to regional and national institutions and thought from early colonial times to the present. Abundant primary and secondary source materials. A foundation for further research. *Credit, 4.*

740. TOPICS IN UNITED STATES URBAN HISTORY.
The origins of the modern American city and the complex problems engendered by large-scale urbanization. *Credit, 4.* Mr. Tager.

741. TOPICS IN AMERICAN SOCIAL HISTORY.
A behavioral approach to the history of American society: the family, religion, ethnicity, socialization of children, explanations of social change etc. *Credit, 4.* Mr. DePillis.

745. TOPICS IN MODERN AND CONTEMPORARY LATIN AMERICA.
Political, economic, social, and ideological forces in the history of Latin America since independence. Reading knowledge of spanish or Portuguese desirable. *Credit, 4.* Mr. Potash.

748. TOPICS IN ISLAMIC AND MODERN MIDDLE-EASTERN HISTORY AND POLITICS.
Readings in primary and secondary sources for the study of important aspects of Islamic and Middle Eastern development.
Prerequisite, permission of instructor.
Credit, 4. Mr. Biddle, Mr. Kirk.

750. RESEARCH SEMINAR IN HISTORY.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.*

751. SEMINAR IN MEDIEVAL HISTORY.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Lewis, Mr. Ware.

752. SEMINAR IN RENAISSANCE AND REFORMATION.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4 each semester; total credit, 4. Mr. Ilardi.

753. SEMINAR IN THE ENLIGHTENMENT.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Greenbaum.

754. SEMINAR IN 18TH-CENTURY BRITAIN.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Wickwire.

755. SEMINAR IN MODERN ENGLISH HISTORY.
Research on selected topics, 1890-1940.
Prerequisite, permission of instructor.
Credit, 4. Mr. Hernon.

756. SEMINAR IN MODERN GERMANY.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Gordon.

757. SEMINAR IN MODERN FRANCE.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.*

758. SEMINAR IN RUSSIAN HISTORY.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. McNeal.

759. SEMINAR IN EUROPEAN DIPLOMACY SINCE 1815.
Training in historical research and an introduction to the relationships among European nations in a critical period.
Prerequisite, permission of instructor.
Credit, 4. Mr. Swartz.

761. SEMINAR IN EARLY AMERICAN HISTORY.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Bernhard.

762. SEMINAR IN THE AGE OF JACKSONIAN DEMOCRACY.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Richards.

763. SEMINAR IN THE CIVIL WAR AND RECONSTRUCTION.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Oates.

764. SEMINAR IN THE WESTWARD MOVEMENT OF THE UNITED STATES.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. DePillis, Mr. Davis.

765. SEMINAR IN THE PROGRESSIVE ERA IN THE UNITED STATES.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Quint.

766. SEMINAR IN THE UNITED STATES BETWEEN THE WORLD WARS.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Quint.

767. SEMINAR IN AMERICAN DIPLOMATIC HISTORY.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Hart.

768. SEMINAR IN AMERICAN INTELLECTUAL HISTORY TO THE CIVIL WAR.
Training in historical research.
Prerequisite, permission of instructor.
Credit, 4. Mr. Quint, Mr. Cantor.

769. SEMINAR IN AMERICAN INTELLECTUAL HISTORY SINCE THE CIVIL WAR.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Quint.

770. SEMINAR IN THE COLONIAL HISTORY OF LATIN AMERICA.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Hanke.

771. SEMINAR IN ARGENTINE HISTORY.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Potash.

772. SEMINAR IN MEXICAN HISTORY.
Training in historical research.
Prerequisite, permission of instructor. *Credit, 4.* Mr. Potash.

780. SEMINAR IN ISLAMIC AND MODERN MIDDLE EASTERN HISTORY AND POLITICS.
Training in historical research.
Prerequisite, permission of instructor.
A reading knowledge of a European language is highly desirable. *Credit, 4.* Mr. Biddle, Mr. Kirk.

800. MASTER'S THESIS. *Maximum credit, 8.*

900. DOCTORAL DISSERTATION. *Maximum credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

500. THE ANCIENT WORLD TO 500 B.C.
From the origins of human society to the Greeks' confrontation with the Persian Empire. Mr. Kirk.

501. THE ANCIENT WORLD: PERICLES TO CONSTANTINE.
The successive assertions and breakdowns of leadership in the Greek and Roman world. Mr. Kirk.

502. EARLY MIDDLE AGES (300-1100).
Spread of Christianity; pagan and early Christian culture; Germanic kingship; the Carolingian world; early feudalism; monasticism and ecclesiastical centralization.
Mr. Lewis, Mr. Ware.

503. THE LATER MIDDLE AGES (1100-1350).
Revival of towns and commerce; the growth and development of the feudal monarchies and ecclesiastical authority; rise of secularism. Mr. Lewis, Mr. Ware.

505. LATE MIDDLE AGES AND EARLY RENAISSANCE (1300-1494).
The changes in European thought and institutions during the development of Humanism. Mr. Ilardi.

506. LATE RENAISSANCE AND REFORMATION, 1494-1600.
The impact on the late Renaissance of the Protestant and Catholic Reformations. Mr. Ilardi.

507. EUROPE IN THE ENLIGHTENMENT: 1685-1789.
Civilization of Western Europe in the 18th century, its social milieu, intellectual setting, institutional forces, religious tendencies, aesthetic contributions, and the growth of the revolutionary spirit. Mr. Greenbaum.

508. THE FRENCH REVOLUTION AND NAPOLEON.
Political change in Europe from the Old Regime and the French Revolution to the fall of Napoleon.

509. HISTORY OF EUROPE: 1815-1870.
Major developments in the internal and international affairs of the European states from the Congress of Vienna to the Franco-German War. Mr. Rearick.

510. EUROPE, 1870-1918.
Internal developments of the principal countries; conditions and diplomacy which led to the World War; military and diplomatic history of the war years. Mr. vanSteenberg.

511. EUROPE SINCE 1918.
Major developments in the internal and international affairs of the European states since World War I.
Mr. vanSteenberg.

512. EUROPEAN INTELLECTUAL HISTORY IN THE 19TH CENTURY.
Chief intellectual currents in Europe; romanticism, liberalism, religious revival, socialism, Darwinism, racism, and mass culture. Mr. Johnston, Mr. Rearick.

513. EUROPEAN INTELLECTUAL HISTORY IN THE 20TH CENTURY.
Philosophical, academic, literary, aesthetic, political and popular currents since 1900.
Prerequisite, permission of instructor. Mr. Johnston.

514 (I), 515 (II). THE HISTORY OF RUSSIA.
Political, economic, social, and intellectual development of Russia. Either semester may be elected independently.
Credit, 3 each semester. Mr. Jones.

516. THE RUSSIAN REVOLUTION.
Intensive study of the origins, course, and impact of the Bolshevik Revolution. Mr. McNeal.

517. SOVIET RUSSIA.
Major social, political, intellectual developments, and the international relations of Soviet Russia since the Bolshevik Revolution. Mr. McNeal.

518. EARLY MODERN GERMANY.
From the end of the Thirty Years' War to the collapse of the Napoleonic hegemony. Mr. Gordon.

519. THE HISTORY OF MODERN GERMANY.
The evolution and development of Germany since the Congress of Vienna; emphasis on diplomatic, political, military and social-economic trends and problems. Mr. Gordon.

520. MODERN SCANDINAVIA.
The major issues of domestic and foreign politics of the states of Northern Europe in the 19th and 20th centuries.
Mr. vanSteenberg.

521. FRANCE SINCE 1789.
Selected formative political crises from 1789 to the present, and their settings in the economic, social, and intellectual life of modern France. Mr. Rearick.

522. IMPERIAL SPAIN: 1450-1810.
Early modern Spain from the time of Ferdinand and Isabella to the outbreak of the Spanish-American wars for independence, including the Habsburg and early Bourbon periods.

523. MODERN SPAIN: 1810 TO THE PRESENT.
Emphasizes economic, political, and cultural developments from the early 19th-century revolutions and the defeat of Napoleon to the age of Franco.

524. EUROPEAN DIPLOMATIC HISTORY: 1870-1914.
The internal politics and foreign policies of the major European powers. Emphasis on the themes of nationalism, liberalism, alliance systems, and the origins of World War I.
Mr. Swartz.

525. EUROPEAN DIPLOMATIC HISTORY: 1914-1956.
The internal politics and foreign policies of the major European powers. Emphasis on the importance of World War I, the polarization of national and international politics; the origins, course, and aftermath of World War II, and the postwar world. Mr. Swartz.

528. 17TH-CENTURY EUROPE.
Europe from the Wars of the Counter-Reformation to the Glorious Revolution. Civilization of the Baroque in its social, political, economic, religious and intellectual settings.
Mr. Greenbaum.

529. SOCIAL HISTORY OF EARLY MODERN EUROPE.
The social institutions of Europe as they changed from a system of feudal organization to pre-industrial society, including the evolution of the town to the city, the changing role of the church and agrarian life, and the development of an intellectual class.
Mrs. Chrisman.

530. HISTORY OF MODERN ITALY.
Survey of modern Italy from the origins of the Risorgimento in the 18th century to the "opening to the left" of the 1960's, with particular reference to domestic problems after the unification, to Italian foreign policy up to the Second World War, and to the rise and consolidation of fascism. Mr. Sarti.

531 (I), 532 (II). ENGLISH HISTORY.
Economic, social, and cultural influences, as well as constitutional development. Either semester may be elected independently. *Credit, 3 each semester.* Mr. Hernon, Mr. Shipley.

533. MEDIEVAL ENGLAND.
England from the fifth to the fifteenth century, with attention to the Anglo-Saxon period, the Norman conquest, and the evolution of government to the accession of the Tudors.
Mr. Ware.

534 (I), 535 (II). TUDOR-STUART ENGLAND: 1485-1688.
Selected aspects of the constitutional, social, intellectual, and imperial history of England in this period. Either semester may be elected independently.
Credit, 3 each semester. Mr. Shipley.

536. BRITAIN IN THE 18TH CENTURY.
Selected aspects of social, intellectual, imperial, and constitutional history including the Acts of Union. Impact of the Industrial and French Revolutions. Mr. Wickwire.

537 (I), 538 (II). MODERN BRITAIN.
Selected topics on the political, social, and intellectual development of Britain in the nineteenth and twentieth centuries. Either semester may be elected independently.
Credit, 3 each semester. Mr. Hernon, Mrs. Berkman.

539. HISTORY OF THE BRITISH EMPIRE AND COMMONWEALTH SINCE 1783.
Evolution of British imperial policy; growth of the Dominions, the Commonwealth, and the dependent Empire; role of the Empire in world politics. Mr. Wickwire.

540. MILITARY HISTORY OF EUROPE, 1740-1914.
Developments in military theory and practice, civil-military relations, technology; the armed forces as social and political institutions. Mr. Gordon.

541. MILITARY HISTORY OF EUROPE SINCE 1914.
See History 540 for description.

601. HISTORY OF ARGENTINA (C).
Argentina since the 18th century. Attention to political, social, and economic change and, in the 20th century, to the growing importance of labor and the military in politics. Mr. Potash.

602. THE HISTORY OF MEXICO.
Mexico from the end of the 18th century to the present. Emphasis on political, economic, and social developments.
Mr. Potash.

603. THE CARIBBEAN.
The Caribbean as a focus of conflict and adjustment from the 15th century to the present. Mrs. Loy.

604. HISTORY OF GRAN COLOMBIA.
Colombia, Venezuela, and Ecuador from colonial settlement to the present. Mrs. Loy.

605. HISTORY OF THE ANDEAN REPUBLICS.
Peru, Bolivia, and Chile from the late colonial period to the present. Emphasis on political, social and economic developments; particular attention to institutions.

607. THE HISTORY OF THE PORTUGUESE EMPIRE.
A survey of the colonial empire Portugal created in Morocco, West Africa, Mozambique, India, Brazil, and the Far East—from the capture of Ceuta in 1415 until Portugal recognized the independence of Brazil in 1825. Comparative treatment of economic affairs, political institutions, race relations, and cultural developments. Mr. White.

608. THE HISTORY OF BRAZIL.
A general view of the cultural, economic, and political development of Brazil since 1822. How the largest and most populous nation in Latin America has become a significant power.
Mr. White.

616. AMERICAN COLONIAL HISTORY TO 1783.
Discovery and exploration, early European settlements, systems of political and economic control, religious and intellectual development. Anglo-French rivalry. Mr. Bernhard, Mr. Bell.

617. THE AMERICAN REVOLUTIONARY ERA.
Coming of the Revolution; War for Independence; evolution of American federalism. Mr. Bernhard, Mr. Bell.

618. THE EARLY NATIONAL PERIOD, 1789-1828.
Development of the United States in its formative years, emphasizing political, intellectual, and diplomatic factors.
Mr. Bernhard.

619. JACKSONIAN AMERICA.
Political, economic, and social developments in the period before the Civil War. Mr. Richards.

620. CIVIL WAR AND RECONSTRUCTION, 1860-1877.
Conduct of the war; political problems; national reunification.
Mr. Oates, Mr. Swenson.

621. THE GILDED AGE.
The emergence of modern political issues during the final decades of the 19th century. Emphasis on the role of industrialization, corporate consolidation, urban growth, and labor, agrarian and genteel protest. Mr. McFarland.

624. THE PROGRESSIVE AGE (1900-1920).
The political response to the changing economic and social conditions in American life. Mr. Thompson, Mr. Tager.

625. THE UNITED STATES BETWEEN THE WORLD WARS.
American political, economic, and intellectual life between the two World Wars. Mr. Griffith, Mr. Wyman.

626 (I), 627 (II). HISTORY OF AMERICAN THOUGHT AND CULTURE.
The basic strands of American thought and their reflection in American culture. First semester deals with the period before 1865. Either semester may be elected independently.
Mr. Cantor, Mr. Boyer, Mr. Nissenbaum.

628. UNITED STATES CONSTITUTIONAL HISTORY TO THE CIVIL WAR.
Origins and development of American constitutionalism from the 17th century to the outbreak of sectional armed conflict.
Mr. Cantor.

629. UNITED STATES CONSTITUTIONAL HISTORY FROM THE CIVIL WAR TO THE PRESENT.
Evolution of constitutional power in modern America.
Mr. Cantor.

630 (I), 631 (II). SOCIAL HISTORY OF THE UNITED STATES.
The evolving status of individuals and groups and problems of migration, livelihood, urbanization, and social conflict. Either semester may be selected independently. Mr. DePillis.

632. THE SOUTH IN AMERICAN HISTORY.
From early settlement to contemporary regional problems.
Mr. Thompson.

633. HISTORY OF AMERICAN WESTWARD EXPANSION: 1763-1893.
Advance of settlement from the Appalachians to the Pacific and the influence of the frontier upon social, economic, and political conditions. Mr. Davis, Mr. Oates.

634 (I), 635 (II). DIPLOMATIC HISTORY OF THE UNITED STATES.
Development of American foreign relations, 1776 to the present. Either semester may be elected independently.
Mr. Hart, Mr. Pelz.

636. HISTORY OF THE AMERICAN LABOR MOVEMENT.
Evolution of the trade unionism in American life from late 18th century origins through post-Civil War developments to the present. Critical evaluation of changes in labor history.
Mr. Laurie.

637. THE CITY IN THE MODERN UNITED STATES.
The industrial city and the full-scale urbanization of the modern United States. The effect of city life upon the social, political, and economic institutions of America. Emphasis on the historical origins of the problems of modern urban existence.
Mr. Tager.

638. AFRO-AMERICAN HISTORY.
African background of the black man, origins and progress of slavery in colonial America and the United States, development of Afro-American culture, and distinctive contributions of the black man to United States history.

639. UNITED STATES SINCE PEARL HARBOR.
Emphasis on political, economic, and social currents since World War II. Mr. Griffith, Mr. Wyman.

640. CIVILIZATION OF ISLAM.
From the "revolutionary idea" of Islam and its conquest of an Arab empire to 18th-century decay and the Western challenge. Mr. Biddle.

641. THE MODERN MIDDLE EAST.
From the impact of 18th-century Europe on the Islamic empire to the emergence of 20th-century nationalism, and socialism and the decline of Western influence. Mr. Kirk.

642. THE OTTOMAN EMPIRE.
Ottoman history and institutions from the origins of the state to the proclamation of the Turkish Republic, ca. 1280 to 1923. Emphasis on political, economic, and social history and the problems of westernization.

660. HISTORY OF MODERN CHINA: THE 19TH CENTURY.
The nature of the "traditional" Chinese order inherited by China's alien Manchu rulers; China's response to the West; rise of rebellions; failure of conservative reform; disintegration of an ancient civilization. Mr. Drake.

661. HISTORY OF MODERN CHINA: THE 20TH CENTURY.
Twentieth-century China's revolutions—intellectual, social, economic, political—and their settings, up to the present.
Mr. Drake.

662. HISTORY OF JAPANESE CIVILIZATION.
The development of Japanese civilization from its origins to the mid-nineteenth century. Mr. Minear.

663. HISTORY OF MODERN JAPAN.
Japan's modernization from the mid-19th century.
Mr. Minear.

670 (I), 671 (II). HISTORY OF SCIENCE.
Development of major scientific achievements from antiquity to the present. Emphasis on scientific theory; conceptual developments are treated in philosophical, cultural, sociological, and scientific contexts.
Prerequisite, one year of physical science. Mrs. Stepan.

Home Economics

GRADUATE FACULTY

Helen R. Vaznaian, *Associate Professor and Head of the Department of Home Economics Education*, B.S., State College, Framingham, 1946; M.Ed., Boston University, 1951.

Marion A. Niederpruem, *Professor and Graduate Program Director in Home Economics*, B.S., University of New York, Buffalo, 1935; M.S., New York University, 1944; Ph.D., University of Michigan, 1956.

Mary E. Green, *Associate Professor*, B.S., Framingham State College, 1956; M.Ed., Boston State College, 1960; Ph.D., Cornell University, 1968.

Carol B. Meeks, *Assistant Professor*, B.Sc., Ohio State University, 1968; M.Sc., 1969; Ph.D., 1972.

Warren F. Schumacher, *Assistant Professor*, B.A., Cathedral College, 1952; J.C.D., Gregorian University (Italy), 1961; M.S., Iona College, 1967.

A Master of Science degree may be earned in Home Economics by candidates who hold an accredited baccalaureate degree and are accepted under the general regulations of the Graduate School of the University. In addition scores in verbal and quantitative ability on the Graduate Record Examination and/or scores on the Miller Analogies Test must be submitted.

PLEASE NOTE: The School of Home Economics is undergoing reorganization and major fields of concentration may be found in other Schools or Colleges within the University. Please consult the subject matter area for the program in which you are interested. Courses available in these areas are listed below. These are undergoing revision.
Emphasis may be selected from among Home Economics Education; Human Development (see *Education* section); and Textiles, Clothing and Environmental Arts (see *Art* section). If the general baccalaureate degree is not in Home Economics, adequate concentration and studies basic to the area of emphasis must be made prior to admission. More specifically, the following prescribed academic backgrounds are suggested: Home Economics Education—substance in the social sciences; Human Development—strength in the biological and social sciences; Textiles, Clothing and Environmental Arts—background in the social sciences.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Home Economics Education (HEEd.)

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN HOME ECONOMICS EDUCATION.
Credit, 3-6. Miss Vaznaian.

710. SEMINAR.
Readings, reports and discussions on the current literature in the area of Home Economics Education.
Credit, 1-3; maximum credit, 6. Miss Vaznaian.

800. MASTER'S THESIS.
Individual research. *Credit, 6-10.* Miss Vaznaian.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

681. ADULT EDUCATION IN HOME ECONOMICS.
Organization of material, and selection, use, and evaluation of teaching techniques suited to group work with adolescents and adults. Credit toward meeting state standards for teachers and A.D.A. requirements.
Prerequisite, minimum of 6 credits in major area.

682. CURRICULUM AND METHODS IN HOME ECONOMICS.
Organization, scope, and sequence of learning experiences in home economics education. Philosophy and content of curriculum, development of resource units, and methods of teaching.
Prerequisites, Psych 601, 563, and Educ 251. *Credit, 4.*

Human Development (Hum Dev)

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN HUMAN DEVELOPMENT. *Credit, 3-6.*

710. SEMINAR.
Readings, reports and discussions on the current literature in the area of Human Development. *Credit, 1-3.*

800. MASTER'S THESIS.
Individual research. *Credit, 6-10.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

570. CHILD DEVELOPMENT.
The child from the developmental point of view. Emphasis on interaction of heredity and environment on development.
Prerequisites, Soc 101, Psych 101, or permission of instructor.

572. DIRECTED LABORATORY SCHOOL OBSERVATION.
Directed experience in observation techniques with laboratory school children.
Prerequisite, HUM DEV 570 or equivalent. Mrs. Craig.

610. LANGUAGE AND COGNITIVE DEVELOPMENT.
Language and cognition from the developmental point of view. Emphasis on the relationship between language and thought and changes in that relationship in the course of cognitive growth.
Prerequisite, HUM DEV 570 or equivalent. Mr. Olim.

650. RESEARCH METHODS IN HUMAN DEVELOPMENT.
Methods and techniques for studying developmental processes at various stages of the life span, from infancy to old age.
Prerequisite, HUM DEV 570 or equivalent, or concurrently with HUM DEV 570. Mrs. Craig.

660. THEORIES OF HUMAN DEVELOPMENT.
The major theories of human development. Emphasis on psychological theories and concepts. The relevance and relationship of biological, social and anthropological concepts.
Prerequisite, HUM DEV 570 or equivalent. Miss Collard.

680. HUMAN DEVELOPMENT IN ADULTHOOD.
Human development from young adulthood through old age. A social psychological perspective of change across the adult life span.
Prerequisite, HUM DEV 270 or equivalent, or permission of instructor. Mrs. Turner.

681. LABORATORY SCHOOL MANAGEMENT.
Principles and methods of early childhood education. Includes teaching methods and curriculum planning for two- to five-year-old children.
Prerequisites, HUM DEV 570 or equivalent.

682. PHILOSOPHY AND THEORIES OF EARLY CHILDHOOD EDUCATION.
Philosophy, theories, and history of early childhood education. Field trips.
Prerequisite, HUM DEV 681 or permission of instructor.
Miss Collard.

683. STUDENT TEACHING IN THE LABORATORY SCHOOL.
Students plan, direct, and teach curriculum in the laboratory school under staff supervision.
Prerequisite, HUM DEV 570 or perimission of instructor.

684. INTERNSHIP IN A CHILD-SERVING PROFESSION.
Teaching or work with normal or exceptional children, Head-start children, or the emotionally disturbed.
Prerequisite, HUM DEV 570 or permission of instructor.

Textiles, Clothing and Environmental Arts (TCEA)

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS. *Credit, 3-6.*

710. SEMINAR.
Readings, reports and discussions on the current literature in the area of Textiles, Clothing and Environmental Arts.
Credit, 1-3; maximum credit, 6.

800. MASTER'S THESIS.
Individual research. *Credit, 6-10.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

533. HISTORY OF DECORATIVE ARTS.
Style periods in their historic contexts with emphasis on developments in furniture and furnishings. Illustrated lectures. Study tours.
Prerequisite, TCEA 125 or permission of instructor.

565. HISTORY OF COSTUME.
Western costume from ancient civilization to the present; the relationship of clothing to the period. Study tours.
Prerequisite, TCEA 125.

629. ADVANCED INTERIOR DESIGN.
Advanced color theory; scale drawing, perspective drawings and renderings; investigation of sources and resources for interior designers and work problems in domestic and commercial interiors. Study tours.
One class hour, four studio hours.
Prerequisite, permission of instructor. Mr. Friedmann.

642. TEXTILES.
Analysis and evaluation of recent scientific and technical developments in fibers and finishes.
Prerequisite, TCEA 240.

661. APPAREL DESIGN.
Patterns and fitting problems: development and use of master pattern in executing original designs.
One class hour, two 1-hour laboratories.
Prerequisite, TCEA 259, or permission of instructor.

Industrial Engineering and Operations Research

GRADUATE FACULTY

Richard W. Trueswell, *Professor and Head of the Department of Industrial Engineering and Operations Research*, M.E., Stevens Institute of Technology, 1952; M.S.I.E., 1958; Ph.D., Northwestern, 1964.

Robert D. Davis, *Associate Professor and Graduate Program Director*, B.S., Trinity College, 1956; Ph.D., Northwestern, 1968.

Joseph L. Balintfy, *Professor of General Business and Finance.*

William J. Duffy, *Associate Professor*, B.S., University of Michigan, 1955; M.S., 1969; Ph.D., 1971.

Richard J. Giglio, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1959; M.S., Stanford, 1964; Ph.D., 1966.

Frank C. Kaminsky, *Associate Professor*, B.S., University of Connecticut, 1961; M.S., Northwestern, 1964; Ph.D., 1965.

Klaus E. Kroner, *Associate Professor*, B.S., College of Wooster, 1949; B.S., New York University, 1957; M.S., American International College, 1962.

Stanley Lippert, *Associate Professor*, B.A., University of California, Los Angeles, 1935.

Hugh J. Miser, *Professor*, B.S., Vanderbilt, 1938; M.A., Armour Institute of Technology, 1940; Ph.D., Ohio State, 1946.

Robert F. Rikkers, *Associate Professor*, B.S., Grinnell College, 1961; M.S., Northwestern, 1964; Ph.D., 1965.

Edward J. Rising, *Professor*, B.M.E., Rensselaer Polytechnic Institute, 1950; M.M.E., Syracuse University, 1954; Ph.D., State University of Iowa, 1959.

Randall P. Sadowski, *Assistant Professor*, B.S., Ohio University, 1965; M.S., 1967; Ph.D., Purdue University, 1971.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

The graduate program in industrial engineering emphasizes the modern and analytical aspects of industrial engineering. Operations-research theory and applications are stressed, although not to the exclusion of traditional industrial engineering.

A Ph.D. in industrial engineering is offered in the major areas of operations research, manufacturing and production, and human-factors engineering. Minor areas of specialization are possible within the Department in data processing and information-handling systems and in other areas outside the Department such as computer science, business administration, engineering (all majors), statistics, economics, and mathematics. The requirements for the Ph.D. degree are essentially described in this catalog under general requirements for the Ph.D. degree.

A master's thesis is optional. If no thesis is written, a special project must be completed, bringing the minimum total number of credits required to 33 rather than 30 as under the thesis program. Industrial Engineering and Operations Research graduate students may select theoretical or applied research projects related to either the industrial-financial sector or the public sector; current projects in the public sector are concerned with health-care delivery, the environment, transportation, and community service.

The Department requires no foreign-language reading competency for the doctoral degree.

Additional information may be obtained by writing to the Head of the Department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH.
Special projects in industrial engineering and/or operations research. Scope varied to meet specific conditions.
Prerequisite as required by the problem. *Credit, 1-6.*

701. INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH.
A series of seminars on current, or recent, research conducted by faculty, graduate students, and/or invited lecturers. Required course for all Industrial Engineering and Operations Research graduate students regardless of background.
Credit, 1.

720. LINEAR PROGRAMMING.
Theory and application of linear programming. Includes formulation of linear programming models, simplex, revised simplex and dual simplex algorithms, duality, parametric procedures, interpretation of results, and the decomposition principle.
Prerequisite, permission of instructor.
Mr. Davis, Mr. Giglio, Mr. Rikkers.

722. TRANSSHIPMENT PROBLEMS AND DISCRETE PROGRAMMING.
Applications and solution techniques for transshipment and discrete programming problems; included are primal-dual algorithms for transshipment problems, primal and dual cutting plane, branch and bound, and heuristic algorithms for discrete programs.
Prerequisite, IE/OR 720 or equivalent.
Mr. Balintfy, Mr. Davis, Mr. Giglio, Mr. Rikkers.

724. NON-LINEAR AND DYNAMIC PROGRAMMING.
Theory and methods required to solve non-linear problems: Kuhn-Tucker theory, quadratic, separable and geometric programming gradient techniques, and dynamic programming. Also methods of stochastic programming are surveyed. Formulations and applications are stressed and case examples are presented.
Prerequisite, IE/OR 720.
Mr. Davis, Mr. Giglio, Mr. Rikkers.

726. OPERATIONS RESEARCH APPLICATION.
Introduction to the practice of operations research. Cases from the literature, the instructor's experience, and backgrounds of government, industry, and education. Field work on an actual case.
Prerequisites, IE/OR 680, 720 (concurrent), or permission of instructor. Mr. Giglio, Mr. Miser.

728. RECENT DEVELOPMENTS IN MATHEMATICAL PROGRAMMING.
In-depth study of the theory and/or application of recent developments in mathematical programming.
Prerequisites, IE/OR 722 and 724.
Mr. Davis, Mr. Giglio, Mr. Rikkers.

751. DESIGN FOR PRODUCTION.
The analysis of the factors and techniques, theoretical and practical, involved in the effective design of production systems.
Prerequisite, basic knowledge of statistics and operations research. Mr. Sadowski.

752. MECHANIZATION AND AUTOMATION.
Investigation and analysis of the planning and control problems associated with the mechanization and automation of production systems.
Prerequisite, basic knowledge of the area. Mr. Sadowski.

753. METHODS OF MEASUREMENT OF HUMAN WORK.
Analysis of physiological and/or psychological aspects of work situations. Learning, skilled performance, decision processes.
3 class hours, lectures and projects.
Prerequisite, permission of instructor.
Mr. Duffy, Mr. Lippert.

754. ADVANCED TOPICS IN ENGINEERING ECONOMY.
An integrated treatment of elements of engineering economy, economics, accounting, finance and operations research to provide a unified background for economics decision-making.
Prerequisites, background in economics, engineering mathematics, and elementary probability theory. Mr. Giglio.

755. QUALITY CONTROL AND RELIABILITY ENGINEERING.
Current methods and techniques in quality control and reliability will be developed and discussed with emphasis being placed on the application of these principles.
Prerequisite, IE/OR 572. Mr. Rising, Mr. Sadowski.

756. ADVANCED TOPICS IN DATA PROCESSING.
Probability theory and information theory, components and operation of analog and digital computers, the analysis of large-scale data-processing systems as applied to the functioning of organizational control systems.
Prerequisite, IE/OR 556. Mr. Trueswell.

757. HUMAN FACTORS DESIGN ENGINEERING.
The design of engineering systems, machines, consumer goods, etc. which accommodate the characteristics of the human users, operators and maintainers. Methods are developed for obtaining data about human performance, preferences, tolerances, and group behavior needed in engineering design problems. The case method is used with comprehensive readings in the literature. Student projects relating to human factors in design are encouraged.
Prerequisite, permission of instructor.
Mr. Duffy, Mr. Lippert.

758. DESIGN OF CLOSELY-CONFINED MANNED-OPERATIONS STATIONS (OE 781).
Introductory anatomy and physiology; respiration, effects of various air composition and pressures on efficiency, console design, anthropometry, work place layout; design of controls, psychological and physiological effects of work in confined spaces; system design and allocation of function.
Three class hours, one 2-hour laboratory per week.
Prerequisite, IE/OR 757 or permission of instructor.
Credit, 4. Mr. Duffy, Mr. Lippert.

761. DATA PROCESSING SYSTEMS ANALYSIS AND DESIGN.
Analysis and design of small, medium, and large-scale electronic data processing systems. Real-time systems applications currently in use and proposed in the data-processing areas as opposed to the scientific areas. Electronic data processing systems and their effect on industrial and other organizations.
Mr. Anderson, Mr. Trueswell.

762. COMPUTER METHOD FOR OPERATIONS RESEARCH/MANAGEMENT SCIENCE APPLICATIONS.
The development of computer systems to process data and implement algorithms in the operations research/management science literature. A project-oriented course; both technical and user-oriented manuals will be prepared for each project.
Prerequisites, IE/OR 722 or IE/OR 724 (concurrrent) and facility with a scientific programming language such as FORTRAN IV. Mr. Kaminsky, Mr. Rikkers.

763. INFORMATION SCIENCE AND TECHNOLOGY.
The information searching tools and techniques available to scientific and industrial organizations. Individual and group behavior in using these techniques. Critical analyses of information searching and retrieval systems, both manual and automated. Mr. Trueswell.

777. MANUFACTURING CONTROL.
A quantitative and qualitative analysis of decision-making techniques in manufacturing and production control. Techniques in areas such as scheduling, queuing, inventory control, and process control are studied, extended, and evaluated.
Prerequisites, basic knowledge of statistics, principles of operations research, and an elementary course in the field.
Mr. Rising, Mr. Sadowski.

783. SIMULATION AND MONTE CARLO TECHNIQUE.
Theory and application of simulation to problems of interest to the Industrial Engineer. Students are expected to design, develop, test, and evaluate several different types of complex simulation models.
Prerequisites, IE/OR 572, 573. Mr. Sadowski and Staff.

784. STOCHASTIC PROCESSES IN INDUSTRIAL ENGINEERING I.
Application and theory of stochastic processes with primary emphasis on Markovian processes. Applications in inventory control, maintenance, and queuing theory.
Prerequisite, IE/OR 571. Mr. Kaminsky, Mr. Rikkers.

785. STOCHASTIC PROCESSES IN INDUSTRIAL ENGINEERING II.
Continuation of IE/OR 784; the study of Markov processes. Included are non-Markovian processes, regenerative stochastic processes, and imbedded Markov processes. Both theory and applications.
Prerequisite, IE/OR 784. Mr. Kaminsky, Mr. Rikkers.

786. DECISION ANALYSIS.
Decision problems involving the choice between alternatives when uncertainty is present. Emphasis on the practical applications of this method, rather than on the more abstract theory. Topics include the structure of a Decision Analysis problem, the assignment of necessary probabilities, and the assessment of the decision-maker's value structure.

791. SEMINAR IN OPERATIONS RESEARCH.
Current applications, research activities, and research problems in operations research. Advanced master's and Ph.D. students only. Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Miser, Mr. Rikkers.

792. SEMINAR IN MANUFACTURING AND PRODUCTION.
Current application, research activities, and research problems in manufacturing and production. Advanced master's and Ph.D. students only. Mr. Rising, Mr. Sadowski.

793. SEMINAR IN DATA-PROCESSING AND INFORMATION-HANDLING SYSTEMS.
Current applications, research activities, and research problems in information-handling and data-processing systems. Advanced master's and Ph.D. students only. Mr. Trueswell.

800. MASTER'S THESIS. *Credit, 3-6.*

900. DOCTORAL DISSERTATION. *Maximum credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

553. METHODS AND STANDARDS ENGINEERING.
The principles involved in the simplification of the work pattern and the design of the work place, and in the establishment of production standards.
Three class hours, one 3-hour laboratory period.
Prerequisite, IE/OR 271, previously or concurrently.
Credit, 4. Mr. Duffy, Mr. Kroner, Mr. Lippert.

556. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.
Principles and applications of data-processing and electronic computer systems for use by industrial engineers as a management tool for control and decision making.
Prerequisite, permission of instructor. Mr. Trueswell.

641. HOSPITAL INDUSTRIAL ENGINEERING I.
Introduction to the application of industrial engineering techniques to hospital management. Emphasis on the institution of industrial engineering programs in hospitals and the choice of suitable projects. Guest lecturers. Mr. Rising.

642. HOSPITAL INDUSTRIAL ENGINEERING II.
A projects course based upon material covered in IE/OR 641. A study is first made of previous industrial engineering projects in hospitals; each student then conducts a project of his own in a local hospital.
Prerequisite, IE/OR 641. Mr. Rising.

660. SAFETY ENGINEERING.
Occupational health and safety for industrial engineers. Especial attention directed towards requirements of the Occupational Safety and Health Administration of the Federal Government. Mr. Lippert.

675. JOB EVALUATION.
The principles used to determine an evaluation of all occupations in order to establish an equitable rating between them, to establish sound wage and salary policies.
Prerequisite, IE/OR 151. *Credit,* 2. Mr. Duffy, Mr. Lippert.

676. TIME STUDY.
The principles involved in the establishment of production standards and their application in the management function of cost accounting, estimating, production control incentives, budgetary control.
Prerequisite, IE/OR 151 concurrently except for Business Administration majors. Mr. Duffy, Mr. Lippert.

677. LAYOUT AND DESIGN OF INDUSTRIAL FACILITIES.
The principles applying to plant layout, materials handling, and plant location. Modes of layout presentations illustrated by means of a student project.
Prerequisite, IE/OR 678 or permission of instructor.
Mr. Kroner, Mr. Sadowski.

682. WORK SIMPLIFICATION.
The principles involved in the simplification of means of doing work and in the application and use of these principles.
One class hour, one 3-hour laboratory period.
Prerequisites, ME 568 and IE/OR 676 concurrently.
Credit, 2. Mr. Duffy, Mr. Lippert.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in Industrial Engineering & Operations Research)

560. DESIGN OF MAN-MACHINE SYSTEMS I.
Introduction to principles of human-factors engineering. Anthropometric, physiological, and psychological data sources. Data-gathering and analysis techniques useful to designers and industrial engineers. Occupational health and safety standards.
Three class hours include lectures, demonstrations, and experiments. Project option. Mr. Duffy, Mr. Lippert.

561. DESIGN OF MAN-MACHINE SYSTEMS II.
Human factors data applications to design of equipment and industrial urban and vehicle environment. Decision processes, communication. Problems of layout in industry, hospitals, etc. Involves more complex problem applications than IE/OR 260/560.
Three class hours include lectures, demonstrations, and experiments.
Project option.
Prerequisite IE/OR 260/560 or permission of instructor.
Mr. Duffy, Mr. Lippert.

571. BASIC PROBABILITY FOR ENGINEERS.
Probability theory, including: sample spaces; discrete and continuous random variables; functions of random variables; marginal, conditional, and joint probability, density and cumulative distribution functions and movements.
Prerequisite, Math 124.
Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

572. PRINCIPLES OF ENGINEERING STATISTICS.
Statistical principles as applied to engineering problems including hypothesis testing, estimation, analysis of variance, design of experiments, sampling plans, statistical quality control.
Prerequisite, IE/OR 571. Mr. Kaminsky.

573. INTRODUCTION TO SIMULATION METHODS (also listed as GB 573).
Introduction to the principles and methods of computer simulation for the analysis and design of complex systems. Problems associated with developing valid and meaningful conclusions from simulation experimentation. Emphasis on experimental design, model validation and verification, and analysis of results.
Prerequisite, IE/OR 571 and basic knowledge of FORTRAN.
Mr. Kaczka, Mr. Rising, Mr. Balintfy, Mr. Sadowski.

653. INDUSTRIAL-ENGINEERING ECONOMICS I.
Accounting tools used by the industrial engineer for effective cost control and the economic operation of industrial enterprises. Mr. Giglio, Mr. Kroner, Mr. Sadowski.

654. INDUSTRIAL-ENGINEERING ECONOMICS II.
Intended for all technical personnel. Concepts and techniques required to make sound economic decisions. Topics include use of interest formulas, replacement theory, scheduling algorithms, lease buy decisions, taxation and depreciation, decision-making under risk, forecasting and financing of projects in both the public and private sections.
Mr. Giglio, Mr. Kroner, Mr. Sadowski.

678. PRODUCTION PLANNING AND CONTROL.
Analysis of quantitative and qualitative techniques for production planning and control with emphasis on their application to various production systems.
Prerequisites, IE/OR 572, 680.
Mr. Kroner, Mr. Rising, Mr. Sadowski.

679. OPERATIONS RESEARCH I.
Deterministic models of operations research; structure and formulation of decision models for planning and operating systems and algorithms for the solution of linear programs, network problems, integer programs, and multi-stage decision problems. Credit not allowed for students who have taken Management 253, 254.
Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

680. OPERATIONS RESEARCH II.
Stochastic operations research models including probabilistic dynamic programming models, Markov chain theory, inventory models, and queuing models. Credit not allowed for students who have taken Management 253, 254.
Prerequisites, IE/OR 679 and IE/OR 571 or an equivalent background in probability theory.
Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

Italian

(Not a degree program)

GRADUATE FACULTY

Zina Tillona, *Professor and Associate Chairman for Italian*, B.A., Hunter College, 1950; M.A., Wellesley, 1951; D.M.L., Middlebury, 1960.

Frank Fata, *Assistant Professor*, B.A., Columbia College, 1961; M.A., Johns Hopkins University, 1964; Ph.D., 1966.

Sara Sturm, *Associate Professor of Italian and French*, B.A., University of Minnesota, 1963; M.A., 1965; Ph.D., University of North Carolina, 1967.

Anthony Terrizzi, *Assistant Professor*, B.A., Rutgers University, 1961; M.A., 1968; Ph.D., 1972.

THE MASTER OF ARTS IN TEACHING DEGREE PROGRAM

The department plans to initiate an M.A.T. program in Italian in 1974-75 and is currently engaged in drafting the specific requirements for the degree, for Graduate School approval. Those interested in applying for admission to the Italian M.A.T. program are urged to write to the department directly for further information.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

409. GRADUATE READING COURSE.
For graduate students preparing for their M.A. or Ph.D. No previous knowledge of Italian required. *No credit.*

550. ITALIAN CIVILIZATION.
The historical, literary, philosophic and artistic aspects of Italian civilization, aimed at an understanding of Italian life and culture.

601 (I), 602 (II). DANTE AND THE DUECENTO.
Selections from the works of Dante and his contemporaries; intensive study of the *Divine Comedy*. Mrs. Sturm.

610. THE RENAISSANCE.
Literature of the 14th and 15th centuries; Petrarca, Boccaccio, Poliziano, Alberti, Sacchetti. Mrs. Sturm.

615. THE HIGH RENAISSANCE.
Literature of the late 15th and 16th centuries: Machiavelli, Castiglione, Ariosto, Tasso. Mr. Fata

630. ITALIAN LITERATURE OF THE 18TH CENTURY.
Significant currents and authors from Goldoni to Alfieri.

635. NEO-CLASSICISM AND ROMANTICISM.
The works of Foscolo, Leopardi, and Manzoni. Mr. Fata.

640. MODERN THEATER.
Italian theater from Verga to the present. Miss Tillona.

645. MODERN POETRY.
Italian poetry from Carducci to the present with emphasis on hermetism. Miss Tillona.

650. MODERN ITALIAN NOVEL.
Development of the novel from Verga to the present.
Miss Tillona.

690. SEMINAR IN ITALIAN LITERATURE.
Italian literature for advanced students. Subject of seminar announced the preceding semester.

Labor Relations

GRADUATE FACULTY

Harvey L. Friedman, *Associate Professor of Political Science and Director of the Labor Relations and Research Center*, J.D., Boston University, 1947.

Solomon Barkin, *Professor of Economics.*

John L. Blackman, Jr., *Associate Professor of Economics.*

David R. Bloodsworth, *Assistant Director of the Labor Relations and Research Center*, M.S. in Labor Relations, Massachusetts, 1968.

Tim L. Bornstein, *Associate Professor of Law and Industrial Relations.*

Milton Brooke, *Research Coordinator of the Labor Relations and Research Center*, LL.B., Fordham Law School, 1928.

Milton Cantor, *Associate Professor of History.*

John T. Conlon, *Professor of Management.*

Hilda Golden, *Associate Professor of Sociology.*

Bruce G. Laurie, *Assistant Professor of History.*

Richard Louttit, *Professor of Psychology.*

Richard W. Trueswell, *Professor of Industrial Engineering.*

THE MASTER OF SCIENCE IN LABOR RELATIONS DEGREE PROGRAM

Students admitted to the Master of Science in Labor Relations degree program must meet the admission requirements of the Graduate School. An undergraduate major in a social science or in business administration is a normal prerequisite to admission. Applicants for admission should ordinarily have completed introductory college courses in principles of economics, labor economics or labor problems, statistics, and sociology or psychology. Students may be admitted who are deficient in one or more of these courses, but such students will be required to remove any deficiencies without credit toward the M.S. degree. College-level courses that would be helpful, although not required, include industrial relations, government, and industrial engineering. A feature of the program requires all students to serve a summer internship between their first and second year and an assignment in field work with unions, government agencies, etc.

Students will be required to take the following courses in order to qualify for this degree:

BA 751. Organizational Behavior.
Econ 744. Labor Statistics.
History 636. History of the American Labor Movement.
Econ 743. Wage Theory and Wage Relationships.
Econ 741. Collective Bargaining.
Econ 747. Manpower Development.
Labor Rel 710. Seminar in Labor Relations.
Labor Rel 705. Practicum in Labor Research.

One graduate course in the 500, 600, or 700 series in psychology; sociology and/or industrial engineering, approved by the Director. In addition, students will be required to choose five electives, at least one of which must be selected from Labor Rel 764, Econ 742, 745, 641, 746, SBA 760 & 762.

Required Courses marked with °.

Labor Relations and Research Center Course Offerings

700. SPECIAL PROBLEMS. *Credit, 1-6.*

°705. PRACTICUM IN LABOR RESEARCH I AND II.
A series of mini-courses in practical areas of labor relations based upon periodic seminars on methodology. On-going research projects of the Center are used for experience, as well as areas of particular concern to the students.
Credit, 6. Mr. Brooke.

°710. SEMINAR IN LABOR RELATIONS.
Current critical issues in the labor field, such as nature of work, "unemployment pockets," racial integration in unions. Based upon historical perspective, selected research and field work. A paper is required. Taken in second year.
Mr. Friedman.

764. THE GOVERNMENT OF UNIONS.
The organization and structure of unions, management of union activity, and policies and practices of unions, including administration, contract negotiation, union organization and grievance handling. Mr. Friedman.

777. LABOR RELATIONS IN THE PUBLIC SECTOR.
Labor relations for employees of federal, state, and local government including but not limited to educational employees, professionals, and people planning to work for various levels of government. Special attention to statutory requirements. Mr. Friedman.

School of Business Administration Course Offerings

MANAGEMENT 534. WAGE AND SALARY ADMINISTRATION.

MANAGEMENT 644. MANAGEMENT AND UNION RELATIONS I.

MANAGEMENT 645. MANAGEMENT AND UNION RELATIONS II.

°751. ORGANIZATIONAL BEHAVIOR.

761. SEMINAR IN PERSONNEL MANAGEMENT.

762. MANAGEMENT OF INDUSTRIAL RELATIONS.

763. SEMINAR IN INDUSTRIAL RELATIONS.

803. MANAGEMENT SYSTEMS.

892. LEGAL ASPECTS OF INDUSTRIAL AND LABOR RELATIONS.

Department of Economics Course Offerings

542. LABOR LAW AND LEGISLATION.

638. ECONOMICS OF HEALTH.

641. ECONOMIC SECURITY.

645. HUMAN RESOURCE ECONOMICS.

647. ECONOMICS OF THE LABOR MARKET.

°741. COLLECTIVE BARGAINING.

°743. WAGE THEORY AND WAGE RELATIONSHIPS.

745. LABOR DISPUTE SETTLEMENT.

746. COMPARATIVE LABOR MOVEMENTS.

°747. MANPOWER DEVELOPMENT.

Department of Psychology Course Offerings

580. SOCIAL PSYCHOLOGY.

Department of Sociology Course Offerings

551. URBAN SOCIOLOGY.

556. RACE RELATIONS.

575. SOCIAL PROBLEMS.

592. INTRODUCTION TO SOCIAL WELFARE.

718. INDUSTRIAL SOCIOLOGY.

731. SOCIAL GERONTOLOGY.

759. SOCIAL STRATIFICATION.

785. COMPLEX ORGANIZATIONS.

Department of Political Science Course Offerings

517. MASSACHUSETTS POLITICS.

523. PUBLIC ADMINISTRATION.

560. CONSTITUTIONAL LAW.

561. CIVIL LIBERTIES.

605. THE LEGISLATIVE PROCESS.

614. METROPOLITAN POLITICS.

624. ADMINISTRATIVE LAW.

627. COMPARATIVE PUBLIC POLICY.

Department of History Course Offerings

624. THE PROGRESSIVE AGE (1900-1920).

625. THE UNITED STATES BETWEEN THE WORLD WARS.

630. SOCIAL HISTORY OF THE UNITED STATES.

*636. HISTORY OF THE AMERICAN LABOR MOVEMENT.

637. THE CITY IN THE MODERN UNITED STATES.

Department of Industrial Engineering and Operations Research Course Offerings

752. MECHANIZATION AND AUTOMATION.

753. METHODS OF MEASUREMENT OF HUMAN WORK.

Landscape Architecture and Regional Planning

GRADUATE FACULTY

Paul N. Procopio, *Professor of Landscape Architecture and Acting Head of the Department of Landscape Architecture and Regional Planning*, B.S., Massachusetts, 1941; M.S., 1954.

Julius Gy Fabos, *Associate Professor of Landscape Architecture and Graduate Program Director*, B.S., Rutgers, 1961; M.L.A., Harvard, 1964; Ph.D., University of Michigan, 1973.

Theodore S. Bacon, Jr., *Professor of Planning*, B.A., Amherst, 1942; M.C.P., Massachusetts Institute of Technology, 1956.

Morton B. Braun, *Lecturer in Regional Planning* B.A., Harvard, 1941; M.G.R., Massachusetts Institute of Technology, 1948.

Robert O. Brush, *Lecturer, North Eastern Forestry Research Unit.*

Carl A. Carlozzi, *Associate Professor of Resource Planning*, Department of Forestry and Wildlife Management.

Richard J. Costley, *Professor of Landscape Architecture*, B.S., Utah State, 1934; M.S., Illinois, 1936.

Hugh C. Davis, *Associate Professor of Resource Planning*, B.S., Rollins College, 1950; M.S., University of Michigan, 1955; Ph.D., 1960.

Nicholas T. Dines, *Assistant Professor of Landscape Architecture*, B.S., Michigan State, 1966; M.L.A., Harvard, 1968.

John H. Foster, *Professor of Agricultural Economics*, Department of Food and Agricultural Economics.

Ethan Gluck, *Assistant Professor of Landscape Architecture*, A.B., Brandeis, 1965; A.M., Harvard, 1968.

Barrie Greenbie, *Associate Professor of Regional Planning*, B.S., Florida, 1953; M.S., Wisconsin, 1968; Ph.D., 1972.

Tom S. Hamilton, Jr., *Associate Professor of Landscape Architecture*, B.F.A., Illinois, 1950; M.S., Massachusetts, 1952.

Benjamin Isgur, *Adjunct Professor of Resource Planning*, B.S., Massachusetts, 1933; M.S., 1935; Ph.D., 1940.

Robert L. Kent, Jr., *Associate Professor of Landscape Architecture*, B.S. Michigan State, 1957; M.L.A., 1959.

Gordon S. King, *Professor of Arboriculture and Park Administration*, B.S., Michigan State, 1941; M.S., Massachusetts, 1956.

John H. Martin, *Assistant Professor of Architecture*, A.R.I.B.A., Brighton College of Art, 1956; Certificate, University College, London, 1960; M.L.A., Harvard, 1967.

Harold E. Mosher, *Professor of Landscape Architecture*, B.S., 1942; B.L.A., 1947; M.L.A., Massachusetts, 1957.

Rutherford H. Platt, *Assistant Professor of Geography in Planning Law*, Department of Geology.

Andrew J. W. Scheffey, *Professor of Regional Planning*, B.A., Haverford, 1951; M.S., Michigan, 1952; Ph.D., 1958.

Harry E. Schwarz, *Lecturer in Regional Planning*, B.C.E., George Washington, 1954.

David W. Sears, *Assistant Professor of Regional Planning*, B.S., Cornell, 1964; M.P.A., 1966; Ph.D., 1971.

Paul W. Shuldiner, *Professor of Civil Engineering.* Department of Civil Engineering.

Ervin H. Zube, *Professor of Landscape Architecture*, B.S., Wisconsin, 1954; M.L.A., Harvard, 1959; F.A.A.R., American Academy in Rome, 1961; Ph.D., Clark University, 1973.

THE MASTER OF LANDSCAPE ARCHITECTURE DEGREE PROGRAM (Project & Site-Planning Option)

This option provides the student with technical competence in the execution of traditional responsibilities of the profession: the design of outdoor spaces for social interaction. Emphasis is on understanding of both social and natural systems and the manifestations of their interrelationships in physical forms. Studio work emphasizes real issues of contemporary man and his society. Graduates of this program receive the M.L.A. degree.

This is the oldest and most firmly established of the graduate offerings; eight graduate courses are offered which relate primarily to this option: L.A. 701, 702, 706, 707, 708, 631, 737, R.P. 700C.

THE MASTER OF REGIONAL PLANNING DEGREE PROGRAM (Public Policy Option)

In the public policy planning option, the political, economic and social aspects of the regional environ-

ment are integrated with the physical/landscape planning aspects. The purpose of this option is to develop understanding of the political and administrative framework within which regional planning is carried out and plans implemented. While geared heavily to the social and institutional areas, it attempts to relate these to ecological constraints and design criteria which are expected to weigh increasingly in regional-planning decisions affecting the landscape. This option offers an M.R.P. degree.

This option was started four years ago. At that time the department offered a number of general planning courses. During the past four years the department has developed four courses in the areas of resource policy and in open space/resources law. Furthermore, this option provides opportunities for both course work and research in quantitative approaches to planning problems.

MASTER OF LANDSCAPE ARCHITECTURE OR MASTER OF REGIONAL PLANNING DEGREE PROGRAM (Landscape-Planning Option)

This option emphasizes the physical and ecological aspects of regional landscape planning, with particular emphasis on in-depth knowledge of natural processes and their relationship to planning and design solutions. Its objective is to produce planners capable of integrating physical and institutional aspects of the regional landscape into the planning process. Students in this option may work toward either an M.L.A. or an M.R.P. degree, but it will not prepare M.L.A. students for all segments of the state registration and licensing examinations.

This option has evolved over the past seven years. The origin of the landscape planning option can be traced back to the activities of several members of the department in both planning and research projects related to landscape assessment. Through these efforts, members of the option have developed qualitative and quantitative landscape assessment techniques and are now planning courses in this area.

M.L.A. AND M.R.P. DEGREE REQUIREMENTS

The Master's degree program offers latitude to the student with regard to the selection of courses. Rigid degree requirements are not stated insofar as formal course work is concerned. It is required that all students meet with their academic advisers prior to the start of classes to determine a suitable program. However, the degree is conferred only upon those graduate students who have satisfactorily met the following basic requirements:

1. work covering at least four semesters in residence,
2. a minimum of three months spent in professional practice or research,
3. the earning of not fewer than 46 credits, of which 28 will consist of graduate level courses given within the Department of Landscape Architecture and Regional Planning, and
4. the preparation of a satisfactory thesis or terminal project and satisfactory completion of an oral examination on the same.

PREREQUISITES FOR THE PROJECT SITE PLANNING OPTION

Students lacking a background in landscape architecture or design should plan on spending up to one additional year taking some or all of the following courses:

Env Des 235, 236. Plant Materials.
Env Des 543, 544. History and Theory.
Env Des 647, 648. Theory.
Env Des 615. Graphic Communication II.
Env Des 628. Applied Design.
Env Des 653. Land Form.
Env Des 656. Construction Materials.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

Landscape Architecture

700. SPECIAL PROBLEMS.
Topics may include: the designed environment, landscape assessment, topographical mapping, architectural design.
Credit, 1-5.

701. DESIGN PROBLEMS I.
Emphasis on the development of skills in site design. Deals with smaller-scale site-development problems, site analysis, program development, design process, and alternative methods of communication. Individual and team projects.
Prerequisite, Env Des 235, 236, & 615.
Credit, 1-5. Mr. Dines, Mr. Gluck.

702. DESIGN PROBLEMS II.
Essentially a problem-solving course, drawing upon techniques from landscape design, physical planning, and architectural design. Problems of varying scale and complexity. Current real world problems emphasized.
Prerequisite, Env Des 615. *Credit, 5.* Mr. Dines, Mr. Gluck.

703. ECOLOGY AND PHYSIOGRAPHY.
Visual evaluation of plant associations as related to land form and environmental conditions. Field studies. Mr. Mosher.

706. PRESENTATION.
Advanced visual communications techniques applicable to landscape architecture.

707. CONSTRUCTION.
Problems in landscape construction as related to general design.
Mr. Dines.

708. CONSTRUCTION.
Road alignment, computations, and advanced landscape construction. Mr. Dines.

713, 714. SEMINAR.
Professional topics in landscape architecture.
Credit, 2 each semester.

731. ADVANCED DESIGN PROJECTS.
Advanced design projects. *Credit, 5.* Mr. Martin.

737. PROFESSIONAL PRACTICE.
Professional office-management and procedures: ethics, commissions, contracts, responsibilities, specifications, and cost estimating. Mr. Kent.

793, 794. SEMINAR.
Topics in environmental planning and design research and theory. *Credit, 2 each semester.*

800. MASTER'S THESIS. *Credit, 8.*

801. TERMINAL PROJECT. *Credit, 8.*

Regional Planning

700. SPECIAL PROBLEMS.
Topics may include: land use planning law, recreation landscape, perception and response, transportation planning, new town design, advanced planning law. *Credit, 1-5.*

741. WATER RESOURCES PLANNING.
Water resources planning as part of environmental planning,

the state of the art from technical and institutional viewpoints, the steps and components of the water resources planning process. Mr. Schwarz.

743. LAND AND THE DEVELOPMENT OF COMMUNITIES.
Land and its use from ancient to modern times. Emphasis on the resource base and its importance as the intensity of land-use increases in the development of both rural communities and highly urbanized areas. Mr. Bacon.

744. METROPOLITAN AND REGIONAL PLANNING.
The growth and decentralization of cities and the formation of metropolitan areas. Planning as applied to the metropolitan complex and for various types of regions. Mr. Bacon.

751. PLANNING IN THE POLITICAL ENVIRONMENT.
Planning as a decision-making process, the attributes of the political and administrative environment within which planning takes place, and the implications of this environment for the planning process and the planner. Mr. Sears.

753. RESOURCE POLICY AND THE PLANNING PROCESS.
National resource policy formation and the planning process at the local, state, and regional levels. Mr. Scheffey.

758. ENVIRONMENTAL ADMINISTRATION.
Alternative administrative arrangements for dealing with problems of environmental management and control at various levels of government. Mr. Scheffey.

775. PROJECTS IN PLANNING I.
Development of elementary planning and design methods, application in the planning of projects.

776. PROJECTS IN PLANNING II.
Development of advanced-level planning and design methods, application in the planning of projects.
Prerequisite, Reg Pl 775.

781. REGIONAL PLANNING STUDIO.
Preparation of regional-development plans based upon an interdisciplinary approach to the analysis and evaluation of regional problems and potentials, *Credit, 5.*
Mr. Fabos, Mr. Carlozzi, Mr. Foster, Mr. Sears.

788. URBAN AND REGIONAL SIMULATION AND GAMING.
Purposes and characteristics of models, simulations, and games. Brief examination of several recent urban and regional planning models, in-depth examination of two or three. The model-building process. Mr. Sears.

795 (I), 796 (II). SEMINAR
Topics in regional planning. In alternate years (S. 1974) 796 is devoted to New Town Policy Issues.
Credit, 2 each semester.

800. MASTER'S THESIS. *Credit, 8.*

801. TERMINAL PROJECT. *Credit, 3.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

Environmental Design

543. HISTORY AND THEORY I.
A broad survey of the history of the designed human environment, from the origins of human society into the Renaissance. Mr. Martin.

544. HISTORY AND THEORY II.
A broad survey of the history of the designed human environment, from the Renaissance to the present. Mr. Fabos.

605. DYNAMICS OF HUMAN HABITATIONS.
The complex interactions between man and the physical environment. Borrows information and viewpoints from psychology, sociology, biology, ecology, ethology, art, architecture, and planning in an attempt to locate and demonstrate fundamental organizing principles in the human perception and use of space and their effect on interpersonal relations. Mr. Greenbie.

615. GRAPHIC COMMUNICATION II.
Current techniques used in the graphic communication of the analysis and solution of environmental-design problems, and the development of facility in the use of various media.
Prerequisite, Env Des 212.
Credit, 4. Mr. Dines.

628. APPLIED DESIGN.
The development of an approach embodying the application of theory and design principles to the solution of environmental design problems.
Prerequisites, 615 and 647.
Credit, 4. Mr. Dines, Mr. Kent.

647. THEORY I.
Basic physical and ecological principles to be considered in design and planning. Mr. Procopio.

648. THEORY II.
Basic economic, social, and political principles to be considered in design and planning. Mr. Dines, Mr. Gluck.

Landscape Architecture

653. LAND FORM.
The manipulation of land surfaces and its graphic representation through topographical plans, cross sections, profiles, and models.
Prerequisite, Env Des 212. *Credit, 2.* Mr. Procopio.

656. CONSTRUCTION MATERIALS.
Materials used in landscape construction, their design potential and limitations.
Prerequisite, Ld Arc 653. Mr. Kent.

668. OPEN-SPACE PLANNING AND DESIGN.
The relationship of open-space planning to city and regional planning; the various functions of open space; the problems of planning and designing parks and recreation areas to satisfy varying needs. Mr. Greenbie.

Regional Planning

545. METROPOLITAN TRANSPORTATION.
(See Business Administration 545.)

573. CITY-PLANNING HISTORY.
The historical aspects of changing land uses, the evolution of community form, and the development of urban areas. Mr. Bacon.

574. CITY PLANNING.
Planning techniques and legal tools for guidance and control of contemporary urban and metropolitan development. Special consideration of problems of land use, housing, transportation, and related urban elements. Mr. Bacon.

602. ECOLOGICAL PRINCIPLES OF RESOURCE PLANNING.
(See Forestry 602.)
Prerequisite, permission of instructor. Mr. Carlozzi.

677. URBAN PROBLEMS I.
Urban issues in the context of metropolitan and regional implications, changing functions and relationships of central cities and suburbs, housing, zoning, urban blight, employment, and industrial location, formulation of planning goals. Mr. Braun.

678. URBAN PROBLEMS II.
Arterial systems, fiscal problems and capital problems, grant programs, local administrative organization, metropolitan and regional organization. Mr. Braun.

Linguistics

GRADUATE FACULTY

Samuel Jay Keyser, *Professor and Head of the Department of Linguistics,* B.A., George Washington University, 1956; B.A., Honors, Oxford University (Merton), 1958; M.A., Yale University, 1960; Ph.D., 1962.

Barbara Hall Partee, *Associate Professor, Graduate Program Director, and Associate Professor of Philosophy,* B.A., Swarthmore College, 1961; Ph.D., Massachusetts Institute of Technology, 1965.

Adrian Akmajian, *Assistant Professor,* B.A., University of Arizona, 1966; Ph.D., Massachusetts Institute of Technology, 1970.

Emmon Werner Bach, *Visiting Professor,* B.A., University of Chicago, 1949; M.A., 1955; Ph.D., 1959.

Joan Bresnan, *Assistant Professor,* B.A., Reed College, 1966; Ph.D., Massachusetts Institute of Technology, 1972.

James E. Cathey, *Assistant Professor of German.*

Richard A. Demers, *Assistant Professor,* B.A., Oregon State University, 1963; M.A., University of Washington, 1965; Ph.D., 1968.

Donald C. Freeman, *Professor and Associate Dean of the Faculty of Humanities and Fine Arts,* B.A., Middlebury College, 1959; M.A., Brown University, 1961; Ph.D., University of Connecticut, 1965.

Frank W. Heny, *Assistant Professor,* B.A., University of Leeds, 1957; P.C.E., University College of Rhodesia, 1965; Ph.D., University of California, Los Angeles, 1970.

Terence Parsons, *Associate Professor of Philosophy*

Thomas Roeper, *Assistant Professor,* B.A., Reed College, 1965; Ph.D., Harvard University, 1973.

Robert Rothstein, *Associate Professor of Slavic Languages and Literatures.*

Elisabeth O. Selkirk, *Assistant Professor,* B.A., University of California, Berkeley, 1967; Ph.D., Massachusetts Institute of Technology, 1972.

The Department of Linguistics offers graduate work leading to the Ph.D. degree; a number of students are also admitted for work leading to the M.A. degree. Students may concentrate their graduate work in any of the following standard areas: syntax, semantics, phonology, diachronic linguistics, formal foundations of linguistic theory, particular languages or language families, and prosody, metrics, and stylistics. It is expected that psycholinguistics and sociolinguistics will also form an integral part of the Department's offerings. The Department of Linguistics is responsible for the University's course offering in English as a Foreign Language. Graduate training in the Department of Linguistics is strongly oriented toward preparing students to carry on individual creative research as early as possible in their graduate careers, and the Graduate Program is set up so as to maximize close student-faculty contact. The requirements for the M.A. and Ph.D. degrees listed below are subject to periodic review, and students are therefore advised to consult with the Department to check for any changes in requirements.

THE MASTER OF ARTS DEGREE PROGRAM

Prerequisites for admission: A B.A. or B.S. degree in nearly any field of undergraduate study. The following undergraduate fields form a useful background to linguistics: anthropology, computer science, English, a foreign language or language family, logic, mathematics, philosophy, psychology, and sociology. A student may be required to make up deficiencies in undergraduate training before being admitted to regular status.

Program of study: Thirty credit hours of graduate work, in which the following courses would normally be included: Linguistics 701, Linguistics 702, Linguistics 502, and other core courses. Certain courses may be waived on the basis of previous work.

Examination and Thesis: A thesis is not required to complete the M.A. M.A. examinations will cover significant areas of graduate work in linguistics.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Prerequisites for Admission: A B.A., B.S., or M.A. degree.

Program of Study: Forty-eight credits of graduate work, at least half of which consist of 700-level linguistics courses.

Language requirement: There is no formal language requirement in the Ph.D. program. (However, students are generally expected to be able to read relevant journal articles in a foreign language.) Students are also strongly encouraged to carry out linguistic research on a foreign language as part of their graduate work.

Examinations: Ph.D. candidates must satisfy the general examination requirement by submitting two linguistic papers, embodying the student's original research, in two distinct areas of the discipline. A final oral examination is held after the doctoral dissertation is submitted.

Dissertation: A dissertation is required.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.
Selected research problems in Linguistics. *Credit, 1-12.*

701. INTENSIVE INTRODUCTION TO TRANSFORMATIONAL GRAMMAR.
An intensive introduction to the concepts of transformational grammar. Survey in depth of problems and methods of research, with emphasis on different types of linguistic evidence and argument. *Credit, 6.*

702. INTRODUCTION TO THE STUDY OF AN UNFAMILIAR LANGUAGE.
Investigation, with the aid of an informant, of the structure of an unfamiliar language and of specific analytical problems it presents. The relevance of these to universal grammar.
Prerequisites: Ling 701. Mr. Demers, Mr. Heny

703. GENERATIVE PHONOLOGY.
Introduction to generative phonology primarily for graduate students in linguistics. The formalism is developed and justified in response to increasingly complex sets of data.
Prerequisites: Ling 701, 514.
Mr. Demers, Mr. Heny, Mr. Keyser.

704. SYNTACTIC THEORY.
Advanced survey of problems in the syntax of natural language encountered in attempting to characterize formally the notion of "grammar of a natural language."
Prerequisite, Ling 701.
Mr. Akmajian, Ms. Bresnan, Ms. Partee.

705. DIACHRONIC LINGUISTICS.
Topics from traditional historical linguistics from the standpoint of transformational generative grammar: language change, relative chronology of sound changes, comparative method, internal reconstruction, and linguistic universals.
Prerequisite: Ling 701. Mr. Demers, Mr. Keyser.

706. PHONOLOGICAL THEORY.
The investigation of issues in current generative phonological theory. The student is required to construct theoretical arguments using original evidence.
Prerequisite: Ling 701, 703.
Mr. Demers, Mr. Heny, Mr. Keyser.

707. UNIVERSAL GRAMMAR.
Universal principles of natural language. Explores universal hypotheses made to date in the development of linguistic theory.
Prerequisites: Ling 701, 702.
Mr. Akmajian, Mr. Demers, Mr. Heny.

708. STRUCTURE OF ENGLISH.
An intermediate-level survey of problems in the syntax of English, designed to follow directly from Ling 701.
Prerequisite: Ling 701.

710. SEMANTICS AND GENERATIVE GRAMMAR.
A comprehensive survey of semantic problems in transformational-generative linguistics. Feature theory, generative semantics, performatives, interpretation of derived structures, the semantic theory of truth and the interpretation of language; the logic of human language. Mr. Heny, Ms. Partee.

711. PSYCHOLINGUISTICS: LANGUAGE ACQUISITION.
The theoretical foundations and methodology of the study of child language. The relationship between language acquisition, the study of universal grammar, and theoretical psychology. An experimental term project is customary.
Prerequisite: Ling 701. Mr. Roeper.

712. PSYCHOLINGUISTICS: THE PERCEPTION OF LINGUISTIC FORM.
An introduction to psycholinguistics concentrating on the psychological perception of linguistic form. The psychological reality of linguistic models and perceptual and learning strategies.
Prerequisite: Ling 701. Mr. Roeper.

713. LINGUISTICS AND LITERATURE.
The application of modern linguistics to literary analysis. Meter, style, and explication of text on the basis of linguistic criteria. Mr. Freeman, Mr. Keyser.

714. CONTEMPORARY PHONETICS.
Phonetics and the theory of language. Universal phonetic alphabet, acoustic phonetics, perceptual phonetics, articulatory phonetics and distinctive features.
Prerequisite, Ling 701 or permission of instructor.
Mr. Demers, Mr. Heny.

715. THEORY OF GRAMMAR.
Survey and comparison of modern theories of language. Structural linguistics, stratificational grammar, scale-and-category grammar, transformational-generative grammar. The nature of linguistic evidence.
Prerequisite, Ling 701 or permission of instructor.
Mr. Freeman, Mr. Keyser, Mr. Heny.

716. DIALECTOLOGY.
The geographical and cultural variations within a language; mapping of dialects. Analysis and interpretation of dialect materials.

726. MATHEMATICAL LINGUISTICS.
Topics relating mathematics, logic, computer science and linguistic theory. Typical topics: grammars and automata, formal models of transformational grammar; syntax-directed compilers.
Prerequisites: Ling 509 or Math 200 or COINS 201.
Ms. Partee.

740. STRUCTURE OF AN AFRICAN LANGUAGE.
741. STRUCTURE OF AN AMERICAN INDIAN LANGUAGE.
742. STRUCTURE OF AN INDO-EUROPEAN LANGUAGE.
743. STRUCTURE OF A MALAYO-POLYNESIAN LANGUAGE.
744. STRUCTURE OF A FINNO-UGRIC LANGUAGE.
745. STRUCTURE OF A NEAR EASTERN LANGUAGE.
746. STRUCTURE OF AN ORIENTAL LANGUAGE.
747. STRUCTURE OF A SOUTH EAST ASIAN LANGUAGE.
748. STRUCTURE OF A NON-INDO-EUROPEAN LANGUAGE.
The phonology and syntax of a language other than English. Emphasis on the application of current linguistic theory to analytical problems presented by that language and the testing of current theoretical hypotheses by reference to those problems. An informant will generally be used. Within each of these courses, languages vary from year to year; any of them may be repeated for credit.
Prerequisite: Ling 702, 703.

750. TOPICS IN LINGUISTIC THEORY.
Treatment in depth of a selected area of linguistic theory. Topics vary. May be repeated for credit.
Prerequisite, permission of instructor.

751. TOPICS IN PHONOLOGY.
Advanced, intensive work on specific phonological problems, or on the phonology of a single language or of a small group of languages.
Prerequisite, Ling 703, 706.

752. TOPICS IN SYNTAX.
An intensive review of current research in syntactic theory, with emphasis on individual student research in syntactic theory.
Prerequisite, Ling 704.

753. TOPICS IN SEMANTICS.
Intensive investigation of topics in semantics. Topics vary from year to year.
Prerequisite, Ling 710.

754. TOPICS IN DIACHRONIC LINGUISTICS.
An advanced seminar, mainly for those students who wish to specialize in language change. Investigation of the empirical claims made by current transformational theory in regard to language change.
Prerequisite, Ling 703, 705.

790. SEMINAR.
Current research topics and literature.

810. RESEARCH TUTORIAL: SYNTAX.
Intensive investigation of a previously unexplored topic in syntax under close faculty supervision. Topic varies from year to year.

820. RESEARCH TUTORIAL: PHONOLOGY.
Intensive investigation of a previously unexplored topic in phonology under close faculty supervision. Topic varies from year to year.

830. RESEARCH TUTORIAL: LINGUISTIC THEORY.
Intensive investigation of a previously unexplored topic in linguistic theory under close faculty supervision. Topic varies from year to year.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO UNDERGRADUATES AND GRADUATES (for either major or minor credit).

501. INTRODUCTION TO LINGUISTIC THEORY.
The nature of language; in-depth study of important aspects of the structure of the native language, from the standpoint of modern linguistic theory. Emphasis on syntactic problems; some attention to phonology, language acquisition, etc.

502. PHONOLOGICAL THEORY.
Introduction to the basic principles of phonological descriptions of natural languages: phonological rules, morpheme structure, distinctive features, phonological levels, and linguistic universals. Prerequisite: Ling 501, 701 or permission of instructor. Mr. Demers, Mr. Heny, Mr. Keyser.

503. INTRODUCTORY SYNTAX.
The methods of word and sentence formation; the notions of grammaticality and of well-formed sentences.
Prerequisite: Ling 501.
Mr. Akmajian, Ms. Bresnan, Mr. Heny, Mr. Keyser.

504. FIELD METHODS.
Methods of eliciting significant linguistic information in the field. How to work with an informant. Investigation, with the aid of the informant, of the structure of an unfamiliar language and of specific analytical problems it presents.
Mr. Demers, Mr. Heny.

514. INTRODUCTORY PHONETICS FOR LINGUISTS.
Principles of the International Phonetic Association. Phonetic script. Identifying and making unfamiliar sounds. The structure of the vocal tract. *Credit, 1.* Mr. Demers, Mr. Heny.

623. STUDY OF THE NATIVE LANGUAGE.
The relevance of linguistic theory and results of linguistics to the study of English. Issues of style, poetics, the teaching of English, and others. Mr. Freeman, Mr. Keyser.

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

410. ENGLISH FOR FOREIGN STUDENTS. *Credit, 0.*

Marine Sciences

GRADUATE FACULTY

Dayton E. Carritt, *Professor of Marine Sciences*, B.S., Rhode Island College, 1937; Ph.D., Harvard, 1948.

Charles F. Cole, *Professor of Fisheries Biology.*

Joseph M. Colonell, *Associate Professor of Civil Engineering.*

D. Craig Edwards, *Professor of Zoology.*

Alan W. Niedoroda, *Assistant Professor of Geology and Director of the Coastal Research Center.*

Edward A. Perry, *Assistant Professor of Marine Sciences*, B.A., Dartmouth, 1964; Ph.D., Case Western Reserve, 1969.

Gregory W. Webb, *Professor of Geology.*

Robert T. Wilce, *Associate Professor of Botany.*

Charles S. Yentsch, *Professor of Marine Sciences and Director of the Marine Station*, B.S., University of Louisville, 1950; M.S., Florida State University, 1953.

John W. Zahradnik, *Professor of Mechanical and Aerospace Engineering.*

The interdisciplinary program in Marine Sciences leads toward the Master of Science degree, enabling the student to go directly into marine research or to continue work for the Ph.D. degree in one of the specialty fields. The program includes a core curriculum of biological, geological, and physical oceanography and a specialty option in Geology, Botany, Zoology, Microbiology, Fisheries, or Food Science and Technology. It is conducted on the Amherst campus, the Marine Station in Gloucester, and at selected coastal sites. The primary research emphasis is presently in estuarine and coastal waters.

Students entering the Marine Science program should have completed an undergraduate degree in science or engineering, normally including at least one year each of mathematics, physics, chemistry, and biology. Any deficiencies should be remedied in the first year of residence in the program, although such work would not receive graduate credit. Exceptions may be made in individual cases. Acceptance to the program involves admission to the Graduate School of the University and admission by the Interdisciplinary Committee in the Marine Sciences. Appropriate faculty members will serve as the students' advisers and supervise the studies and research in the various specialty options.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Courses for Students in Other Programs

MARINE SCIENCE 525. INTRODUCTORY OCEANOGRAPHY.
A survey of the oceans and sea water, the substrate, marine life, and processes; oceanographic techniques. For students in engineering and others desiring a general knowledge of the sea. Interdepartmental Staff.

Core Courses

GEOLOGY 655. PHYSICAL OCEANOGRAPHY.
Physical properties of sea water and their variations; water masses and circulation; interactions between ocean and atmosphere; wave, tide and current dynamics; techniques of oceanographic study.
Prerequisite, one year of college physics; calculus recommended. Mr. Niedoroda.

GEOLOGY 752. GEOLOGICAL OCEANOGRAPHY.
Physical characteristics and geological processes of the ocean basins and margins, and their bearing on interpretation of geological history. Mr. Webb.

MARINE SCIENCE 501. BIOLOGICAL OCEANOGRAPHY.
Aspects of major planktonic and benthic marine taxa, including distribution, periodicity, and dominant ecological factors. Emphasis on shallow water organisms and habitats.
Interdepartmental Staff.

Optional Specialty Courses

MARINE SCIENCE 530. CHEMICAL OCEANOGRAPHY.
The chemical properties of the ocean that influence and are influenced by marine physical, biological, and geological systems. The nutrient cycles; the carbon dioxide system; the density, chlorinity, salinity problem; the geological history of sea water; the age of the ocean; gas solubility and gas exchange processes and problems; trace element chemistries; chemistry and man's use of the ocean.
Prerequisites, one-year college-level chemistry, physics, and mathematics. Mr. Carritt.

MARINE SCIENCE 550. MICROBIAL ECOLOGY OF MARINE ENVIRONMENT.
The ecology, function, and importance of microorganisms in the marine environment including the underlying sediments; their role in the food chain and productivity of the seas and estuaries; and the factors influencing seasonal and geographical population dynamics.
Prerequisites, general courses in biology, microbiology, and chemistry; and permission of instructor.
Credit, 2. Mr. Litsky.

MARINE SCIENCE 700. SPECIAL PROBLEMS IN OCEANOGRAPHIC TECHNIQUES. *Credit, 1-6.*

MARINE SCIENCE 710. TOPICS IN MARINE CHEMISTRY.
The present state and trends in a few segments of marine chemistry, selected by those enrolled. Reading of contemporary literature and contact with visiting scientists. Enrollment limited to ten.
Prerequisite, graduate standing in a science or engineering department, or permission of instructor. Pre-enrollment interview requested. Mr. Carritt.

(Other optional courses are listed under the headings of the several cooperating departments.)

Mathematics and Statistics

GRADUATE FACULTY

Robert J. Blattner, *Professor and Head of the Department of Mathematics and Statistics*, A.B., Harvard University, 1953; Ph.D., University of Chicago, 1957.

George H. Knightly, *Associate Professor and Graduate Program Director*, B.S., Tufts, 1956; M.S., Stanford, 1962; Ph.D., 1965.

Donald Adams, *Assistant Professor*, B.A., University of New England (Australia), 1965; Ph.D., Monash University, 1970.

Stephen I. Allen, *Associate Professor and Assistant Dean of the College of Arts and Sciences*, B.A., Amherst College, 1937; M.A., Harvard University, 1946; Ph.D., University of Pittsburgh, 1963.

Mary Katherine Bennett, *Associate Professor*, B.A., Albertus Magnus College, 1961; M.A., University of Massachusetts, 1965; Ph.D., 1966.

Joseph T. Borrego, Jr., *Associate Professor*, B.A., University of Florida, 1961; M.S., 1962; Ph.D., 1966.

Aviad M. Broshi, *Assistant Professor*, A.B., Harvard, 1965; M.S., Chicago, 1966; Ph.D., 1969.

Donald E. Catlin, *Associate Professor*, B.S., Pennsylvania State University, 1958; M.A., 1961; Ph.D., University of Florida, 1965.

Eduardo H. Cattani, *Assistant Professor*, Universidad de Beunos Aires, Licenciado en Matemáticas, 1967; Ph.D., Washington University, 1972.

Chan-Nan Chang, *Assistant Professor*, B.S., National Taiwan University, 1963; Ph.D., Notre Dame University, 1970.

Yu W. Chen, *Professor*, Ph.D., University of Goettingen, Germany, 1934.

Jack Clark, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1964; M.S., Stanford University, 1966; Ph.D., 1972.

Haskell Cohen, *Professor*, B.A., University of Omaha, 1942; S.M., University of Chicago, 1947; Ph.D., Tulane, 1952.

Edward A. Connors, *Assistant Professor*, B.A., College of the Holy Cross, 1962; M.A., University of Massachusetts, 1964; Ph.D., University of Notre Dame, 1968.

Thurlow A. Cook, *Assistant Professor*, B.A., University of Rochester, 1961; M.A., University of Buffalo, 1963; Ph.D., Florida State University, 1967.

Helen F. Cullen, *Professor*, B.A., Radcliffe, 1940; M.A., Michigan, 1944; Ph.D., 1950.

Ram C. Dahiya, *Assistant Professor*, B.A., Panjab University, 1962; M.A., University of Delhi, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1970.

David J. Dickinson, *Associate Professor*, B.A., University of Denver, 1942; M.A., Columbia, 1948; Ph.D., Michigan, 1954.

Murray Eisenberg, *Associate Professor*, B.A., University of Pennsylvania, 1960; M.A., 1962; Ph.D., Wesleyan University, 1965.

Hans R. Fischer, *Professor*, University of Zurich, Matriculation, 1952; Ph.D., 1959.

John Fogarty, *Associate Professor*, B.A., Harvard University, 1961; Ph.D., 1966.

David J. Foulis, *Professor*, B.A., University of Miami, 1952; M.S., 1953; Ph.D., Tulane, 1958.

Michael A. Gauger, *Assistant Professor*, B.S., University of Notre Dame, 1967; Ph.D., 1971.

Donald Geman, *Assistant Professor*, B.A., University of Illinois, 1965; Ph.D., Northwestern, 1970.

Alan Gleit, *Assistant Professor*, B.A., Harvard, 1965; M.S., Stanford University, 1967; Ph.D., 1969.

David R. Hayes, *Professor*, B.A., Duke, 1959; Ph.D., 1963.

James H. Hedlund, *Assistant Professor*, B.A., Cornell University, 1963; M.A., University of Michigan, 1965; Ph.D., 1968.

David A. Hoffman, *Assistant Professor*, A.B., University of Rochester, 1966; M.Sc., Stanford University, 1968; Ph.D., 1971.

Samuel S. Holland, Jr., *Professor*, B.A., Massachusetts Institute of Technology, 1950; M.S., Chicago, 1952; Ph.D., Harvard, 1961.

Joseph Horowitz, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1962; M.S., University of Michigan, 1963; Ph.D., 1967.

Norman E. Hurt, *Assistant Professor*, Ph.D., University of Chicago, 1967.

Henry G. Jacob, *Professor*, B.E., Yale, 1943; M.E., 1947; Ph.D., 1953.

Melvin Janowitz, *Professor*, B.A., University of Minnesota, 1950; Ph.D., Wayne State University, 1963.

Harry F. Joiner, *Assistant Professor*, B.A., Texas Christian University, 1965; M.S., Florida State University, 1966; Ph.D., 1968.

Ralph Jones, *Assistant Professor,* B.A., University of Missouri, 1967; M.A., 1968; Ph.D., University of Wisconsin, 1972.

Chung-siung Kao, *Assistant Professor,* B.S., National Taiwan University, 1964; M.S., Institute of Mathematics, National Tsing Hua University, 1966; Ph.D., Columbia University, 1972.

Eleanor Killam, *Assistant Professor,* B.S., New Hampshire, 1955; M.S., 1956; Ph.D., Yale, 1961.

Larry King, *Assistant Professor,* B.S., Brooklyn College, 1963; M.A., University of Maryland, 1966; Ph.D., 1968.

Hsu-Tung Ku, *Associate Professor,* B.S., Taiwan Normal University, 1961; M.S., Tulane, 1964; Ph.D., 1967.

Mei-Chin Ku, *Assistant Professor,* B.S., Taiwan Normal University, 1961; M.S., Syracuse University, 1964; Ph.D., Tulane University, 1967.

Esayas G. Kundert, *Professor,* Diploma, E.T.H., Zurich, 1945; Ph.D., 1950.

Lorraine D. Lavallee, *Awsociate Professor,* B.A., Mount Holyoke, 1953; M.A., University of Massachusetts, 1955; Ph.D., University of Michigan, 1962.

Robert A. Lew, *Assistant Professor,* B.A., Yale, 1962; M.S., University of Michigan, 1964; Ph.D., 1970.

Teng-Sun Liu, *Associate Professor,* B.S., National Taiwan University, 1954; M.A., University of Pennsylvania, 1961; Ph.D., 1963.

Ernest G. Manes, *Assistant Professor,* B.S., Harvey Mudd College, 1963; Ph.D., Wesleyan University, 1967.

Larry N. Mann, *Professor,* B.A., University of Pennsylvania, 1955; M.S., 1956; Ph.D., 1959.

Wallace S. Martindale, III, *Professor,* B.A., Amherst, 1952; M.A., University of Pennsylvania, 1954; Ph.D., 1958.

Robert A. McGuigan, Jr., *Assistant Professor,* B.A., Carleton College, 1964; Ph.D., University of Maryland, 1968.

Peter Norman, *Assistant Professor,* B.A., Harvard, 1965; Ph.D., University of Pennsylvania, 1971.

Gail B. Oakland, *Professor,* B.A., University of Saskatchewan, 1933; M.A., Minnesota, 1939; Ph.D., University of Aberdeen, 1956.

Charles H. Randall, *Associate Professor,* B.S.M.E., Polytechnic Institute of Brooklyn, 1951; M.S., University of Pittsburgh, 1957; Ph.D., Rensselaer Polytechnic Institute, 1966.

Ellen E. Reed, *Associate Professor,* B.A., Gonzaga University, 1962; M.A., University of Colorado, 1964;

Walter A. Rosenkrantz, *Associate Professor,* B.S., University of Chicago, 1958; M.S., University of Illinois, 1959; Ph.D., 1963.

Arunas Rudvalis, *Assistant Professor,* B.S., Harvey Mudd College, 1965; M.A., Dartmouth College, 1967; Ph.D., 1969.

Donald F. St. Mary, *Assistant Professor,* B.S., McNeese State College, 1962; M.A., University of Kansas, 1964; Ph.D., University of Nebraska, 1968.

Berthold Schweizer, *Professor,* B.S., Massachusetts Institute of Technology, 1951; M.S., Illinois Institute of Technology, 1954; Ph.D., 1956.

Jon L. Sicks, *Associate Professor,* B.A., Indiana University, 1961; Ph.D., 1965.

Morris Skibinsky, *Professor,* B.S., City College of New York, 1948; M.A., University of North Carolina, 1951; Ph.D., 1954.

Doris S. Stockton, *Associate Professor,* B.S., Douglass College in Rutgers University, 1945; M.S., Brown, 1947; Ph.D., 1959.

Marshall H. Stone, *Professor,* B.A., Harvard, 1922; M.A., 1924; Ph.D., 1926.

Wayman L. Strother, *Professor,* B.S., Alabama State, 1943; M.S., University of Chicago, 1949; Ph.D., Tulane, 1951.

Jin Chen Su, *Professor,* B.S., National Taiwan University, 1954; Ph.D., University of Pennsylvania, 1962.

Robert W. Wagner, *Professor,* B.A., Ohio, 1934; M.A., University of Michigan, 1935; Ph.D., 1937.

Ju-Kwei Wang, *Professor,* B.S., National Taiwan University, 1954; Ph.D., Stanford University, 1960.

Franklin A. Wattenberg, *Assistant Professor,* B.S., Wayne State University, 1964; M.S., University of Wisconsin, 1965; Ph.D., 1968.

George W. Whaples, *Professor,* B.A., Knox College, 1935; M.A., Wisconsin, 1937; Ph.D., 1939.

Joel Zinn, *Assistant Professor,* B.A., Queen's College, CUNY, 1966; M.A., University of Wisconsin, 1969; Ph.D., 1972.

The Department of Mathematics and Statistics offers programs leading to both the Master of Arts and Doctor of Philosophy degrees. These programs allow the student considerable flexibility in selecting a course of study which emphasizes a broad knowledge of mathematics and its applications as well as concentration within one or more of the areas of algebra, analysis, applied mathematics, probability and statistics, and topology. A detailed description of degree requirements may be obtained from the departmental Graduate Program Director.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Admission. Applications for admission to the Ph.D. program are screened by a departmental committee, which bases its recommendations for admission and financial aid on the applicant's undergraduate record, letters of recommendation, GRE scores, and other data. Admission is highly selective, and there is no minimal set of courses or grades that will guarantee admission. Applicants are encouraged to submit additional data on their mathematical training, such as texts used and topics covered in courses, details of any honors projects or individual reading, etc.

Course requirements. The doctoral aspirant must successfully complete 36 credits in graduate courses, including: (a) year-long courses in three of the basic areas of algebra, analysis, applied mathematics, statistics-probability, and topology, together with a semester course in each of the other two basic areas

(courses in other departments may be approved to satisfy the applied mathematics requirement); (b) a semester of complex analysis; (c) a "special" course (from among those so designated each semester) whose purpose is to pose and solve a specific, often classical, problem by developing the requisite mathematical tools, but not necessarily in their most general or finished form; (d) two semester-long "global" courses (from among those so designated each semester) whose content overlaps the boundaries between the traditional major divisions of the discipline.

Qualifying Examination. Each year a written examination will be offered in each of the areas of algebra, analysis, applied mathematics, statistics-probability and topology. To qualify for the Ph.D., the student entering with a Bachelor's (Master's) degree must pass the examination in three of these areas by the end of the third (second) year of graduate study in the department.

Preliminary Comprehensive Examination. Once the student has passed the Qualifying Examination, to be admitted to Ph.D. candidacy he or she must pass the Preliminary Comprehensive Examination. This examination, which is oral, is based on material dealing with a central theme related to the student's prospective area of concentration.

Foreign language requirement. For the Ph.D. the department requires a reading knowledge of two of the following languages: French, German, and Russian at the Graduate School's level 3—sufficient to understand mathematical or statistical journal articles in the language. The requirement in each of the two languages may be satisfied either by passing one of the written examinations offered by the department each year, or by successfully completing in the department a semester course or seminar where the foreign language of instruction or the language of the text or other primary reference material.

As a requirement for the Ph.D. degree, all students in the doctoral program are expected to gain experience in communicating their subject by participating in the instruction of students. This requirement may be satisfied by performing the duties ordinarily assigned to a Teaching Assistant or Teaching Associate, but the precise kind and extent of activities necessary to satisfy it will be determined on an individual basis for each doctoral student.

Each year a variety of advanced seminars, including joint seminars with other departments or with nearby institutions, are available for credit. Students are encouraged to attend the departmental Colloquium, which meets regularly and where visiting speakers present topics of current research.

THE MASTER'S DEGREE PROGRAM

An entering Master's candidate should normally have completed at least 18 semester credit hours in undergraduate mathematics and statistics beyond the calculus. A one-year course in linear and modern algebra and a one-year course in advanced calculus would be highly desirable.

To earn a Master's degree, a student must:

(1) Complete 30 credit hours, at least 18 of which must be in courses in the department numbered 700 or above, including one "special" course (see Ph.D. course requirement (c), above) and the first semester of the basic course in each of three of the areas of algebra, analysis, applied mathematics, statistics-probability, and topology. Any course outside the department or numbered below 700, offered to satisfy the 30-credit requirement, must have departmental approval. The student must earn an average grade of B, and no more than six credit hours with a grade less than B, in the 30 credit hours used to fulfill this requirement.

(2) Pass the Master's examination. Each year the department will offer a written examination in each of the areas of algebra, analysis, applied mathematics, statistics-probability, and topology. In order to pass the Master's examination, the student must either pass three of these examinations, or else pass the Ph.D. Qualifying Examination.

There is neither a thesis requirement nor a foreign language requirement for the Master's degree. A Master's candidate who has not completed the degree requirements by the end of his second year will ordinarily not be permitted to re-register in the department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

Mathematics Courses

700. TOPICS COURSE.
Topics may be chosen from the fields of algebra, geometry, theory of functions, topology, and applied mathematics.
Prerequisite, permission of instructor. *Credit, 1-3.*

701 (I), 702 (II). TOPICS IN ALGEBRA.
Basic topics in algebra.
Prerequisite, permission of instructor.
Credit, 1-3 each semester.

703 (I), 704 (II). TOPICS IN GEOMETRY.
Basic topics in geometry.
Prerequisite, permission of instructor.
Credit, 1-3 each semester.

705 (I), 706 (II). TOPICS IN ANALYSIS.
Basic topics in analysis.
Prerequisite, permission of instructor.
Credit, 1-3 each semester.

711. ALGEBRA I.
A review of linear algebra via the theory of modules over principal ideal rings; also Jordan decomposition, canonical forms, and spectral theorem for real and complex operators. Tensor products, symmetric and exterior algebras, determinants Cayley-Hamilton theorems, application to geometry.

712. ALGEBRA II.
Either topics from field theory, Noetherian rings, and applications, or topics from rings with chain conditions, groups, and group representations.
Prerequisite, Math 711 or equivalent.

713. INTRODUCTION TO ALGEBRAIC NUMBER THEORY.
The basic theory of valuations, rings of integral elements, and ideal theory in algebraic number fields of algebraic functions of one variable, including Dirichlet-Hasse unit theorem and Riemann-Roch theorem for curves.
Prerequisite, Math 711-712 or equivalent.

714. QUADRATIC FORMS.
Quadratic spaces, the orthogonal group, the representation and equivalence of quadratic forms over arithmetic fields, the Hasse-Minkowski theorem, the integral theory of quadratic forms over arithmetic domains, the genus and the spinor genus.
Prerequisites, Math 711-712 and 713 or equivalents.

715 (I), 716 (II). CLASS FIELD THEORY.
Local class field theory, residues in fields of algebraic functions, global class field theory, generalized local class field

theory, application to simple algebras and quadratic forms.
Prerequisite, Math 713. *Credit, 3 each semester.*

721. COMPLEX ANALYSIS.
Complex number field, elementary functions, holomorphic functions, integration, power and Laurent series, harmonic functions, conformal mappings, applications.

722. INTERMEDIATE COMPLEX ANALYSIS.
Topics from intermediate complex analysis.
Prerequisite, Math 721 or equivalent.

723. REAL ANALYSIS I.
Lebesgue measure and Lebesgue integration, differentiation, and Lp spaces.

724. REAL ANALYSIS II.
Abstract measure theory, probability, Lebesgue-Stieltjes integration, Radon-Nikodym Theorem, weak convergence of measures, central limit theorem.
Prerequisite, Math 723.

725. INTRODUCTION TO FUNCTIONAL ANALYSIS.
Banach and Hilbert spaces, continuous linear operators, spectral theory, Banach algebras.
Prerequisites, Math 723 or 705.

726. FUNCTIONAL ANALYSIS.
Topics from Banach algebras and representation theorems for Banach algebras; von Neumann algebras; analysis in Banach algebras, spectral theory; analytical theory of semigroups; vector lattices, Krein-Milman theorem.

731 (I), 732 (II). INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.
Equations in mathematical physics, types of systems, characteristic manifolds, questions of uniqueness and existence, generalized derivatives.
Prerequisite, Math 626. *Credit, 3 each semester.*

735. LATTICE THEORY I.
Partially ordered sets, lattices, modular lattices, Boolean algebras, representation theory for lattices.
Prerequisite, Math 512.

736. LATTICE THEORY II.
Continuation of Math 735. Stone's representation theorem for Boolean algebras, Loomis' representation theorem for Boolean sigma-algebras, introduction to the theory of orthomodular lattices and their coordinating Baer*-semigroups.
Prerequisite, Math 735.

745 (I), 746 (II). ADVANCED APPLIED MATHEMATICS.
Topics from engineering and mathematical physics presented rigorously and with free use of abstract mathematical concepts and modern mathematical machinery.
Prerequisite, permission of instructor.
Credit, 3 each semester.

771. TOPOLOGY I.
Compactness, local compactness, compactification, products, quotients, separation axioms, theory of retracts, connectedness, continua, path connectedness, local connectedness, fundamental group, covering spaces.

772. TOPOLOGY II.
Introduction to the topology and geometry of differentiable manifolds.
Prerequisite, Math 771.

773. ALGEBRAIC METHODS IN TOPOLOGY.
Topics from homotopy, homology, and cohomology with applications.
Prerequisite, Math 771.

781. ALGEBRAIC TOPOLOGY I.
Homotopy theory, simplicial and Cech homology theories.
Prerequisites, Math 771, 711.

782. ALGEBRAIC TOPOLOGY II.
General homology theory, universal coefficient theorems, singular homology theories, ring structure in cohomology theories, spectral sequences, Steenrod operations.
Prerequisite, Math 781.

803. ADVANCED TOPICS IN ALGEBRAIC TOPOLOGY.
Presheaves and sheaves, sheaf cohomology, Cech cohomology, applications; deRham theorem; spectral sequences.
Prerequisite, Math 782.

811 (I), 812 (II). ADVANCED ALGEBRA.
Advanced topics in algebra.
Prerequisite, permission of instructor.
Credit, 3 each semester.

821 (I), 822 (II). ADVANCED COMPLEX ANALYSIS.
Advanced topics in complex analysis.
Prerequisite, permission of instructor.
Credit, 3 each semester.

823 (I), 824 (II). ADVANCED ANALYSIS.
Advanced topics in analysis.
Prerequisite, permission of instructor.
Credit, 3 each semester.

831 (I), 832 (II). ADVANCED ORDINARY OR PARTIAL DIFFERENTIAL EQUATIONS.
Advanced topics chosen from dynamic systems, differential operators with constant coefficients, hyperbolic and elliptic operators, non-linear equations, asymptotic expansions.
Prerequisite, permission of instructor.
Credit, 3 each semester.

835. ADVANCED LATTICE THEORY I.
Advanced topics chosen from the fields of orthomodular lattices, quasi-orthomodular lattices, continuous geometries, complemented modular lattices, and their representation theories.
Prerequisite, Math 736.

836. ADVANCED LATTICE THEORY II.
Continuation of Math 835. One or more of the topics of Math 835 examined in detail up to the present frontiers of knowledge.
Prerequisite, Math 835.

852 (I), 852 (II). DIFFERENTIAL TOPOLOGY.
Differential manifolds, immersions and imbeddings; Whitney approximation theorems; vector bundles; tangent and normal bundles; characteristic classes and cobordism.
Prerequisites, Math 772 and 781. *Credit, 3 each semester.*

853 (I), 854 (II). TOPOLOGICAL SEMIGROUPS.
Topics: from ideals in semigroups, Green's relations, Rees-Suschkewitsch theorem, semigroup structures on continua, homomorphisms, irreducible semigroups, actions by semigroups, and other topics of current interest.
Prerequisites, Math 771-772 or equivalent.
Credit, 3 each semester.

861 (I), 862 (II). ADVANCED GEOMETRY.
Advanced topics in geometry. *Credit, 3 each semester.*

871 (I), 872 (II). ADVANCED TOPOLOGY.
Advanced topics in topology. *Credit, 3 each semester.*

881 (I), 882 (II). ADVANCED PURE AND/OR APPLIED MATHEMATICS.
Credit, 3 each semester.

883 (I), 884 (II). DIRECTED READINGS.
Credit, up to 6.

889 (I), 890 (II). PROBLEM SEMINAR.
Introduces beginning graduate students to the methods of mathematical research. *Credit, 1 each semester.*

891 (I), 892 (II). PROSEMINAR.
Presentation by the beginning graduate student of material from the mathematics literature. *Credit, 1 each semester.*

893 (I), 894 (II). LITERATURE SEMINAR.
Presentation by the intermediate graduate student of material from the mathematics literature. *Credit, 1 each semester.*

895 (I), 896 (II), 897 (III), 898 (IV). RESEARCH SEMINAR.
Presentation by the advanced graduate student of research articles, perhaps his own research. *Credit, 1 each semester.*

900. DOCTORAL DISSERTATION. *Credit, up to 30.*

Statistics Courses

701 (I), 702 (II). STATISTICAL TEST AND DECISION PROCEDURES.
Statistical decision theory, theory of hypothesis testing, optimal tests, non-parametric procedures.
Prerequisites, Stat 707; Math 611 and 625, or equivalent.
Credit, 3 each semester.

705 (I), 706 (II). PROBABILITY THEORY FOR STATISTICS.
Experiments, sample spaces, probability measures, combinatorics, random variables, distribution functions, conditional probability, independence, derived distributions, moment generating functions, central limit theorem. Borel sets, measures, correspondence theorem, random variables, expectations, product spaces, multivariate distributions, convolutions, weak and strong laws of large numbers, uniqueness theorem, central limit theorem. Radon-Nikodym theorem and the general concept of conditioning.
Prerequisite, Math 165 or equivalent.
Prerequisite or corequisite, Math 625 or equivalent.
Credit, 3 each semester.

707. A FIRST COURSE IN MATHEMATICAL STATISTICS.
Distribution theory, maximum likelihood estimation, confidence intervals, sufficiency, point estimation, hypotheses testing, Bayesian inference, decision theory, nonparametric statistics, survey of special topics.
Prerequisite, Stat 705.

725 (I), 726 (II). ESTIMATION THEORY AND HYPOTHESIS TESTING.
Maximum likelihood, types of estimation, properties of estimators, 2 sample problem, k sample problem.
Prerequisites or corequisites, Stat 562 and 582; Math 611 and 625, or equivalent. *Credit, 3 each semester.*

751. RANDOM PROCESSES I.
Foundation of the theory of random processes, stopping times, sample analysis, calculus in quadratic mean, spectral analysis; survey of various special processes and applications, *e.g.*, Markov processes, random walks, queuing and renewal processes, Brownian motion, Ornstein-Uhlenbeck process, diffusion processes, stationary processes.
Prerequisites, Math 723 or Stat 705, 706 or Stat 851 or permission of instructor.

752. RANDOM PROCESSES II.
Topics from the following: modern theory of Markov processes and potential theory, martingale theory, stochastic integral and differential equations, stationary processes, ergodic and information theory; various applied areas, such as queuing theory, theory of dams, optimal stopping and decision problems, statistical analysis of time series.
Prerequisite, Stat 751.

805 (I), 806 (II). ADVANCED MATHEMATICAL STATISTICS.
Review and extension of 705, 706, 707. Characteristic functions and their properties, central limit theorems, matrix algebra and multivariate analysis, bounds for the variance. Sufficiency, completeness, efficiency, maximum likelihood, least squares, tests, interval estimation, multiple comparisons.
Prerequisites, Stat 706 and 707. *Credit, 3 each semester.*

841 (I), 842 (II). RECENT DEVELOPMENTS IN STATISTICS.
Content varies with instructor. Possible topics include: inference in stochastic processes, decision processes, spectral analysis of stationary processes, geometry of moment spaces, sequential procedures, optimal stopping.
Prerequisites, Stat 706 and 707, Math 611 and 625 or equivalent. *Credit, 3 each semester.*

851 (I), 852 (II). ADVANCED PROBABILITY, I AND II.
Measure and integration, distribution and characteristic functions, Laplace transforms; laws of large numbers, central limit theorem; Radon-Nikodym theorem, conditioning. Topics from the following: the general central limit problem, classes of probability laws, domains of attraction; foundations of random processes, Kolmogorov consistency theorem, potential theory, ergodic and information theory.
Prerequisites, Math 723 or Stat 706 or permission of instructor. *Credit, 3 each semester.*

880. SEMINAR.
Research papers by staff and students; invited lectures by prominent statisticians. *Credit, 1-3.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

Mathematics Courses

533. PROBABILITY.
A postulational study of probability, including counting methods, random variables; additional topics chosen from Bayes' Theorem, statistical independence, laws of large numbers, and Markov processes.
Prerequisites, Math 165/166 or Math 174/184, and Math 167. In addition Math 500 and/or Math 511 are strongly recommended.

541. APPLIED ANALYSIS I.
Complex analysis including analytic functions, residues, and conformal mappings; superposition of solutions of linear differential equations; orthogonal functions and Fourier series.
Prerequisite, Math 174/184 or Math 165/166.

542. APPLIED ANALYSIS II.
Continuation of Math 541. Properties of Fourier series; boundary value problems; orthogonal functions; Laplace and Fourier transforms; applications to physical and engineering sciences.
Prerequisite, Math 541; differential equations and a year of physics are desirable.

545, 546. APPLIED MATHEMATICS I AND II.
Topics from engineering and mathematical physics presented rigorously and with free use of abstract mathematical concepts and modern mathematical machinery.
Prerequisites, Math 165, 166 and either Math 167 or Math 500. *Credit, 3 each semester.*

551. NUMERICAL ANALYSIS I.
A first course in techniques of numerical approximation in analysis and algebra. Not for credit after Comp Sci 251.
Prerequisites, Math 174/184 or 165/166, and Comp Sci 121 or 131 or knowledge of basic FORTRAN.

552. NUMERICAL ANALYSIS II.
Continuation of Math 551, including numerical solution of partial differential equations.
Prerequisite, Math 551.

571. THEORY OF NUMBERS.
Euclidean algorithm, prime numbers, congruences, quadratic reciprocity, further topics in number theory. Recommended for prospective high school mathematics teachers.
Prerequisite, Math 167 or Math 500, or permission of instructor.

611. THEORY OF GROUP REPRESENTATIONS.
Abstract groups, subgroups, quotient groups, homomorphisms, representations, irreducible representations, characters, orthogonality relations. Intended for students qualified to study algebra at a significantly higher level of abstraction than Math 511.
Prerequisites, Math 167 and permission of the Department.

612. ADVANCED TOPICS IN ALGEBRA.
Topics chosen from: rings, integral domains, modules over principal ideal domains, field extensions, and Galois theory.
Prerequisite, Math 611, or Math 511 and permission of instructor.

625. INTRODUCTORY MODERN ANALYSIS I.
Basic topology of Euclidean n-space and metric spaces, convergence of sequences and series, continuous functions and their local and global properties.
Prerequisites, Math 174/184 or Math 165/166, and Math 167. Math 500 is strongly recommended.

626. INTRODUCTORY MODERN ANALYSIS II.
Continuation of Math 625. Differentiation, Riemann integration, sequences and series of functions, functions of several variables.
Prerequisite, Math 625.

631. ORDINARY DIFFERENTIAL EQUATIONS.
First and second-order equations, existence and uniqueness theorems, systems of equations.
Prerequisites, Math 174/184 or Math 165/166, and Math 167.

632. TOPICS IN ORDINARY DIFFERENTIAL EQUATIONS.
Topics to be chosen from: Sturm-Liouville Theory, series solutions, stability theory and singular points, numerical methods, transform methods.
Prerequisite, Math 631.

634. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.
Classification of second-order partial differential equations, wave equation, Laplace's equation, heat equation, separation of variables.
Prerequisites, Math 174/184 or Math 165/166, Math 167, and Math 631 or Math 643.

645. LINEAR ALGEBRA FOR APPLIED MATHEMATICS.
Introduction to vector spaces, inner products, and matrices, followed by study of linear transformations, tensors, determinants, orientation, the spectral theorem for normal operators, complexification, real normal operators, and exterior algebra.
Prerequisite, Math 167. Math 500 is recommended but not required.

646. VECTOR AND TENSOR ANALYSIS WITH APPLICATIONS.
Continuation of Math 645. Frechet derivatives, the inverse and implicit function theorems, vector and tensor fields, exterior differentiation, differential forms, differentiable manifolds.
Prerequisites, Math 645 and Math 165/166 or Math 174/184.

663. DIFFERENTIAL GEOMETRY.
Differential geometry of curves and surfaces in Euclidean 3-space using vector methods.
Prerequisites, Math 174/184 or Math 165/166, and Math 167, or permission of instructor.

671. SET THEORY.
Basic properties of sets. Ordered sets. Complete ordered sets. Well-ordered sets. Cardinal and ordinal numbers. Axiom of choice, well-ordering theorem, and Zorn's lemma. Cardinal arithmetic. Highly recommended for continuing mathematics majors.
Prerequisite, Math 167 of permission of instructor.

Statistics Courses

561. DESIGN OF EXPERIMENTS (METHODS).
Purpose of experimental designs and their basic assumptions; individual comparisons, components of error, confounding; applications from various fields.
Prerequisite, Stat 121, 532, or 616.

562. ADVANCED STATISTICAL ANALYSIS OF EXPERIMENTAL DATA (II).
Analysis of data with disproportionate subclass numbers. Includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses.
Prerequisite, Stat 561.

571. SURVEY SAMPLING.
Theory and practice of sampling, optimum allocation of resources, estimation of sample size, various sampling methods, ratio and regression estimates, problem of non-response.
Prerequisite, Stat 121, 532, or 616.

572. SAMPLING THEORY AND METHODS.
Problems and methods of sampling, production and quality control, acceptance sampling, O.C. and A.S.N. curves, types and properties of estimators.
Prerequisite, Stat 121, 532, or 616.

581. MULTIVARIATE ANALYSIS (METHODS).
Applications of the theory in Statistics 582 to actual problems; research studies by the students, critiques of published research, or analysis of other bodies of data.
Prerequisite, Stat 551, or 616.

582. MULTIVARIATE ANALYSIS (THEORY).
Correlation and regression, principal components, canonical analysis, analysis of dispersion and covariance, tests of homogeneity, discriminant functions.
Prerequisite, Stat 616.

615. INTRODUCTION TO THE THEORY OF STATISTICS I.
Probability, random variables, probability distribution (with emphasis on the binomial and normal distributions), mathematical expectation, bivariate and multivariate distributions, sampling distributions, the central limit theorem, point estimation, maximum likelihood estimators, interval estimation.
Prerequisite, Math 124/125/134 or 117/119 or 132/136/138 or 154.

616. INTRODUCTION TO THE THEORY OF STATISTICS II.
Interval estimation, hypothesis testing, analysis of variance, regression, correlation, decision theory.
Prerequisite, Stat 615.

NOT FOR GRADUATE CREDIT IN MATHEMATICS AND STATISTICS

(These courses cannot be credited toward an advanced degree in mathematics and statistics.)

Mathematics Courses

500. FUNDAMENTAL CONCEPTS OF MATHEMATICS.
Non-axiomatic propositional calculus (with truth tables), basic quantification theory and set algebra. Binary relations, equivalence relations, partitions, functions. Development of the basic algebraic and topological features of real numbers from the axioms for a complete ordered field.
Prerequisite, permission of instructor.

511. INTRODUCTION TO MODERN ALGEBRA I.
Introduction to groups, rings, and fields.
Prerequisite, Math 167. Math 500 may be helpful but is not necessary.

512. INTRODUCTION TO MODERN ALGEBRA II.
Continuation of Math 511. Algebraic field extensions and solutions by radicals, canonical forms of matrices, quadratic forms, theory of groups, or other topics in algebra.
Prerequisite, Math 511.

525. ADVANCED CALCULUS I.
Elementary topology of the line and Euclidean n-space, continuous functions, Riemann integration, infinite series and

power series. Not for credit after Math 625.
Prerequisite, Math 165/166 or Math 174/184 and Math 167. Math 500 may be very helpful but is not necessary.

526. ADVANCED CALCULUS II.
Continuation of Math 525. Multivariate analysis and the theorems of Green, Gauss, and Stokes. Not for credit after Math 626.
Prerequisite, Math 525.

557. LINEAR PROGRAMMING AND THEORY OF GAMES.
The Simplex Method and extensions; duality theorems; transportation problems and other applications; finite two-person zero-sum games and the fundamental theorem.
Prerequisite, Math 167 or permission of instructor.

561. AFFINE AND PROJECTIVE GEOMETRY I.
Coordination of the Desarguesian affine plane; the projective plane as an extension of the affine plane. Highly recommended for prospective secondary school mathematics teachers.
Prerequisite, Math 167 or permission of instructor.

562. AFFINE AND PROJECTIVE GEOMETRY II.
Continuation of Math 561. Topics from affine, projective, Euclidean, and non-Euclidean geometry.
Prerequisite, Math 561.

575. TOPICS IN HISTORY OF MATHEMATICS.
A detailed examination of the work of a single great mathematician, the mathematics of a single historical period, or the historical development of a single mathematical idea.
Prerequisite, Math 174/184 or Math 165/166.

665. TOPOLOGY I.
Introduction to the topology of metric spaces and topological spaces: metrics, topologies, continuity, connectedness, compactness.
Prerequisite, Math 525 or Math 625 or permission of instructor.

666. TOPOLOGY II.
Introduction to the geometric ideas behind algebraic topology. Polyhedra, manifolds, Jordan curve theorem, homology mod 2, classification of surfaces, Brouwer fixed-point theorem.
Prerequisites, Math 511 or 611, and Math 665.

Statistics Courses

531. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE I.
Random experiments and probability models; independence; conditional probability; sampling, random variables; data representations; special distributions; deduction and inference.

532. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE II.
Point, interval, and model estimation; hypothesis testing; optimality concepts; power; least squares techniques; decision theoretic notions.
Prerequisite, Stat 531.

551. ELEMENTARY LEAST SQUARES, REGRESSION, AND ANALYSIS OF VARIANCE.
Theory of least squares, analysis of variance, simple linear and multiple regression, and application of these techniques to the real data.
Prerequisite, Stat 121 or 532.

Mechanical Engineering

GRADUATE FACULTY

Edward Sunderland, *Professor and Head of the Department of Mechanical and Aerospace Engineering*, B.S.M.E., Massachusetts Institute of Technology, 1954; M.S.M.E., Purdue, 1956; Ph.D., 1958.

Corrado R. Poli, *Professor and Graduate Program Director*, B.S., Rensselaer Polytechnic Institute, 1957; M.S., 1958; Ph.D., Ohio State, 1965.

Lawrence L. Ambs, *Assistant Professor*, B.S., University of Minnesota, 1960; M.S., 1962; Ph.D., 1967.

Maurice E. Bates, *Professor*, B.S.E., Michigan, 1934; M.S., Massachusetts Institute of Technology, 1935; Ph.D., 1937.

Geoffrey Boothroyd, *Professor*, B.S.E., University of London, 1957; Ph.D., 1962.

Duane E. Cromack, *Associate Professor*, B.S., Massachusetts, 1959; M.E., Yale, 1961; Eng.D., Rensselaer Polytechnic Institute, 1968.

F. Erskine Crossley, *Professor*, B.A., Cambridge University, 1937; M.A., 1941; Eng.D., Yale University, 1949.

Robert W. Day, *Professor*, B.S., Massachusetts, 1948; M.M.E., Rensselaer Polytechnic Institute, 1954.

John H. Dittfach, *Professor*, B.S.M.E., Minnesota, 1947; M.S.M.E., 1948.

John R. Dixon, *Professor*, B.S., Massachusetts Institute of Technology, 1952; M.S., 1953; Ph.D., Carnegie Institute of Technology, 1961.

William P. Goss, *Associate Professor*, B.S., University of Connecticut, 1961; M.S., 1962; Ph.D., 1967.

G. Horvay, *Professor*, B.S., New York University, 1930; E.E., Columbia, 1931; Ph.D., 1939.

Karl Jakus, *Assistant Professor*, B.M.E., University of Wisconsin, 1963; M.S., University of California, Berkeley, 1965; Ph.D., 1968.

Robert H. Kirchhoff, *Assistant Professor*, B.M.E., University of Santa Clara, 1961; M.S., University of Arizona, 1963; Ph.D., University of California, Berkeley, 1969.

Jon G. McGowan, *Associate Professor*, B.S., Carnegie Institute of Technology, 1961; M.S., Stanford, 1962; Ph.D., Carnegie Institute of Technology, 1965.

Lawrence Murch, *Assistant Professor*, B.S., Northeastern, 1965; M.S., Clarkson College of Technology, 1968; Ph.D., University of Massachusetts, 1972.

Carl W. Nelson, *Associate Professor of Metallurgy*, B.S., Case Institute of Technology, 1956; M.S., 1963; Ph.D., 1965.

Joseph M. O'Byrne, *Associate Professor*, B.S.M.E., Cincinnati, 1950; M.E., 1952; M.S.M.E., Kentucky, 1952.

Robert K. Patterson, *Associate Professor*, B.S., Maine, 1948; M.S., 1955.

Kenneth G. Picha, *Professor and Dean of the School of Engineering*, B.S., Georgia Institute of Technology, 1946; M.S., 1948; Ph.D., Minnesota, 1957.

John E. Ritter, *Associate Professor of Materials Engineering*, B.S., Massachusetts Institute of Technology, 1961; M.S., 1962; Ph.D., Cornell, 1966.

G. Albert Russell, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1958; M.S., Arizona State, 1961; Ph.D., Connecticut, 1967.

Paul E. Tartaglia, *Assistant Professor*, B.M.E., University of Detroit, 1967; M.S., Northwestern University, 1968; Eng.D., University of Detroit, 1970.

Franklin Umholtz, *Associate Professor*, B.A., California State University, 1958; M.A., 1961.

William R. D. Wilson, *Associate Professor*, B.S., Queens University of Belfast, 1963; Ph.D., 1967.

John W. Zahradnik, *Professor*, B.S., Pennsylvania State University, 1950; M.S., Iowa State University, 1951; Ph.D., Massachusetts Institute of Technology, 1965.

George E. Zinsmeister, *Associate Professor*, B.M.E., Rensselaer Polytechnic Institute, 1961; M.S., Purdue, 1963; Ph.D., 1965.

The Master of Science program in Mechanical Engineering is designed to meet the needs of students planning either doctoral study or professional employment. Thirty credit hours are required, 6 of which are to be earned by taking one course from any two of the following groups:

Group A: MAE 702. Thermodynamics.
MAE 722. Advanced Fluid Mechanics.
Group B: MAE 730. Advanced Solid Mechanics.
MAE 740. Advanced Dynamics.
Group C: MAE 608. Physical Metallurgical Principles.
MAE 780. Metal Forming Processes.

Six credits of Mathematics are required, and a thesis or project of from 6 to 9 credits is normally required. The remaining credits are electives for specialization in such areas as heat transfer, fluid mechanics, thermodynamics, dynamics and vibrations, machine or system design, propulsion, aerodynamics, biological processing, and metallurgy or materials processing. In addition, all students must satisfy the Graduate School's requirements for the Master's degree.

The Doctor of Philosophy program in Mechanical Engineering imposes no minimum credit hours but each course program must include the following elements:

a. Advanced and comprehensive study in the fundamentals of mechanical engineering including appropriate science courses in mathematics, physics, and chemistry;

b. Intensive study of a special discipline within mechanical engineering (for example, heat transfer, mechanics, gas or fluid dynamics, design, etc.), including study of the current literature;

c. Either intensive study of a second special discipline within mechanical engineering, including study of the current literature, or study in another discipline. The selection of this second discipline and the program of study is subject to approval by the student's Guidance Committee and by the Mechanical Engineering Graduate Committee but it is the intent of the option to allow and even encourage wide latitude in the selection of fields from engineering, science, social science, arts, or humanities.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING.
Special investigation or research problems, the scope to be varied to meet specific conditions.
Prerequisite, as required by the problem. *Credit, 1-6.*

701. ADVANCED THERMODYNAMICS.
Theory of advanced, direct and indirect, energy conversion systems. Thermodynamic cycle optimization methods. Irreversible thermodynamics as applied to steady state energy conversion systems. Direct energy conversion systems include MHD, fuel cells, thermoelectric, thermionic, and other current systems.
Prerequisite, MAE 702 or equivalent. Mr. McGowan.

702. THERMODYNAMICS.
Review of classical thermodynamics and conventional energy conversion systems. Introduction to kinetic theory of gases, and statistical thermodynamics. Selected topics in chemical thermodynamics.
Prerequisite, graduate standing or permission of instructor.
Mr. Ambs, Mr. McGowan.

705. ADVANCED HEAT TRANSFER I — CONDUCTION.
Development of the general heat conduction equation for nonhomogeneous and anisotropic materials with temperature dependent properties. Formulation of boundary conditions in heat conduction problems. Solution of sample resulting boundary value problems using separation of variables, integral transform and finite difference techniques.
Prerequisite, MAE 582 or equivalent. Mr. Zinmeister.

706. ADVANCED HEAT TRANSFER II — CONVECTION.
Development of the general energy equation for convective heat transfer from basic concepts of energy and mass flow. Application to laminar and turbulent, internal and external convective heat transfer problems. Solution methods, including boundary layer theory, similarity concepts, integral approximation methods, and numerical techniques. Introduction to mass transfer.
Prerequisite, MAE 772, or equivalent.
Mr. Jakus, Mr. Goss.

707. VISCOUS FLUIDS.
Exact solutions to the Navier-Stokes equations, slow flow, and boundary layer flow. One-dimensional gas dynamics, shock waves, the acoustic equations, and application of the theory of characteristics to compressible flow.
Prerequisite, MAE 722 or equivalent. Mr. Jakus.

709. MECHANICAL PROPERTIES OF MATERIALS.
Dislocation theory and its application to the mechanical properties of non-organic materials.
Prerequisite, MAE 608 or equivalent. Mr. Nelson, Mr. Ritter.

713. ADVANCED PROPULSION SYSTEMS.
Design, control, and integration of propulsion systems with the vehicle. Air-breathing engines, chemical rocket motors, electrical and nuclear engines. Power and energy limited systems for various mission requirements.
Prerequisite, MAE 578 or equivalent. Mr. Ambs.

722. ADVANCED FLUID MECHANICS.
Fundamentals of fluid mechanics including kinematics, the stress tensor, and the basic equations from the conservation of mass, momentum, and energy. The dynamics of an inviscid fluid and vortex motion. MAE 722 and 707 form a one-year comprehensive course in fluid mechanics.
Prerequisite, MAE 265 or equivalent.
Mr. Jakus, Mr. Kirchhoff.

730. ADVANCED SOLID MECHANICS.
A unified treatment of the analysis of solids. Consideration of continuity, mechanical energy, stress and strain. Application to elasticity, thermoelasticity, and plasticity.
Prerequisite, graduate standing or permission of instructor.
Mr. Horvay.

740. ADVANCED DYNAMICS.
Advanced dynamics of particles, systems of particles, variable mass systems, and rigid bodies. Gyroscopic motion. Rotating and accelerating frames of reference. Use of energy methods, LaGrange's equations. Hamilton's principle, and Eulerian angles in engineering problems.
Prerequisite, graduate standing or permission of instructor.
Mr. Horvay, Mr. Poli.

741. VIBRATIONS II.
Vibration of discrete systems with many degrees of freedom, normal modes and frequencies, approximate methods. Introduction to nonlinear vibrations. Nonlinearities in inertia, damping, restoring forces, etc. Singular points and stability, including approximate methods of solution. Liapunov's method.
Prerequisite, MAE 740. Mr. Horvay, Mr. Poli.

743. STABILITY OF STRUCTURES.
Correlations of various linear and nonlinear theories with experiments. Creep buckling. Thermal buckling. Buckling due to dynamic loads. Buckling of non-conservative systems.
Prerequisite, graduate standing. Mr. Horvay.

744. THERMAL EFFECTS IN STRUCTURES.
Uncoupled thermoelastic theory, thermal stresses in beams, rings, plates, and shells. Thermally induced vibrations of beams, plates, and shells. Inelastic thermal stress problems. Stresses in the presence of creep. Ablation phenomena.
Prerequisite, graduate standing. Mr. Horvay.

746. ADVANCED VIBRATIONS.
Free and forced vibrations of strings, rods, bars, and thin elastic plates. Free vibrations of circular, cylindrical, and conical shells. Forced harmonic vibrations of thin shells. Propagation of elastic waves. Rayleigh surface waves. Statistical concepts of random vibration analysis.
Prerequisite, MAE 740. Mr. Horvay, Mr. Poli.

750. MECHANISMS AND THEORY OF MACHINES I.
Structure and type synthesis of mechanisms; a solution to the designer's problem of selecting the type of mechanism for a job; applications of the theory of graphs. Digital computer methods for design of linkages; optimization of nonlinear systems. Geometry of plane curves, and instantaneous kinematics of a plane moving body.
(Open to qualified undergraduates with permission of instructor.) Mr. Crossley.

751. MECHANISMS AND THEORY OF MACHINES II.
Dynamics of cam drives; design by computer or simulation by analog computer. Gear train design; problems of efficiency and circulation power in loops. Analog computer simulation of two- and three-dimensional mechanisms in motion. Some three-dimensional linkages and design methods. Mr. Crossley.

760. ADVANCED MECHANICAL ENGINEERING DESIGN I.
Application of control systems theory to design of thermal, fluid, mechanical, electromechanical, and combined systems. Consideration of optimization, stability and methods of simulation. *Credit, 4.* Mr. Tartaglia.

761. ADVANCED MECHANICAL ENGINEERING DESIGN II.
Optimization in design. Methods of optimization; numerical and variational, linear and non-linear. Advantages, disadvantages, restrictions and use of the various methods.

770. ADVANCED COMBUSTION.
Topics in chemically reacting flow systems, heat, mass, and momentum transfer in chemically reacting ducted flows. Topics include chemical equilibrium, chemical kinetics, transport properties, laminar and turbulent flows, droplets and sprays.
Prerequisite, graduate standing and permission of instructor.
Mr. Ambs.

780. METAL FORMING PROCESSES.
The theory of plasticity including yield criteria and flow laws. Upper and lower bound methods and their application to the analysis of selected metal forming processes. Practical problems encountered in metal forming.
Prerequisite, MAE 520. Mr. Boothroyd, Mr. Wilson.

790. ENGINEERING PROJECT.
A research, design, or development project. Written preparation and oral defense of a project proposal giving objectives, literature survey, and proposed plan. Written preparation and oral defense of a final report giving results and conclusions. May be repeated for credit.
Prerequisite, graduate standing. *Credit, 1-10.*

799. LITERATURE SURVEY AND SEMINAR.
A comprehensive study and organization of the current literature on a selected topic. Presentation of the survey in an open seminar including Department faculty and graduate students. Open only to students who have passed Preliminary Examinations. *Not for credit.*

Selected Topics Courses

To best serve the varied interests of its graduate students, the Department has available the following set of selected topics courses. These are one-semester courses and not individualized reading courses. The particular choice of subject matter to be covered in any one of these courses depends upon the specialized needs and interests of the students and is tailored to their requests. The courses are offered only on sufficient demand.

801. SELECTED TOPICS IN THERMODYNAMICS.
Current topics in thermodynamics. An in-depth investigation of a specific topic or specialized thermodynamic system. Emphasis on concurrent reading of the literature.
Prerequisite, MAE 701. Mr. Ambs, Mr. McGowan.

811. SELECTED TOPICS IN HEAT TRANSFER.
Topics may be chosen from the following: nonlinear problems in heat conduction with emphasis on temperature-dependent properties; heat conduction in composite and anisotropic materials; heat transfer with change of phase (boiling, condensation, sublimation, melting, and freezing); finite difference and integral approximation techniques in heat transfer; introduction to radiation heat transfer including combined radiation-conduction and radiation-convection.
Prerequisites, MAE 705 and/or MAE 706.
Mr. Goss, Mr. Zinsmeister.

821. SELECTED TOPICS IN FLUID MECHANICS.
Any one or two of the following topics: numerical methods in fluid mechanics; advanced measurement techniques; advanced compressible flow; singular perturbation theory; magnetohydrodynamics; free molecule flow-kinetic theory.
Prerequisite, MAE 707. Mr. Kirchhoff.

831. SELECTED TOPICS IN SOLID MECHANICS.
Topics normally chosen from such areas as stability of structures, thermal effects in structures, inelastic behavior of materials, and shell theory.
Prerequisite, MAE 730. Mr. Horvay, Mr. Poli.

841. SELECTED TOPICS IN VIBRATIONS.
A more in-depth study of some of the topics covered in 741 and 746; usually topics in the area of nonlinear vibrations, stability theory, or random vibrations.
Prerequisites, MAE 741 and/or MAE 746.
Mr. Horvay, Mr. Poli.

851. SELECTED TOPICS ON MECHANISMS AND MACHINE DESIGN.
A few of the following may be studied as a continuation of MAE 751: Classical Burmester theory. The geometry of screw systems, line complexes, and their relation to the mobility of linkages. Use of dual numbers, quaternions, and dual matrices in the computer solution of spatial mechanism design problems. Application of Chebyshev approximation methods in design. Dynamic analysis and balancing of linkages. Dynamics of mechanical systems with play, backlash, or separation of the parts as in cams, with either analog or computer simulation. Dynamics of mechanisms containing springs of highly elastic elements; nonlinear vibratory systems; stability according to Mathieu-Hill; systems with different regimes of behavior.
Prerequisite, MAE 751. Mr. Crossley.

871. SPECIAL TOPICS IN COMBUSTION AND PROPULSION.
Special topics according to student and instructor interest selected from the current literature. An in-depth student in-

vestigation of some aspect of the problem.
Prerequisites, MAE 713 and/or MAE 770. Mr. Ambs.

881. SELECTED TOPICS IN MATERIALS.
Advanced study in topics of current interest. Examples include thermodynamics of phase transfer motions, mechanical behavior of ceramic materials, composite materials, and relaxation phenomena in metals.
Prerequisite, MAE 709. Mr. Nelson, Mr. Ritter.

800. MASTER'S THESIS. *Credit, 3-10.*

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

520. MACHINING AND MACHINE TOOLS.
Fundamentals of metal cutting including temperatures generated and dynamic stability of the cutting process. Lubrication and wear of cutting tools and cutting conditions for maximum production or minimum cost. Design of machine tools. Numerical control and economics of machine tools.
Mr. Boothroyd.

521. AUTOMATION IN MANUFACTURING.
In-depth study of the automatic assembly process including feeding and orienting of parts and the performance and economics of assembly systems. Design of parts and products for automatic assembly. Mr. Boothroyd.

535. MANUFACTURING PROCESSES.
Introduction to casting, forming, cutting, and joining processes for metals and plastics. Includes the economics, relative advantages and limitations of the processes. Mr. Wilson.

537. MANUFACTURING PROCESSES LABORATORY.
Experiments, workshops and short experimental projects based on the topics covered in MAE 535. Emphasis on experimental technique and presentation of results. One 3-hour laboratory period. *Credit 1.* Mr. Wilson.

548. STRUCTURES FOR MECHANICAL AND AEROSPACE ENGINEERS I.
Introduction to the load and temperature environment of structures. Review of stress and strain with an introduction to the theory of elasticity. Theories of blending, extension, torsion and shear of slender beams without structural discontinuities. Introduction to work-energy principles and their application to the deflection and stress analysis of complex structures. Examples from the fields of mechanical and aerospace engineering.
Prerequisite, MAE 145. Mr. Poli.

549. STRUCTURES FOR MECHANICAL AND AEROSPACE ENGINEERS II.
Continuation of MAE 548. Elastic instability. Applications to axially symmetrical problems, curved beams and stress concentrations. Applications to plates and shells. Introduction to problems involving viscous and plastic behavior. Numerical methods.
Prerequisites, MAE 548 or permission of instructor. Mr. Poli.

554. PRODUCT DESIGN I.
Human values in design. Central philosophy of product design. Emphasis on the relation between technical and human values, creativity, and design methodology. Laboratory includes the development of simple product concepts visualized in rapidly developed three-dimensional mockups.
Two class hours, two 2-hour laboratory periods.
Mr. Umholtz.

555. AQUACULTURAL ENGINEERING SYSTEMS (OE 591).
Rate theory and similitude in the scaling of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bioengineering comparison of several systems used in aquaculture. Mr. Zahradnik.

557. PRODUCT DESIGN II.
Continuation of MAE 554. Integration of knowledge, methodology, and skills obtained in previous work applied and extended to product design. Semester-long design project with formal presentation to professional jury.
Prerequisite, MAE 554.
Two class hours, two 2-hour laboratory periods.
Mr. Umholtz.

574. PERFORMANCE OF FLIGHT VEHICLES.
Aircraft performance, static and maneuvering. Fundamental astronautics, two-body, problem transfer orbits, rendezvous, intercept, lunar and interplanetary trajectories.
Prerequisites, MAE 246, 265. Mr. Cromack, Mr. Poli.

576. COMBUSTION.
Phenomenological study of combustion processes in flowing systems.
Prerequisite, MAE 264. Mr. Ambs.

577. INTERNAL COMBUSTION ENGINES.
The thermodynamic and performance aspects of reciprocating gasoline and Diesel engines, steady flow gas turbines and turbo-jet engines, and rockets are major topics.
Prerequisite, MAE 264. Mr. Ambs, Mr. Dittfach.

578. AEROSPACE PROPULSION.
Primary and auxiliary power sources. Matching of air-breathing and rocket motors with vehicle. Electrical and nuclear propulsion systems.
Prerequisite, MAE 287. Mr. Ambs.

582. HEAT TRANSFER.
Fundamental principles of heat transfer by conduction, radiation, and convection. Methods of evaluating heat transfer rates and predicting operating temperatures.
Prerequisites, MAE 264 and Math 186 or 541.
Mr. O'Byrne and Mr. Zinsmeister.

583. MACHINE DESIGN.
Principles of the design of various machine parts; economy of manufacture, safety, styling, invention and creativity.
Two class hours, one 3-hour laboratory period.
Prerequisites, MAE 293, 235, and 237.
Mr. Bates, Mr. Crossley.

585. VIBRATIONS I.
The linear vibrations of machines and machine structures. Uses of active and passive isolation, balancing, absorption, damping and feedback control to reduce the effects of vibrations.
Prerequisite, MAE 246. Mr. Poli.

586. ADVANCED MACHINE DESIGN.
Continuation of MAE 563. Additional elementary parts are analyzed, and some complete machines are studied. Considerable emphasis on invention and creativity.
Two class hours, one 3-hour laboratory period.
Prerequisite, MAE 583. Mr. Bates, Mr. Crossley.

587. GAS DYNAMICS.
Continuation of MAE 265. Continuous and discrete media. Compressible flow equations and compressibility effects. Flow in variable area ducts, normal and oblique shocks. Two dimensional flow. Applications.
Prerequisites, MAE 265 and MAE 263.
Mr. Day, Mr. Kirchhoff.

591. MECHANICAL AND AERO-SPACE ENGINEERING ANALYSIS II.
Continuation of MAE 284 with emphasis on more complex problems and more advanced mathematical methods.
Two class hours, one 3-hour laboratory period.
Prerequisite, MAE 284. Mr. Zinsmeister.

594. MECHANICAL AND AERO-SPACE SYSTEMS ANALYSIS.
Application of engineering analysis techniques to large-scale systems. Concepts and methodology of systems engineering.
Prerequisite, EE 142 or permission of instructor.
Mr. Russell.

595. MECHANICAL AND AERO-SPACE ENGINEERING DESIGN.
Application of fundamentals of technology to complex design

projects.
One class hour, two 3-hour laboratory periods.
Mr. Dixon, Mr. Tartaglia.

608. PHYSICAL METALLURGICAL PRINCIPLES.
Principles underlying the structure and behavior of metals. Equilibrium and non-equilibrium phase relations in one- and two-component systems. Kinetics of diffusion and nucleation. Phase transformations, heat treatment, and hardenability.
Prerequisite, graduate standing or permission of instructor.
Mr. Nelson, Mr. Ritter.

615. AERODYNAMICS.
Application of theoretical fluid mechanics to aerodynamics including topics of theory of lift; finite wing theory; the effects of compressibility and viscosity on lift and drag; slender body theory.
Prerequisite, MAE 265 or equivalent. Mr. Cromack.

616. STABILITY AND CONTROL OF VEHICLES.
Introduction to the general concepts of stability of motion. The stability of air, space, and ground vehicles.
Prerequisite, MAE 574 or permission of instructor.
Mr. Cromack, Mr. Poli.

650. X-RAY DIFFRACTION.
Principles of crystallography. X-ray diffraction.
Prerequisite, MAE 608. Mr. Nelson, Mr. Ritter.

Microbiology

GRADUATE FACULTY

ROBERT P. MORTLOCK, *Professor and Acting Head of the Department of Microbiology*, B.S., Rensselaer Polytechnic Institute, 1953; Ph.D., Illinois, 1958.

CURTIS B. THORNE, *Professor and Graduate Program Director*, B.S., West Virginia Wesleyan, 1943; M.S., Wisconsin, 1944; Ph.D., 1948.

ERCOLE CANALE-PAROLA, *Professor*, B.S., Illinois, 1956; M.S., 1957; Ph.D., 1961.

CHARLES D. COX, *Professor*, B.S., Illinois, 1940; M.S., 1941; Ph.D., 1947.

CLIFTON E. DOWELL, JR., *Associate Professor*, B.A., Texas Christian University, 1955; M.A., 1957; Ph.D., University of Texas, 1962.

STANLEY C. HOLT, *Associate Professor*, B.S., New York University, 1958; M.S., Michigan State, 1960; Ph.D., California at Davis, 1964.

THOMAS G. LESSIE, *Associate Professor*, B.S., Queens College, 1958; M.A., Harvard, 1961; Ph.D., 1963.

LEONARD C. NORKIN, *Assistant Professor*, B.S., Rensselaer Polytechnic Institute, 1964; Ph.D., Columbia University, 1969.

ALBEY M. REINER, *Assistant Professor*, B.S., Princeton, 1962; M.S., Wisconsin, 1964; Ph.D., Harvard, 1968.

MARTIN S. WILDER, *Assistant Professor*, B.S., Brooklyn College, 1960; M.S., University of Kansas, 1963; Ph.D., 1966.

ROBERT A. ZIMMERMAN, *Associate Professor*, B.A., Amherst College, 1959; Ph.D., Massachusetts Institute of Technology, 1964.

The Department of Microbiology provides facilities for students intending to complete the requirements for the Master of Science and Doctor of Philosophy degrees. Students accepted for graduate study are expected to have met the usual requirements for the bachelor's degree. Those students considered by the Department to be deficient in cognate sciences may be accepted as graduate student majors in microbiology and have their deficiencies removed during graduate study. Extensive advanced undergraduate courses in microbiology are not as essential as undergraduate background in chemistry, biological sciences, mathematics and physics, in preparation for graduate work in microbiology. Satisfactory knowledge of microbiology and cognate sciences is required for admission to advanced courses in microbiology. The department requires no foreign-language reading competency for the doctorate.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. RESEARCH.
Not for thesis credit, but normally for research preliminary to registration for thesis credit. May be repeated for a total of no more than 9 credits for a master's degree or 18 credits for a doctor's degree. Permission of instructor required.
Credit, 2-6 each semester.

710. ADVANCED IMMUNOLOGY.
Advanced theories and laboratory procedures basic to immunology and serology. Permission of instructor required.
Credit, 3-6. Mr. Cox.

720. ANIMAL VIROLOGY.
The molecular biology of animal viruses and viral genetic systems. Special consideration of poliovirus, influenza, and the DNA and RNA tumor viruses. Permission of instructor required. Mr. Norkin.

730. MICROBIAL FERMENTATIONS.
Theories, methods, and processes by which various chemicals and biological materials are produced industrially through the action of microorganisms. Laboratory experiments consider the microorganisms involved, procedures used, and the chemistry of the fermentation reactions. Permission of instructor required.

740. ADVANCED MICROBIAL PHYSIOLOGY.
Primarily laboratory. Growth of bacteria in batch and continuous culture; macro-molecular composition of bacteria grown under different conditions; bacterial respiration and electron transport systems; fractionation and characterization of bacterial enzymes. Emphasis on regulation of their formation and activity. Permission of instructor required.
Credit, 2-5. Mr. Lessie, Mr. Mortlock.

750. MICROBIAL CYTOLOGY.
Lectures, literature reviews, and laboratory; a comprehensive survey of the structure of microbial cells and the functions of their components; use of the electron microscope and ancillary equipment. Permission of instructor required.
Credit, 3-5. Mr. Holt.

760. MICROBIAL METABOLISM.
Metabolic pathways and mechanisms in microorganisms. Lectures, readings and discussions. Permission of instructor required. Mr. Mortlock.

770. MICROBIAL GENETICS.
Inheritance and variation in microorganisms. Mechanisms of recombination, transformation, transduction, and other genetic phenomena in microorganisms. Emphasis on molecular basis. Permission of instructor required.
Credit, 4. Mr. Thorne.

780. HOST-PARASITE RELATIONSHIPS.
Intensive treatment of specific relationships between parasitic microorganisms and their hosts, by appropriate literature and laboratory studies. Permission of instructor required.
Credit, 2-5. Mr. Wilder

790. SEMINAR.
Reports and discussions of pertinent literature and research.

Normally required of all graduate majors each semester in residence. Permission of instructor required. *Credit, 1.*

800. MASTER'S THESIS. *Credit, 10.*

890. CURRENT TOPICS.
Intensive consideration of a specific microbiological topic of current interest utilizing staff and student participation and visiting scientists. Lectures and discussions only. Credit depends upon particular topic. Permission of instructor required. *Credit, 1-2.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

550. GENERAL MICROBIOLOGY.
General consideration of microbial structure, growth and physiology, and the reactions of microorganisms to their physical, chemical, and biological environments. For students intending to take more advanced courses in microbiology and other science majors.
Two class hours, two 3-hour laboratory periods.
Prerequisites, Chem 262, 166, or 160; and one semester of biological science. *Credit, 4.*

560. MICROBIAL DIVERSITY.
Principles of selective enrichment and isolation; morphological, physiological, and ecological characteristics of a number of microbial groups isolated from nature.
Two class hours, two 3-hour laboratory periods.
Prerequisite, Microbiol 550. *Credit, 4.* Mr. Canale-Parola.

580. PATHOGENIC BACTERIOLOGY.
Principles of host-parasite interactions; microbial virulence; pathogenic mechanisms; innate and acquired immunity to infectious disease.
Prerequisite, Microbiol 550. *Credit, 4.* Mr. Wilder.

610. IMMUNOLOGY.
The nature of antigens and antibodies, their interactions and significance in resistance and hypersensitivity.
Two class hours, two 3-hour laboratory periods.
Prerequisite, Microbiol 550, or permission of instructor. *Credit, 4.* Mr. Cox.

620. VIROLOGY.
The structure, and the chemical, physical, and biological properties of bacterial viruses.
Two class hours, two 3-hour laboratory periods.
Prerequisites, Microbiol 550 and permission of instructor. *Credit, 4.* Mr. Dowell.

640. MICROBIAL PHYSIOLOGY.
Microbial chemistry and growth. Composition of bacterial cells, energy metabolism, biosynthesis of macro-molecules and macromolecule precursor materials, and regulatory mechanisms governing these events. Permission of instructor required. Mr. Mortlock, Mr. Lessie.

Music

GRADUATE FACULTY

Robert V. Sutton, *Professor and Head of the Department of Music,* B.M., University of Alabama, 1948; M.M., Eastman School of Music, 1949; Ph.D., 1955.

John R. King, *Professor and Graduate Program Director,* B.Mus., Cambridge University, 1935; M.A., 1939; F.A.G.O. (American Guild of Organists), 1945; Ph.D., University of Toronto, 1950.

Philip Bezanson, *Professor,* B.Mus., Yale School of Music, 1940; M.A., University of Iowa, 1948; Ph.D., 1951.

Nigel Coxe, *Assistant Professor,* L.R.A.M., Royal Academy of Music, London, 1950; F.R.A.M., 1964.

Richard duBois, *Professor,* B.Mus., Heidelberg College, 1948; M.M., American Conservatory of Music, 1949; Ph.D., University of Iowa, 1964.

Robert Stern, *Associate Professor,* B.A., University of Rochester, 1955; M.A., Eastman School of Music, 1956; Ph.D., 1962.

William D. Gaver, *Assistant Professor,* B.M., Eastman School of Music, 1954; M.M., University of Houston, 1958; D.M.A., University of Missouri at Kansas City, 1971.

Peter H. Tanner, *Associate Professor,* B.M., Eastman School of Music, 1958; M.M., 1959; Ph.D., The Catholic University of America, 1967.

Frederick C. Tillis, *Professor,* B.A., Wiley College, 1949; M.A., University of Iowa, 1952; Ph.D., 1963.

Miriam Whaples, *Associate Professor,* B.A., Indiana University, 1950; M.M., 1954; Ph.D., 1958.

A minimum of 33 hours and a comprehensive oral examination are required for the Master of Music degree. A basic core of courses in music theory and history and ensemble work is required of all degree candidates. The further hours are required according to the area of concentration, as advised, and electives are usually possible.

Areas of concentration are: Performance; Music Education; Music-History & Musicology; Theory-Composition. Candidates for the M.M. in Composition must submit, in lieu of a thesis, one original composition in large form (chamber music, orchestral, choral with instruments, or the like).

For admission in any area of concentration an audition in person (or by tape) is required in the applicant's major performance subject (instrument or voice). In Theory-Composition, scores of recent work are additionally required. On graduate registration day, Placement Tests are held in music theory, history, and piano proficiency. Applicants should write immediately and separately to the Music Department for the M.M. leaflet, and name their performance subject and any alternative concentration. A double concentration is also usually possible with six or more additional hours.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS. *Credit, 1-6.*

701, 702. SEMINAR IN MUSICOLOGY.
Materials and methods of systematic and historical musicology. Specialized topics investigated each semester. The application to different problems of various subjects such as history, acoustics, aesthetics, analysis. May be repeated for credit with varying content as advised. Mr. King.

710. COUNTERPOINT (CANON AND FUGUE).
Writing and analysis of invertible counterpoint, various canonic devices, and fugue. Mr. Bezanson, Mr. Fussell.

711, 712. COMPOSITION.
Free composition in various forms and media. Individual lessons. Weekly seminar. Mr. Bezanson.

713-716. ANALYSIS OF MUSIC LITERATURE.
Representative compositions from each period. Analysis by score and sound of the various musical forms and media.

713. ANALYSIS OF MUSIC LITERATURE, 1600-1750.

714. ANALYSIS OF MUSIC LITERATURE, 1750-1825.

715. ANALYSIS OF MUSIC LITERATURE, 1825-1900.

716. ANALYSIS OF MUSIC LITERATURE, 1890-PRESENT.

717. HISTORY AND PEDAGOGY OF THEORY.
Principal authors of treatises dealing with composition, counterpoint, and harmony. Emphasis on the relationship between the works discussed and contemporary pedagogical techniques of presenting theory and allied subjects.

721-738. PERFORMANCE—INDIVIDUAL INSTRUCTION.
Literature and instrumental technique or voice production. Audition required. *Credit, 1-4.*

721. APPLIED PIANO.
Mr. Coxe, Miss Kaeser, Mrs. Olevsky.

723. APPLIED VOICE.
Mr. d'Armand, Mr. Humphrey, Miss Ornest.

724. APPLIED VIOLIN. Mr. Olevsky.

725. APPLIED VIOLA. Mr. Olevsky.

726. APPLIED CELLO. Mr. Teraspulsky.

728. APPLIED FLUTE. Mrs. Tanner.

729. APPLIED OBOE. Mr. Lehrer.

730. APPLIED CLARINET. Mr. Contino.

731. APPLIED BASSOON. Miss Smith.

732. APPLIED SAXOPHONE. Miss Smith.

733. APPLIED TRUMPET. Mr. Chestnut.

734. APPLIED FRENCH HORN. Mr. Jenkins.

735. APPLIED TROMBONE. Mr. Duchi.

736. APPLIED BARITONE HORN. Mr. Duchi.

737. APPLIED TUBA. Mr. Duchi.

738. APPLIED PERCUSSION. Mr. Tanner.

741. SUPERVISION AND ADMINISTRATION OF MUSIC.
The function of the music supervisor, and administrative problems in public school. Mr. duBois.

742. RESEARCH IN MUSIC EDUCATION.
Individual research projects in selected areas of Music Education. Mr. duBois.

751. MUSIC EDUCATION IN THE ELEMENTARY SCHOOL.
Exploration and evaluation of recent trends in elementary school music. Curriculum planning, materials, techniques. Mr. Gaver.

752. INSTRUMENTAL MUSIC IN THE PUBLIC SCHOOL.
The teaching of instrumental music: organization and pedagogical problems. Evaluation of current methods, materials, and research. Mr. Gaver.

753. CHORAL MUSIC IN THE PUBLIC SCHOOL.
Organization of the choral program in the junior and senior high school. Materials and methods of teaching small and large vocal ensembles. Mr. duBois.

754. ADVANCED ORCHESTRAL CONDUCTING.
Score analysis, rehearsal techniques, and advanced conducting problems of orchestral ensembles. Mr. Steele.

755. ADVANCED CHORAL CONDUCTING.
Score analysis, rehearsal techniques, and advanced conducting problems of choral ensembles. Mr. duBois.

800. MASTER'S THESIS. *Credit, 3-10.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

014. REMEDIAL THEORY.
For students deficient in undergraduate theory. Materials adapted to individual requirements. *Credit, 0.*

503. MUSIC HISTORY—FROM MONTEVERDI TO BACH.
The Baroque and Rococo periods, including the music of such composers as Monteverdi, Schütz, Lully, Purcell, Corelli, Couperin, Rameau, the Scarlattis, Bach, Handel. Mr. King.

505. MUSIC HISTORY—MEDIEVAL AND RENAISSANCE MUSIC.
Chant and organum through Renaissance motet and madrigal. Reading, listening, score study, analysis. Mrs. Whaples.

509. MUSIC HISTORY—MUSIC OF THE 20TH CENTURY.
Music, European and American, written since 1900. Includes Stravinsky, Bartok, Hindemith, Copland, jazz, and electronic music. Mr. Fussell, Mr. Tillis.

515. COUNTERPOINT.
Techniques of counterpoint, and analysis of polyphonic music of the 16th century. Composition in small forms, utilizing contrapuntal techniques. Mr. Fussell, Mr. Stern.

516. ORCHESTRATION.
Problems in scoring for various ensembles including full orchestra. Mr. Stern.

517. CONTEMPORARY TECHNIQUES.
Melody, rhythm, harmony, and form in 20th-century music. Analysis, listening, written assignments.
Credit, 2. Mr. Stern.

525. MARCHING BAND TECHNIQUES.
Organization, training, and repertoire for the high school and college marching band. Charting of drills, formations, and continuity. *Credit, 2.* Mr. Jenkins.

526. ADVANCED CHORAL LITERATURE AND TECHNIQUES.
Historical survey of choral literature and the study of performance practices. Mr. Harler.

527. ADVANCED ORCHESTRAL LITERATURE AND TECHNIQUES.
Historical survey of orchestral literature and the study of performance practices. Mr. Steele.

528. ADVANCED BAND LITERATURE AND TECHNIQUES.
Historical survey of wind ensemble and band literature and the study of performance practices. Mr. Jenkins.

602. MUSIC HISTORY—HAYDN, MOZART, AND BEETHOVEN.
Reading, listening, score study. Music of Haydn, Mozart, and Beethoven, and possibly that of their contemporaries.
Mr. King.

602. MUSIC HISTORY—FROM SCHUBERT TO DEBUSSY.
Historical study of 19th-century music in small and large forms, and various media including keyboard instruments. Lieder, chamber music, symphony, opera. Reading, listening, score study. Mr. King.

603. MUSIC HISTORY—HISTORY OF OPERA.
History of opera from the late 16th through the present century.
Mr. King.

Performing Organizations

761. UNIVERSITY CHORALE.
Advanced choir, selected by audition. Preparation and performance of choral literature ranging from the Renaissance

to contemporary music. Performance on campus and on concert tours. Three or four rehearsals a week. Chamber Singers selected from this group. *Credit, 1.* Mr. duBois.

762. UNIVERSITY CHORUS.
Open to all. Preparation and concert performance of oratorios and other large choral works. *Credit, 1.* Mr. Harler.

765. WOMEN'S CHOIR.
A select choir specializing in literature for women's voices. Audition required. *Credit, 1.* Mr. Harler.

767. CHAMBER SINGERS.
Vocal ensembles specializing in performance of chamber music from Renaissance to contemporary. Audition required. *Credit, 1.* Mr. duBois.

768. MADRIGAL SINGERS.
Vocal ensemble specializing in music of the Renaissance. Audition required. *Credit, 1.* Mr. Harler.

771. UNIVERSITY ORCHESTRA.
Preparation and performance of orchestral literature of various styles and periods. *Credit, 1.* Mr. Steele.

781. MARCHING BAND.
Preparation and performance of pre-game and half-time shows during the football season. May be taken one semester with a semester of Music 782 or 783, or for two semesters. *Credit, 1.* Mr. Duchi, Mr. Jenkins.

782. SYMPHONY BAND.
Preparation and performance of band and wind ensemble literature of various styles and periods. May be taken one semester with a semester of Music 781 or 783, or for two semesters. *Credit, 1.* Mr. Jenkins.

783. CONCERT BAND.
Preparation and limited performance of selected band literature. May be taken one semester with a semester of Music 781 or 782, or for two semesters. *Credit, 1.* Mr. Duchi.

787. ENSEMBLE.
Preparation and performance of appropriate literature for small instrumental and vocal ensembles. *Credit, 1.*

Nursing

GRADUATE FACULTY

Mary E. Helming, *Professor and Director of the Division of Nursing,* R.N., Massachusetts General Hospital School of Nursing, 1940; B.S., Simmons College, 1948; M.S.N., The Catholic University of America, 1954.

Alvin E. Winder, *Professor and Graduate Program Director,* B.A., Brooklyn College, 1947; M.S., University of Illinois, 1948; Ph.D., University of Chicago, 1952.

Catherine G. Adams, *Assistant Professor of Psychiatric Nursing,* B.S.N., University of Connecticut, 1957; R.N., Boston University, 1960; M.S., 1960.

Virginia Earles, *Professor of Medical-Surgical Nursing,* B.S.N., Syracuse University, 1950; M.S., 1954.

Susan D. Grancio, *Assistant Professor of Medical-Surgical Nursing,* B.S.N., Georgetown University, 1965; R.N., New York University, 1969; M.A., 1969.

Anne Marie Haase, *Associate Professor,* B.S., State University of New York, 1963; M.A., University of Connecticut, 1967; Ph.D., 1969.

May B. Hall, *Assistant Professor of Psychiatric-Mental Health Nursing,* R.N., St. Barnabas Hospital for Women and Children, 1939; B.S., Marquette University, 1951; M.S., Boston University, 1953.

Constance A. Petrunenko, *Associate Professor of Community Nursing,* R.N., Children's Hospital School of Nursing, 1942; B.S.N., Boston University, 1948; M.A., Columbia University, 1952.

Loretta R. Sharp, *Associate Professor of Pediatric Nursing,* B.S.N., University of Colorado, 1944; M.A., University of Chicago, 1954.

Ruth A. Smith, *Associate Professor of Community Nursing,* R.N., Massachusetts General Hospital School of Nursing, 1944; B.S., University of Connecticut, 1953; M.N., University of Washington, 1961.

The program has been developed in consideration of four broad areas: first, the need for clinical specialization to follow the general preparation in baccalaureate education; second, the changing needs of society in regard to nursing which are intimately related to the rapid advances in health practice based upon the explosion of knowledge in the sciences; third, the imperative need for the development of theoretical content for the profession of nursing based upon research and other scholarly pursuits; and, fourth, the need for the development of leadership personnel who have new knowledge, new insights and concepts, and who are prepared to cope with the constantly changing functions and roles of the professional nurse. Clinical specialization in Community Health Nursing, Medical-Surgical Nursing, and Psychiatric-Mental Health Nursing is provided.

The first three semesters emphasize advanced study in clinical nursing, both theory and practice, and advanced study of the natural and behavioral sciences, and an introduction to research methodology. In the fourth semester, the student may elect to concentrate in one of the functional areas—supervision and administration of nursing, or the teaching of nursing. Concurrent field practice is provided in both areas. As a third alternative, the student may choose to continue clinical study, concentrating in greater depth in some specialized area of the major field or in a second area of clinical interest.

Candidates for admission, in addition to the minimum Graduate School requirements, must present evidence of:

a. Graduation from a baccalaureate program in nursing accredited by the National League for Nursing.

b. Evidence of academic ability, on the basis of the Miller Analogy Test or the Graduate Record Examination.

c. Professional references indicating expectation of success in a graduate program.

Requirements for the master's degree in nursing include:

1. Total of 48 credits, of which a minimum of 36 are in combined clinical nursing and related behavioral and natural sciences and research. The remaining 12 credits may be in one of the functional areas of administration or teaching of nursing or may be devoted to the study of a specialized area in the major clinical field or a second clinical field.

2. Field practice, required of all students who

elect a concentration in administration or teaching in the fourth semester.

3. A field study (Nursing 700, Problems) or Master's Thesis (Nursing 800) in a selected area of nursing. Must be completed by all students.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS OF NURSING ONLY

700. PROBLEMS IN NURSING.
Independent study, including the completion of a field study of a selected problem in nursing, under guidance of a faculty adviser.

703. MEDICAL-SURGICAL NURSING I.
Theoretical framework for application of the behaviora sciences to enhance the therapeutic process through nurse-patient interaction; understanding of the dynamics of behavior in illness, and in solving clinical problems.

704. MEDICAL-SURGICAL II.
Principles of the biological and physical sciences pertinent to the designation and implementation of highly-skilled patient-care. Includes depth analysis of clinical data. Emphasis on definition of the scientific basis for nursing action.

705. MEDICAL-SURGICAL NURSING III.
A seminar in clinical nursing devoted to identification of research themes in nursing and medicine, development of theoretical concepts of nursing based on research and clinical study, and identification of research questions relevant to nursing practice. *Credit, 6.*

706. MEDICAL-SURGICAL NURSING IV.
Guided study. Opportunity for development of special skills in nursing, specialization in study of content and pursuit of research interests. *Credit, 6-12.*

708. SEMINAR IN RESEARCH IN NURSING.
Introduction to research design and methods and their application to nursing problems. Mrs. Haase.

709. PSYCHIATRIC NURSING I.
Seminar and practicum in clinical and community psychiatric nursing. Opportunities for advanced students to refine and sharpen skills, knowledge, and understanding in defining and performing in the therapeutic role of providing nursing care to individuals who are mentally ill or in preventing such illness.

710. PSYCHIATRIC NURSING II.
Seminar and practicum in defining and determining the therapeutic role of the clinical specialist in providing nursing care needed by groups and families. Primary, secondary, and tertiary prevention emphasized in both theory and practice. Leadership functions identified and experience as the therapeutic role is extended beyond the one-to-one relationship.

711. PSYCHIATRIC NURSING III.
Opportunity for the clinical nurse specialist to become familiar with the consultant role. Practicum experience in functioning as a nursing consultant; theories of communities and consultation necessary for the performance. *Credit, 6.*

712. PSYCHIATRIC NURSING IV.
The culminating experience for the clinical nurse specialist student; opportunity to explore the supervisory and educative facets of the role, and a time for synthesis. Independent work possible in areas of special interest utilizing faculty as resource persons. *Credit, 9-12.*

715. COMMUNITY HEALTH NURSING I.
Seminar and practicum in community health nursing. Focus on the health needs of individuals and families. Theories relevant to family systems examined and applied to the family whom the nurse is caring for in the community. Includes 2 hours for seminar discussion and 4 hours for field work.

716. COMMUNITY HEALTH NURSING II.
Seminar and practicum in which a community is studied with particular attention to those aspects directly influencing the health and nursing needs of people. Identification of the interactions and interrelationships between family and community that affect health care and health behavior. Evolving patterns in the delivery of health services.

751. SEMINAR IN NURSING ADMINISTRATION.
The leadership role of the nursing administrator in the context of various theories of management and organization. Emphasis on the processes of policy formulation and decision-making and the administrator's role as a change agent in determining the character and quality of clinical nursing in an agency. Analysis of administrative problems encountered in concurrent field practice.

761. FIELD PRACTICE IN NURSING ADMINISTRATION.
Under guidance of the faculty adviser and the preceptor in the agency, experiences in various hospital units. Experience and analysis of some of the administrative problems related to provision of direct nursing care. Opportunity to participate in the major activities and to carry selected responsibilities of either the administrator of a clinical department or the director of nursing services, depending upon student background. *Credit, 6.*

762. PRACTICUM IN TEACHING.
Experience in teaching in the classroom and clinical setting. Emphasis on experience and critical evaluation of the range of teaching methods cogent to a professional field. *Credit, 3-6.*

800. MASTER'S THESIS. *Credit, 6.*

Philosophy

GRADUATE FACULTY

VERE C. CHAPPELL, *Professor, Head of the Department of Philosophy and Chairman of the Five-College Graduate Faculty of Philosophy*, B.A., Yale University, 1951; M.A., 1953; Ph.D., 1958.

JOHN ROBISON, *Associate Professor and Associate Head of the Department of Philosophy*, B.A., University of Georgia, 1957; M.A., Emory University, 1958; Ph.D., University of Pennsylvania, 1962.

HERBERT HEIDELBERGER, *Professor and Graduate Program Director*, B.A., New York University, 1955 M.A., Princeton University, 1960; Ph.D., 1962.

ROBERT ACKERMANN, *Professor*, A.B., Capital University, 1954; M.A., Ohio University, 1957; Ph.D., Michigan State University, 1960.

BRUCE AUNE, *Professor*, A.B., University of Minnesota, 1955; M.A., 1957; Ph.D., 1960.

JOHN A. BRENTLINGER, *Associate Professor*, A.B., University of Chicago, 1958; M.A., Yale University, 1960; Ph.D., 1962.

RODERICK M. CHISHOLM, *Adjunct Professor (Romeo Elton Professor of Natural Theology and Professor of Philosophy*, Brown University), A.B., Brown University, 1938; A.M., Harvard University, 1940; Ph.D., 1942.

LEONARD H. EHRLICH, *Associate Professor*, B.S., Roosevelt University, 1947; M.A., Yale University, 1958; Ph.D., 1960.

Joseph Epstein, *Professor* (Amherst College).

Fred Feldman, *Assistant Professor*, B.A., Bard College, 1963; M.A., Harpur College, 1965; Ph.D., Brown University, 1968.

Ann Ferguson, *Associate Professor*, B.A., Swarthmore College, 1959; M.A., Brown University, 1961; Ph.D., 1965.

Lawrence Foster, *Associate Professor*, A.B., University of Pennsylvania, 1961; Ph.D., 1966.

Michael Gardner, *Assistant Professor* (Mount Holyoke College).

Edmund L. Gettier, III, *Professor*, B.A., Johns Hopkins University, 1949; Ph.D., Cornell University, 1961.

Michael Jubien, *Assistant Professor*, A.B., Dartmouth College, 1965; Ph.D., Rockefeller University, 1972.

Thomas R. Kearns, *Assistant Professor* (Amherst College).

William E. Kennick, *Professor* (Amherst College).

Murray J. Kiteley, *Professor* (Smith College).

John J. LeTourneau, *Associate Professor of Logic* (Hampshire College).

William Marsh, *Associate Professor of Logic* (Hampshire College).

Gareth Matthews, *Professor*, A.B., Franklin College, 1951; A.M., Harvard University, 1952; Ph.D., 1961.

Felix Oppenheim, *Professor of Political Science and of Philosophy.*

Kathryn Pyne Parsons, *Associate Professor* (Smith College).

Terence Parsons, *Associate Professor*, B.A., University of Rochester, 1961; Ph.D., Stanford University, 1966.

Barbara Hall Partee, *Professor of Linguistics and of Philosophy.*

Richard S. Robin, *Professor* (Mount Holyoke College).

David S. Schwarz, *Assistant Professor* (Mount Holyoke College).

Mary Sirridge, *Assistant Professor*, B.A., St. Mary's College, 1967; M.A., Ohio State University, 1971; Ph.D., 1972.

Robert C. Sleigh, Jr., *Professor*, A.B., Dartmouth College, 1954; M.A., Brown University, 1957; Ph.D., 1963.

Malcolm B. E. Smith, *Assistant Professor* (Smith College).

George V. Tovey, *Professor* (Mount Holyoke College).

A. Thomas Tymoczko, *Assistant Professor* (Smith College).

Christopher Witherspoon, *Assistant Professor* (Hampshire College).

Robert Paul Wolff, *Professor*, A.B., Harvard University, 1953; A.M., 1954; Ph.D., 1957.

Two graduate programs are offered in philosophy. The M.A. program is operated by the University's Department of Philosophy, and the Ph.D. program by its Graduate Faculty of Philosophy, which includes members of the Amherst, Hampshire, Mount Holyoke, and Smith College Faculties as well as of the University Department.

THE COOPERATIVE Ph.D. PROGRAM

The Ph.D. degree in philosophy is offered by the University in cooperation with Amherst, Hampshire, Mount Holyoke, and Smith Colleges. Though the degree is awarded by the University's Board of Trustees, a student may be in residence at any one of the five institutions; the institution of residence is noted on his permanent record.

The Cooperative Program in Philosophy is administered by the University's Graduate Faculty of Philosophy. This Faculty consists of all those teachers of philosophy at the five institutions who have been admitted to the Graduate Faculty of the University.

Admission to the Program is determined by the Graduate School upon recommendations by the Admissions Committee of the Faculty.

Upon entering the Program, each student is assigned a Faculty member as Adviser, who provides consultation concerning schedule of courses, progress, and any special problems encountered.

Students generally take four courses (12 credit hours) each semester during their first two years in the Program. The total course requirement for the Ph.D. degree is 16 courses (48 hours) exclusive of Philosophy 800 and 900. Of these 16, eight (24 hours) must be University philosophy courses numbered above 700. The remaining eight may include: up to six hours of Philosophy 700; University philosophy courses at the 500- or 600-level; comparable courses at the four cooperating Colleges or, with the approval of the Faculty's Director of Studies, at other institutions; or, again with the approval of the Director of Studies, graduate courses in other fields at the University or the cooperating Colleges.

There is no language requirement for the Ph.D. in philosophy.

The remaining requirements for the Ph.D. degree have recently been revised. Current information is available in the Philosophy Department office.

THE M.A. PROGRAM

The M.A. Program in Philosophy is administered by the University's Department of Philosophy.

Admission to the Program is determined by the Graduate School upon recommendations made by the Department's Admissions Committee.

Upon entering the Program, each student is assigned a Department member as Adviser, who provides consultation concerning schedule of courses, progress, and any special problems encountered.

Students generally take four courses (12 credit hours) each semester during their first year in the Program. The total course requirement for the M.A. degree is 10 courses (30 hours). Of these 10, four (12 hours) must be University philosophy courses numbered above 700, exclusive of Philosophy 800. The remaining six may include: up to six hours of Philosophy 700; six hours of Philosophy 800 (for students who write

a thesis); University philosophy courses at the 500- or 600-level; comparable courses at Amherst, Hampshire, Mount Holyoke, and Smith Colleges; or, with the approval of the Department's Graduate Program Director, up to six hours of graduate courses in other fields at the University or the four Colleges.

There is no language requirement for the M.A. in philosophy.

The remaining requirements for the M.A. degree have recently been revised. Current information is available in the Philosophy Department office.

Not all of the following courses are given every year, nor are they always taught by the same instructors. A list of courses offered in 1974-75, indicating the instructor and the particular topics to be covered in each, will be available in the Philosophy Department office around April 15.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. RESEARCH AND READING IN PHILOSOPHY.

705. PROSEMINAR. Mr. Feldman.

710. SELECTED PHILOSOPHER I. Mr. Chappell.

711. SELECTED PHILOSOPHER II. Mr. Sleigh.

715. PLATO. Mr. Matthews.

720. KANT I. Mr. Ehrlich.

721. KANT II. Mr. Wolff.

725. EXISTENTIAL PHILOSOPHY.

740. FORMAL LOGIC.

745. ETHICS. Mr. Aune.

750. PHILOSOPHY OF EDUCATION.

751. PHILOSOPHY OF RELIGION.

755. PHILOSOPHY OF LANGUAGE. Mr. Parsons.

756. PHILOSOPHY OF SCIENCE. Mr. Ackermann.

760. METAPHYSICS. Mr. Jubien.

761. PHILOSOPHY OF MIND. Mr. Heidelberger.

765. THEORY OF KNOWLEDGE. Mr. Gettier.

780. PROBLEMS IN THE HISTORY OF PHILOSOPHY I. Ms. Sirridge.

781. PROBLEMS IN THE HISTORY OF PHILOSOPHY II. Mr. Robison.

790. SEMINAR. Mr. Chisholm.

791. SEMINAR. Ms. Partee.

800. MASTER'S THESIS.

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

501. PLATO AND ARISTOTLE. Mr. Chappell.

502. MEDIEVAL PHILOSOPHY. Mr. Brentlinger.

503. CONTINENTAL RATIONALISM. Mr. Sleigh.

504. BRITISH EMPIRICISM. Mr. Foster.

505. KANT AND 19TH-CENTURY PHILOSOPHY. Mr. Ehrlich.

518. AMERICAN PHILOSOPHY. Mr. Robison.

525. INDIAN PHILOSOPHIES.

526. EAST ASIAN PHILOSOPHIES.

530. INTERMEDIATE LOGIC. Mr. Jubien.

531. FORMAL FOUNDATIONS OF LINGUISTIC THEORY. Ms. Partee.

543. PHILOSOPHY OF ART. Ms. Sirridge.

561. CONTEMPORARY ANALYTIC PHILOSOPHY. Mr. Heidelberger.

563. MARXISM. Mr. Brentlinger.

564. EXISTENTIAL PHILOSOPHIES. Ms. Sirridge.

640. PHILOSOPHY OF SCIENCE. Mr. Foster.

641. PHILOSOPHY OF RELIGION. Mr. Ackermann.

642. POLITICAL PHILOSOPHY. Mr. Oppenheim.

643. AESTHETICS. Ms. Ferguson.

644. EPISTEMOLOGY. Mr. Ackermann.

645. METAPHYSICS. Mr. Aune.

646. PHILOSOPHY OF LANGUAGE. Ms. Parsons.

650. HISTORY OF ETHICS. Mr. Gardner.

651. ETHICAL THEORY. Mr. Feldman.

665. PHILOSOPHICAL THEOLOGY. Mr. Ehrlich.

671. PHILOSOPHY AND LOGIC. Mr. Sleigh.

672. MATHEMATICAL LOGIC I. Mr. Parsons.

673. MATHEMATICAL LOGIC II. Mr. Marsh.

674. PHILOSOPHY OF MATHEMATICS. Mr. Jubien.

681. SELECTED ANCIENT OR MEDIEVAL PHILOSOPHER. Mr. Matthews.

682. SELECTED MODERN CONTINENTAL PHILOSOPHER. Mr. Smith.

683. SELECTED MODERN BRITISH PHILOSOPHER. Mr. Wolff.

684. CONTEMPORARY PROBLEMS. Mr. Schwarz, Mr. Tymoczko.

691. SEMINAR. Mr. Kearns.

692. SEMINAR. Mr. Kiteley.

Physical Education

(see also EXERCISE SCIENCE)

GRADUATE FACULTY

DAVID C. BISCHOFF, *Professor and Dean of the School of Physical Education*, B.S., Pennsylvania State, 1952; M.Ed., North Carolina, 1953; Ph.D., Pennsylvania State, 1958.

William E. Randall, Jr., *Professor and Head of the Department of Recreation,* B.S., University of Massachusetts, 1949; M.S., University of Wisconsin, 1951; Ph.D., 1952.

Betty Spears, *Professor and Head of the Department of Physical Education for Women,* B.S., Purdue University, 1940; M.S., Wellesley College, 1944; Ph.D., New York University, 1956.

Harold J. VanderZwaag, *Professor and Head of the Department of Physical Education for Men,* B.A., Calvin College, 1951; M.A., University of Michigan, 1952; Ph.D., 1962.

Margaret A. Coffey, *Professor,* B.S., DePauw University, 1943; M.A., Iowa, 1946; Ph.D., 1963.

Ellen W. Gerber, *Associate Professor,* B.S., Boston University, 1957; M.Litt., Pittsburgh, 1960; Ph.D., Southern California, 1966.

E. Vickery Hubbard, *Associate Professor,* B.S., Wisconsin, 1932; M.A., Chicago, 1951; Ed.D., California, 1961.

Guy M. Lewis, *Professor,* B.S., East Carolina College, 1950; M.Ed., North Carolina, 1952; Ph.D., Maryland, 1964.

John W. Loy, Jr., *Associate Professor,* B.S., Lewis and Clark College, 1961; M.A., Iowa, 1963; Ph.D., Wisconsin, 1967.

Carole Oglesby, *Assistant Professor,* B.S., University of California at Los Angeles, 1961; M.S., 1964; Ph.D., Purdue University, 1969.

C. Lynn Vendien, *Associate Professor,* B.S., Eastern Michigan, 1932; M.A., Michigan, 1945; Ed.D., Stanford, 1957.

Sport Studies

CURRICULAR REQUIREMENTS

M.S. in Physical Education and Ph.D. in Human Movement

Graduate degrees offered by the School of Physical Education are the Master of Science (M.S.) in Physical Education and the Doctor of Philosophy (Ph.D.) in Human Movement. Three programs of study leading to the M.S. degree have been structured as concentrations and identified as Exercise Science, General and Sport Studies. The latter concentration includes a related professional program in Sport Administration. Concentrations in either Exercise Science or Sport Studies are available at the Ph.D. level. Sport Studies consists of specialization in the history, sociology, social psychology and philosophy of sport. Outlined below are specific curricular requirements for the concentrations in sport studies:

M.S. (non-thesis)

°Core	— 12 hrs.
Seminars	— 9
Electives	— 9
	30 hrs.

M.S. (thesis)

°Core	— 12 hrs.
Thesis	— 6
Seminars	— 6
Electives	— 6
	30 hrs.

M.S.—Sport Administration

°Core	— 12 hrs.
700. Special Problems (Sport Administration)	— 3
700. Special Problems (Internship in Sport Admin.)	— 6
Electives (at least 6 hours in the School of Business Admin.)	— 9
	30 hrs.

°Core Courses—
561. World History of Sport
564. Philosophy of Sport
565. Sociology of Sport
or
662. History of Sport in the United States

Ph.D.

A. School of Physical Education—Content Courses	30 hrs.
1. Basic Courses (500 and 600 level)	15 hrs.
2. Advanced Courses	15 hrs.
a. Seminars in major and minor specializations°	6 hrs.
b. Advanced Topics and Seminars	9 hrs.
B. School of Physical Education—Research	30 hrs.
1. Thesis (800)	6 hrs.
2. Seminar in Human Movement (899)	6 hrs.
3. Dissertation (900)	18 hrs.
C. Related Work (taken in departments outside School of Phys. Ed.)	30 hrs.
1. Cognate Field°°	15 hrs.
2. Electives	15 hrs.
TOTAL	90 hrs.

(18 of the 30 hours in related work must be taken at the 700 or above level.)

°Seminar—
782. Seminar in the Sociology of Sport

°°Study in one of the following departments—
History
Sociology
Psychology
Philosophy

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

(For either major or minor credit)

Sociology of Sport

565. SOCIOLOGY OF SPORT.
Sport as a social institution, including both the structure and function of sport.
Prerequisite, PE 200. Mr. Loy.

782. SEMINAR IN THE SOCIOLOGY OF SPORT.
An analysis of the utility of sociological paradigms, models and theories for the explanation of sport phenomena, including autotelic and agonetic behavior.
Prerequisites, PE 565, one sociological theory course, and one research methods course. Mr. Loy.

Philosophy of Sport

564. PHILOSOPHY OF SPORT.
A philosophical analysis of key concepts which influence the

objectives and content of various programs in the broad realm of sport.
Prerequisite, PE 203. Mr. VanderZwaag.

664. ATHLETICS: A PHILOSOPHIC INQUIRY.
A critical analysis of those historical, sociological, and psychological factors which have influenced the concept of athletics and caused issues in programs associated with this concept.
Prerequisite, PE 564. Mr. VanderZwaag.

History of Sport

561. WORLD HISTORY OF SPORT.
Factors influencing the rise of sport and the role of sport in society.
Prerequisite, PE 202. Mr. Lewis.

662. HISTORY OF SPORT IN THE UNITED STATES.
Sport in America from earliest times to the contemporary period. Emphasis on the social, political, and economic factors which affected the development of sport.
Prerequisite, PE 561. Mr. Lewis.

666. HISTORY OF SCHOOL AND COLLEGE SPORT.
Developments in sport at educational institutions from the age of unorganized play to the present.
Prerequisites, PE 561 or PE 662. Mr. Lewis.

Other Courses

663. COMPARATIVE SPORT.
A comparative analysis of sport in selected countries. Emphasis on historical, cultural, and social values affecting the status of sport.
Prerequisite, PE 561. Miss Vendien.

700. SPECIAL PROBLEMS.
Topics include: sport and theories of psychological processes, history of women in sport, sport administration, internship in sport administration, the social psychology of sport, the philosophy of sport, the history of sport, and advanced individual research topics.
Credit, 1-9, fall; 1-6, spring.

799. CONTEMPORARY PROBLEMS IN HUMAN MOVEMENT.
Seminar, review, analysis, and evaluation of contemporary problems. A broad review of literature combined with critical analysis of selected items. *Credit, 3-6.*

800. MASTER'S THESIS. *Credit, 3-6.*

834. KINESTHETIC FORM.
The problem of the definition of form in movement as it relates to learning. Miss Hubbard.

899. SEMINAR IN HUMAN MOVEMENT.
Topics in human movement not covered in regular course.
Credit, 1 each semester; Maximum credit, 6.

Physics

GRADUATE FACULTY

LEROY F. COOK, *Professor of Physics and Head of the Department of Physics and Astronomy,* B.A., California at Berkeley, 1953; M.A., 1957; Ph.D., 1959.

FRANCIS PICHANICK, *Associate Professor and Graduate Program Director in Physics and Astronomy,* B.S., University of Capetown, South Africa, 1957; M.S., 1958; Ph.D., Oxford University, England, 1961.

THOMAS T. ARNY, *Associate Professor of Astronomy,* B.A., Haverford, 1961; Ph.D., Arizona, 1965.

JOHN J. BREHM, *Professor,* B.S., Maryland, 1956; M.S., Cornell, 1959; Ph.D., Maryland, 1963.

FREDERICK W. BYRON, *Associate Professor,* B.A., Harvard, 1959; Ph.D., Columbia, 1963.

EDWARD S. CHANG, *Assistant Professor,* B.A., California at Riverside, 1961; M.A., 1964; Ph.D., 1967.

JAMES T. DAKIN, *Assistant Professor,* B.A., Harvard, 1967; Ph.D., Princeton, 1971.

WILLIAM A. DENT, *Associate Professor of Astronomy,* B.S., Case Institute of Technology, 1960; M.S., University of Michigan, 1962; Ph.D., 1965.

STANLEY ENGELSBERG, *Professor,* B.S., Massachusetts Institute of Technology, 1955; M.A., Harvard, 1957; Ph.D., 1961.

NORMAN C. FORD, *Associate Professor,* B.S., Massachusetts Institute of Technology, 1953; M.A., Syracuse, 1960; Ph.D., California at Berkeley, 1964.

DIETRICH R. FREYTAG, *Associate Professor,* Diploma, University of Bonn, Germany, 1958; Ph.D., 1962.

WILLIAM J. GERACE, *Associate Professor,* B.S., Massachusetts Institute of Technology, 1963; Ph.D., Princeton, 1967.

ROBERT L. GLUCKSTERN, *Professor and Vice Chancellor for Academic Affairs,* B.E.E., City College of New York, 1944; Ph.D., Massachusetts Institute of Technology, 1948.

H. MARK GOLDENBERG, *Associate Professor,* B.S., California Institute of Technology, 1956; M.S., Harvard, 1957; Ph.D., 1960.

EUGENE GOLOWICH, *Associate Professor,* B.S., Rensselaer Polytechnic Institute, 1961; Ph.D., Cornell, 1965.

ROBERT A. GUYER, *Associate Professor,* B.S., New Mexico State, 1959; Ph.D., Cornell, 1966.

ROBERT B. HALLOCK, *Assistant Professor,* B.S., Massachusetts, 1965; M.S., Stanford, 1967; Ph.D., 1969.

EDWARD R. HARRISON, *Professor of Astronomy,* Graduate, Institute of Physics, England, 1949; Associate, 1956; Fellow, 1963.

STANLEY S. HERTZBACH, *Associate Professor,* B.E.S., Johns Hopkins, 1959; Ph.D., 1965.

ALLAN R. HOFFMAN, *Assistant Professor,* B.E. Phys., Cornell, 1959; M.S., Illinois, 1961; Ph.D., Brown, 1966.

BARRY R. HOLSTEIN, *Assistant Professor,* B.S., Carnegie Institute of Technology, 1965; M.S., 1967; Ph.D., Carnegie-Mellon University, 1969.

G. RICHARD HUGUENIN, *Professor of Astronomy,* B.S., Massachusetts Institute of Technology, 1959; Ph.D., Harvard, 1964.

DAVID R. INGLIS, *Professor,* B.A., Amherst, 1928; D.Sc., Michigan, 1931.

WILLIAM M. IRVINE, *Professor of Astronomy and Head of the Astronomy Program,* B.A., Pomona College, 1957; M.A., Harvard, 1958; Ph.D., 1961.

PHILLIPS R. JONES, *Professor,* B.S., Massachusetts, 1951; M.S., Connecticut, 1956; Ph.D., 1959.

Joseph W. Kane, *Assistant Professor,* B.S., Wisconsin at Milwaukee, 1961; M.S., Illinois, 1962; Ph.D., 1966.

Richard R. Kofler, *Associate Professor,* B.S., Marquette University, 1958; M.S., Wisconsin, 1960; Ph.D., 1964.

Michael N. Kreisler, *Associate Professor,* B.A., Princeton, 1962; M.S., Stanford, 1963; Ph.D., Stanford, 1966.

Robert V. Krotkov, *Professor,* B.A., Queens University, Canada, 1951; M.S., 1952; Ph.D., Princeton, 1958.

Kenneth H. Langley, *Associate Professor,* B.S., Massachusetts Institute of Technology, 1958; Ph.D., California at Berkeley, 1966.

Richard N. Manchester, *Associate Professor of Astronomy,* B.S., University of Canterbury, New Zealand, 1964; Ph.D., University of Newcastle, Australia, 1969.

William J. Mullin, *Associate Professor,* B.S., St. Louis University, 1956; Ph.D., Washington University (St. Louis), 1965.

Claude M. Penchina, *Associate Professor,* B.E., Cooper Union, 1959; M.S., Syracuse University, 1961; Ph.D., 1964.

Gerald A. Peterson, *Professor,* B.S., Purdue, 1953; M.A., 1955; Ph.D., Stanford, 1962.

Arthur R. Quinton, *Professor,* B.S., Queen Mary College, London University, England, 1944; M.S., University of Western Ontario, Canada, 1951; Ph.D., Yale, 1954.

Monroe S. Rabin, *Associate Professor,* B.A., Columbia, 1961; M.S., Rutgers, 1964; Ph.D., Rutgers, 1967.

Philip Rosen, *Professor,* B.S., City College of New York, 1944; M.S., Yale, 1946; Ph.D., 1949.

Kandula S. R. Sastry, *Associate Professor,* B.S., Andhra University, India, 1955; M.S., 1956; Ph.D., Indiana, 1962.

Janice Button Shafer, *Professor,* B.E.P., Cornell, 1954; Ph.D., California at Berkeley, 1959.

Edward A. Soltysik, *Professor,* B.S., Lafayette, 1950; M.S., Indiana, 1952; Ph.D., 1956.

Morton M. Sternheim, *Professor,* B.S., City College of New York, 1954; M.S., New York University, 1956; Ph.D., Columbia, 1961.

John D. Strong, *Professor of Astronomy,* B.A., Kansas, 1926; Ph.D., Michigan, 1930.

Arthur R. Swift, *Associate Professor,* B.A., Swarthmore, 1960; Ph.D., Pennsylvania, 1964.

Eugene Tademaru, *Assistant Professor of Astronomy,* B.S., University of Illinois, 1964; Ph.D., University of Chicago, 1969.

Joseph H. Taylor, Jr., *Associate Professor of Astronomy,* B.A., Haverford, 1963; Ph.D., Harvard, 1968.

David J. van Blerkom, *Assistant Professor of Astronomy,* B.S., City College of New York, 1963; Ph.D., Colorado, 1969.

James F. Walker, *Assistant Professor,* B.S., Minnesota, 1959; M.S., 1961; Ph.D., 1964.

Randy R. Whitney, *Assistant Professor,* B.A., University of Oregon Honors College, 1966; Ph.D., Stanford, 1971.

Graduate degrees are offered in both physics and astronomy by the Department. Candidates planning to major in astronomy are referred to the description of the astronomy program (see Astronomy).

The general requirements for the Ph.D. in Physics are those of the Graduate School. These are implemented along the following lines. During the first two years, a student takes a normal load of basic courses. The basic courses of the program are 701, 702, 703, 704, 705, 706, 707, 709, 710, 714, 715, 718, 719. The student must complete a research requirement of three research-oriented courses. Two of these must be outside of the student's area of specialization. After passing the qualifying examination the student will be expected to devote his major effort to research. Courses taken during this period will usually be in the student's research field. The department requires no foreign-language reading competency for the doctorate.

The requirements for the master's degree consist of 30 graduate credits, at least 15 of which shall be in the 700-900 courses, and at least 21 of which shall be in physics. The 15 credits of 700-900 courses shall include one course in the basic Quantum Mechanics sequence or its equivalent, and may include 6 credits of master's thesis, Physics 800. At least five courses in physics must be passed with a grade of A or B, and a general examination must be passed before the degree is awarded.

Candidates planning to major in physics should have completed at least (preferably, more than) 15 semester credit hours in undergraduate physics beyond an introductory course (such as Physics 161, 162, 163) and also 6 credits of mathematics beyond college-level calculus.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. INDEPENDENT STUDY.
Special study in some branch of physics, either theoretical or experimental, under direction of a faculty member. A written proposal must be submitted to that faculty member and to the Head of the Department for approval prior to registration.

701. CLASSICAL MECHANICS.
Lagrange's and Hamilton's equations, central force problem, rigid bodies, small oscillations, continuum mechanics, fluid dynamics.
Prerequisites, Physics 552, 556, and Math 241.

702. STATISTICAL PHYSICS.
Survey of thermodynamics, Boltzmann distribution, statistical interpretation of thermodynamics, Gibbsian ensembles and the method of Darwin, Fowler; quantum distributions and their applications, transport phenomena.
Prerequisites, Physics 701, 703, and 706 (the latter may be taken concurrently.)

703. INTRODUCTORY QUANTUM MECHANICS I.
Breakdown of classical physics, wave mechanics including the Schroedinger equation and its interpretation, one-dimensional problems, uncertainty principle, harmonic oscillator, hydrogen atom.
Prerequisites, Physics 701 and 705 (both may be taken concurrently).

704. INTERMEDIATE QUANTUM MECHANICS II.
Abstract quantum mechanics, linear algebra and Hilbert space, representation theory, three-dimensional problems, orbital angular momentum spins, vector coupling.
Prerequisites, Physics 703, or equivalent.

705. METHODS OF MATHEMATICAL PHYSICS.
Selected topics with application to physics in linear algebra and Hilbert space theory, complex variables, Green's functions, partial differential equations, integral transforms, integral equations. *Credit, 4.*

706. CLASSICAL ELECTRODYNAMICS I.
Electrostatic fields in vacuum and material media, two and three dimensional potential problems, the magnetostatic field, interaction of steady currents, Maxwell's equations, the electromagnetic field, special relativity, and covariant formulation of electrodynamics.
Prerequisites, Physics 701 and 705.

707. CLASSICAL ELECTRODYNAMICS II.
The field of a moving charge, the Lienard-Wiechert potentials, Lorentz transformation and special relativity, covariant formulation of Maxwell's equations. Radiation of electromagnetic waves; the near field and far field, radiation damping and self fields, spectral resolution of radiation. Magnetohydrodynamics and plasma physics, collisions, scattering and absorption.
Prerequisite, Physics 706.

709. INTERMEDIATE QUANTUM MECHANICS III.
Approximation methods, WKB, bound State Perturbation theory, time-dependent perturbation theory, variational method, selfconsistent techniques, scattering theory.
Prerequisite, Physics 704.

710. ADVANCED QUANTUM MECHANICS IV.
Semi-classical radiation theory, non-relativistic second quantization, advanced scattering theory; relativistic wave-equations.
Prerequisite, Physics 709.

714. INTRODUCTORY HIGH ENERGY PHYSICS.
General introduction to the physics of elementary particles treating invariance principles, analysis of π-N scattering, strange particles, final state interactions and resonances, internal symmetries, introduction to the theories of strong, electromagnetic, and weak interactions.
Prerequisite, Physics 709.

715. INTRODUCTORY SOLID STATE PHYSICS.
Solids treated as translational symmetry structures, and their effect in x-ray and particle scattering, thermal and vibrational properties of solids. Binding energy of solids, electronics in periodic potentials, and the formation of bands. The free electron model of metals.
Prerequisite, Physics 704.

717. PLASMA PHYSICS.
Properties of plasma, equation of motion, particle versus continuum description, magnetohydrodynamics, stabilities, linear theory of waves and oscillations. Landau damping, nonlinear effects and transport phenomena.
Prerequisites, Physics 702, 707.

718. BASIC PHYSICS OF ATOMS AND MOLECULES.
Quantum description of free atoms and molecules and their interactions with external fields, radiation, and electrons.

719. NUCLEAR PHYSICS.
Basic concepts of nuclear physics, instruments and methods. Topics include natural radioactivity, nuclear radiations—their properties and interaction with matter, nuclear-radiation detectors, electrostatic and magnetic analyzers, mass spectrometry, charged particle accelerators, elementary discussion of alpha and beta decay, nuclear isomerism, internal conversion, nuclear reactions, neutron physics, fissions, nuclear spin and magnetic moments, cosmic rays and elementary particles.
Prerequisite, Physics 703 or equivalent.

723. TOPICS IN MATHEMATICAL PHYSICS.
Subjects vary somewhat depending on the instructor, but probably include applications of the theory of functions, group theory and symmetries, Hilbert and Banach spaces in quantum mechanics.
Prerequisites, Physics 705 and permission of instructor.

724. GROUP THEORY IN QUANTUM MECHANICS.
Finite dimensional groups and their representations; representations of the permutation group; representations of SU_n, tensor representations, decomposition of direct product representations; three-dimensional rotation group, Clebsch-Gordon and Racah coefficients; the Lorentz group and its representations; applications to atomic, solid state, nuclear, and high energy physics.
Prerequisite, Physics 709.

811 (I), 812 (II). FIELD THEORY.
Relativistic quantum mechanics of a single particle, Klein-Gordon and Dirac equations, formal scattering theory, field quantization, interacting fields, S-matrix, reduction formulae, perturbation theory and Feynman diagrams renormalization, dispersion relations, and recent developments.
Prerequisites, Physics 709 (may be taken concurrently) for 811; Physics 811 for 812.

813. HIGH ENERGY PHYSICS.
Experimental and theoretical aspects of: meson and baryon resonances; leptonic and non-leptonic, strangeness changing and non-changings weak decays; high energy experiments and the phenomenology of Regge poles.
Topics vary with the instructor.
Prerequisite, Physics 714.

816. SOLID STATE PHYSICS.
Transport phenomena in solids including semiconductors, optical properties of solids, superconductivity, superfluidity, magnetism. Topics vary with the instructor.
Prerequisite, Physics 715.

817. ADVANCED STATISTICAL PHYSICS.
Phase transitions, including condensation; description of imperfect gases. Transport theory and other nonequilibrium phenomena. Irreversible processes. Field theoretic quantum statistical physics.
Prerequisites, Physics 702, 811.

818. ATOMIC STRUCTURE.
An advanced course covering the field of atomic structure including the theory of complex spectra, fine structure, hyperfine structure, electron spin, Zeeman effect, the theory of atomic collisions, general theory of multiplets and magnetic and radiative properties of atoms.
Prerequisite, Physics 709.

820. NUCLEAR THEORY.
A theoretical understanding of nuclear structure. Topics include internucleon forces, the deutron and the two-body problem, nuclear models and structure of complex nuclei, electromagnetic properties of nuclei, theory of alpha and beta decay, theory of nuclear reactions.
Prerequisites, Physics 709 and 719.

821. RELATIVITY.
Mathematical and conceptual aspects of the special and general theories of relativity. Lorentz transformations, covariant formulation of the laws of nature. The equivalence principle, curved spaces, solutions of the equations of relativity.
Prerequisites, Physics 701, 706.

850. ADVANCED TOPICS IN PHYSICS.
One or more subjects of special interest covered in lectures.
Prerequisite, permission of instructor.

851. SPECIAL TOPICS IN NUCLEAR PHYSICS.
Advanced and current topics in nuclear physics.
Prerequisite, Physics 820.

852. SPECIAL TOPICS IN HIGH ENERGY PHYSICS.
Advanced and current topics in high energy physics.
Prerequisite, Physics 813.

853. SPECIAL TOPICS IN SOLID STATE PHYSICS.
Advanced and current topics in solid state physics.
Prerequisite, Physics 816.

854. SPECIAL TOPICS IN ATOMIC PHYSICS.
Advanced and current topics in atomic physics.
Prerequisite, Physics 818.

860. SEMINAR ON RESEARCH TOPICS.
Instruction via reading assignments and seminars on research topics not currently covered in regular courses.
Prerequisite, permission of instructor. *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, 6.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

564. WAVE MOTION.
Physical optics, acoustics, and other wave phenomena in a single unified structure.
Prerequisite, Physics 552.

571 (I), 572 (II). STATISTICAL PHYSICS.
Thermodynamics, kinetic theory, and statistical mechanics in a single unified structure.
Prerequisites, Physics 552, 556. *Credit, 3 each semester.*

585. MODERN PHYSICS I.
Review of classical mechanics, theory of relativity, black body radiation, photoelectric effect, Compton effect, background for development of quantum mechanics, Bohr atom.
Prerequisites, Physics 552, 556.

586. MODERN PHYSICS II AND QUANTUM MECHANICS.
Quantum mechanics, applications to atomic and nuclear physics, such as atomic spectra, Zeeman effect, angular momentum, barrier penetration.
Prerequisite, Physics 585. *Credit, 4.*

588. SOLID STATE PHYSICS.
An introduction to theoretical and experimental physics of the solid state.
Prerequisite, Physics 585.

619. ELECTRONICS INSTRUMENTATION.
A laboratory-oriented course designed expressly for physicists and chemists. Basic electronics principles, servo systems, operational amplifiers, digital circuits, other modern devices.
Prerequisite, permission of instructor.

620. RADIATION PHYSICS.
For science majors specializing in nuclear medicine, radiology, environmental sciences, radiation protection, and applied areas using ionizing radiations. Principles of atoms and nuclei, radioactivity, interaction of radiation with matter, radiation detectors and methods, applications of radioactive and stable nuclei as tracers. Special topics.
Three lectures weekly; three-hour laboratory once every two weeks.
Prerequisite, permission of instructor. *Credit, 4.*

675 (I), 676 (II). ADVANCED EXPERIMENTAL WORK.
Selected experiments and projects, according to the needs of individual student.
Prerequisite, Physics 551. *Credit, 1 to 3 each semester.*
(For major credit subject to approval of Graduate Studies Committee)

551. ELECTRICITY AND MAGNETISM I.
Classical field theory, static electric fields and magnetic fields of steady currents. Scalar and vector potentials, Laplace's equation and its solutions.
Prerequisites, Physics 142 or 162 or 183; Math 174 or 186.

552. ELECTRICITY AND MAGNETISM II.
Continuation of 551. Time varying fields, Maxwell's equations, and applications to radiation.
Prerequisites, Physics 551 and Math 187 or 343.

555 (I), 556 (II). MECHANICS.
Development of the fundamental concept of dynamics with applications to particles and rigid bodies in translation and rotation.
Prerequisites, Physics 142, 162 or 184; Math 174 or 186.
Credit, 3 each semester.

Plant Pathology

GRADUATE FACULTY

Richard A. Rohde, *Professor and Head of the Department of Plant Pathology*, A.B., Drew University, 1951; M.S., Maryland, 1956; Ph.D., 1958.

George N. Agrios, *Associate Professor and Graduate Program Director*, B.S., University of Thessaloniki, Greece, 1957; Ph.D., Iowa State, 1960.

Constantine J. Gilgut, *Professor*, B.S., Massachusetts, 1931; M.S., 1934; M.A., Harvard, 1937; Ph.D., 1942.

Francis W. Holmes, *Professor*, B.A., Oberlin, 1950; Ph.D., Cornell, 1954.

William J. Manning, *Assistant Professor*, B.S., Michigan State, 1963; M.S., Delaware, 1966; Ph.D., 1968.

Mark S. Mount, *Assistant Professor*, B.S., Illinois Wesleyan, 1963; M.S., Michigan State, 1965; Ph.D., 1968.

William N. Rice, *Associate Professor*, B.S., Sioux Falls College, 1936; M.S., Iowa State, 1939; Ph.D., 1944.

Terry A. Tatter, *Assistant Professor*, B.A., Northeastern University, 1961; Ph.D., University of New Hampshire, 1971.

Bert M. Zuckerman, *Professor*, B.S., North Carolina State, 1948; M.S., N.Y. State College of Forestry, 1949; Ph.D., Illinois, 1954.

Students accepted for graduate study towards the Master of Science or Doctor of Philosophy degree are expected to have fulfilled the usual requirements for a bachelor's degree in a related discipline. Requirements for the M.S. degree ordinarily include a thesis, but course work, including Plant Pathology 700, may be substituted with permission of the adviser and Graduate Studies Committee. Facilities at the Suburban Experiment Station, Waltham, and the Cranberry Experiment Station, East Wareham, are available for projects in special areas. The department has no foreign-language requirement.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.
Selected research problems in plant pathology. *Credit, 1-5.*

790. SEMINAR.
Reports and discussion on the current literature and research in plant pathology; special reports by resident and visiting speakers.
One class hour. *Credit, 1 each semester.*

800. MASTER'S THESIS. *Credit, 10.*

804. FOREST PATHOLOGY.
The diseases of trees and the decay of forest products.
Prerequisites, Plant Path 551 and Botany 531.

805. ADVANCED PLANT PATHOLOGY—PARASITISM AND PATHOGENESIS.
The physiology of diseased plants and the nature of host-parasite interactions. Emphasis on the biochemical and physiological changes induced in the host by plant pathogens. Laboratory consists of biochemical investigations of diseased plants.
Prerequisite, Plant Path 551. *Credit, 4.* Mr. Mount.

806. ADVANCED PLANT PATHOLOGY—EPIPHYTOLOGY.
The interactions of host, parasite, and environment in the rise and decline of devastating epiphytotics. The mechanisms that govern disease disposition, disease-resistance, and immunity.
Prerequisites, Botany 531 and Plant Path 551.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

551. PLANT PATHOLOGY.
The nature, causes, and control of plant diseases.
Prerequisite, a course in Botany. Mr. Agrios.

569. FOREST AND SHADE TREE PATHOLOGY.
The nature, cause, and control of the principal types of disease in trees, including decay of forest products and of standing and structural timber.

575. METHODS IN PLANT PATHOLOGY.
General techniques and specialized methods used in the investigation of plant diseases.
Prerequisite, one semester of Plant Pathology.

640. GENETICS OF PLANT-PATHOGEN INTERACTION.
Characterization of genetic factors which control plant disease reaction and virulence. Included will be the influence of environment on genetic stability of pathogens. Mutations and parasexuality as a factor in pathogenic variation, and plant population genetics in relation to disease development.
Prerequisite, Plant Path 251 or 551. Mr. Mount.

661. PLANT VIROLOGY.
Structure and properties of plant viruses. Virus transmission. Virus infection and synthesis. Symptomatology and physiology of virus-infected plants. Assay and purification of plant viruses. Identification and control of plant viruses.
Prerequisite, Plant Path 251 or 551 or permission of instructor. *Credit, 4.* Mr. Agrios.

678. NEMATOLOGY.
Anatomy, morphology, and classification of plant-parasitic and other soil-inhabiting nematodes. Parasitic relationships with plants and current control-measures stressed.
Prerequisite, a year of biological science.
Credit, 4. Mr. Rohde.

Plant and Soil Sciences

GRADUATE FACULTY

Franklin W. Southwick, *Professor of Plant Science, Head of the Department of Plant and Soil Sciences, and Graduate Program Director*, B.S., Massachusetts, 1939; M.S., Ohio State, 1940; Ph.D., Cornell, 1943.

John H. Baker, *Associate Professor of Soil Science*, B.S., Massachusetts, 1952; M.S., Cornell, 1954; Ph.D., 1959.

Allen V. Barker, *Associate Professor of Plant and Soil Science*, B.S., Illinois, 1958; M.S., Cornell, 1959; Ph.D., 1962.

Alfred W. Boicourt, *Professor of Plant Science*, B.S., Cornell, 1938; M.S., 1941.

William J. Bramlage, *Associate Professor of Plant Science*, B.S., Ohio State, 1959; M.S., Maryland, 1961; Ph.D., 1963.

Robert N. Carrow, *Assistant Professor of Plant and Soil Science*, B.S., Michigan State University, 1968; Ph.D., 1972.

William G. Colby, *Professor of Plant and Soil Science*, B.S., Illinois, 1929; M.S., Rutgers, 1932; Ph.D., 1934.

Mack Drake, *Professor of Plant and Soil Science*, B.S., Purdue, 1937; M.S., Purdue and Alabama Polytechnic, 1939; Ph.D., 1946.

Everett R. Emino, *Assistant Professor of Plant Science*, B.S., Massachusetts, 1965; M.S., Michigan State University, 1967; Ph.D., 1972.

Walton C. Galinat, *Professor of Environmental Sciences*, Ph.D., University of Wisconsin, 1953.

George B. Goddard, *Associate Professor of Plant Science*, B.S., Massachusetts, 1954; M.S., 1958; Ph.D., 1963.

Duane W. Greene, *Assistant Professor of Plant Science*, B.S., Colgate University, 1964; M.S., Michigan State University, 1966; Ph.D., 1969.

Haim B. Gunner, *Professor of Environmental Sciences*, B.S.A., University of Toronto, 1946; M.Sc., University of Manitoba, 1948; Ph.D., Cornell, 1962.

John R. Havis, *Professor of Plant Science*, B.S., Texas Technological College, 1942; M.S., Cornell, 1947; Ph.D., 1949.

Paul H. Jennings, *Assistant Professor of Plant Science*, B.V.A., Massachusetts, 1960; M.S., North Carolina State University, 1962; Ph.D., 1965.

William H. Lachman, *Professor of Plant Science*, B.S., Pennsylvania State, 1934; M.S., 1936.

William J. Lord, *Professor of Plant Science*, B.S., New Hampshire, 1943; M.S., 1953; Ph.D., Pennsylvania State, 1955.

Herbert V. Marsh, *Associate Professor of Plant Science,* B.S., Massachusetts, 1954; M.S., 1958; Ph.D., North Carolina State University, 1961.

Donald N. Maynard, *Professor of Plant Science,* B.S., Connecticut, 1954; M.S., North Carolina State College, 1956; Ph.D., Massachusetts, 1963.

William A. Rosenau, *Associate Professor of Plant and Soil Science,* B.S., Yale, 1948; M.S., Connecticut, 1950; Ph.D., Pennsylvania State, 1961.

Gordon L. Stewart, *Associate Professor of Soil Science,* B.S., Utah State, 1955; M.S., 1957; Ph.D., Washington State University, 1962.

Cecil L. Thomson, *Professor of Plant Science,* B.S.A., University of Toronto, 1937; M.S., University of Minnesota, 1945.

Joseph Troll, *Professor of Plant Science,* B.S., Rhode Island, 1954; M.S., 1957; Ph.D., Massachusetts, 1965.

Jonas Vengris, *Professor of Plant Science,* Diploma, Agr. College, Lithuania, 1934; 1936; Dr. Agr. Sci., University of Bonn, Germany, 1939.

Martin E. Weeks, *Professor of Plant and Soil Science,* B.S., South Dakota State, 1934; Ph.D., Wisconsin, 1937.

John M. Zak, *Associate Professor of Plant and Soil Science,* B.S., Massachusetts, 1936; M.S., 1938.

The Department of Plant and Soil Sciences offers doctoral work in either Plant Science or Soil Science. Specialization and thesis problems related to horticultural and agronomic plants and in soil science are available to both Master of Science and Doctor of Philosophy degree candidates.

The department has no foreign-language requirement for the doctoral degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700, 701. SPECIAL PROBLEMS.
Selected research problems not related to a candidate's thesis. *Credit, 3 each semester.*

702, 703. RESEARCH LITERATURE.
A critical review of the scientific literature in an area of specialization. *Credit, 3 each semester.*

710. MORPHOLOGY OF ECONOMIC PLANTS.
The anatomy of the plant body with emphasis on those structures which have horticultural and agronomic significance.
Prerequisite, Botany 291 or permission of instructor.
Mr. Goddard

713. CLAY MINERALOGY.
Structure of clay minerals; identification, weathering, and alteration of minerals; properties of clay surfaces; geotechnical studies of clays in geology, soil science, and soil mechanics.
Prerequisite, permission of instructor.

715. PLANT GROWTH REGULATORS.
Recent advances in the field of plant growth regulators; including phytochromes, auxins, gibberellins, kinins and herbicides. Emphasis on investigations of the mechanisms whereby these materials control plant growth and development.
Prerequisites, Botany 511 and one semester of biochemistry.
Mr. Marsh, Mr. Rubinstein.

717. WATER AND TEMPERATURE STRESS IN PLANTS.
Concepts of water absorption and distribution; factors in development of plant water stress. Low temperature injury and acclimation in plants.
Prerequisites, Botany 511 or permission of instructor.
Mr. Havis.

730. ADVANCED SOIL CHEMISTRY.
The chemistry of soil formation, soil acidity, nutrient element availability, ionic exchange, and fixation, soil-plant microorganism relationships, and relationships of organic matter of the soil. Laboratory work consists of physical, analytical and biochemical investigations of soils and important soil constituents.
Prerequisite, permission of instructor. Mr. Baker.

745. MICROBIAL ECOLOGY OF THE SOIL.
The biochemistry and physiology of interaction among microorganisms in the soil environment, and their relationship with the soil environment. Lectures, discussion, and a critical review of current literature.
Prerequisite, Plant and Soil Sci 585 or permission of instructor. Mr. Gunner.

750. PLANT PHOTOSYNTHESIS.
Lectures and discussions of the mechanisms, requirements, evolution and specific related processes. Extensive study of the basic literature required.
Prerequisite, Botany 512, or Chem 524, or equivalent.
Mr. Barker.

760. NITROGEN METABOLISM.
A comprehensive presentation of nitrogen metabolism in plants. The biological mechanisms of nitrogen absorption, synthesis, and degradation of nitrogenous compounds, nitrogen fixation, specific roles of nitrogenous compounds and nitrogen toxicities.
Prerequisite, Botany 512, or Chem 524, or equivalent.
Mr. Barker.

791. SEMINAR.
Required of all graduate students majoring in the Department. *Credit, 1 each semester.*

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Maximum credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

530. PLANT NUTRITION.
The accumulation and transport of inorganic ions in plants and their function in plant metabolism. Mr. Maynard.

535. TAXONOMY OF ECONOMIC PLANTS.
Plant families, genera, species, and cultivars of importance in the horticultural and agronomic fields.
Mr. Boicourt.

540. PLANT BREEDING.
An advanced study of genetic topics peculiar to plants; the methods and problems of the plant breeder.
Prerequisite, Zool 240 or equivalent. Mr. Lachman.

545. POST-HARVEST PHYSIOLOGY.
Physical and chemical processes of plants before and after harvest and the influence of environmental, chemical, and storage factors on these processes. Mr. Bramlage.

550. FORAGE AND FIELD CROPS.
Analysis of the principles involved in the establishment, fertilization, and harvest management of forage and field crops.
Mr. Colby.

555. AGROSTOLOGY.
The establishment and maintenance of turf grasses used on lawns, athletic fields, highways, airports, and cemeteries.
Mr. Troll.

560. ECOLOGY AND CONTROL OF WEEDS.
Identification and ecology of common weeds and principles of weed control with emphasis on the use of chemical herbicides.
Mr. Vengris.

565. SOIL FORMATION AND CLASSIFICATION.
The development of soils as related to physical, chemical, biological, climatic, and geological factors.
Credit, 4. Mr. M. Weeks.

570. SOIL PHYSICS.
Physical properties of soil, including textural, structural, water, air, and temperature relationships; their measurements, evaluation, and influence in the soil system.
Prerequisite, Plant and Soil Sci 105 or equivalent.
Mr. Stewart.

575. SOIL CHEMISTRY.
The inorganic and organic chemical reactions related to the nutrient supply in soils and soil nutrition of plants. Colloidal aspects of soil chemical reactions and soil-plant mineral relationships.
Prerequisites, Chem 127 and Plant and Soil Sci 265 or equivalent. Mr. Baker.

580. SOIL-PLANT MINERAL NUTRITION.
Mineral nutrients in the growth of plants; the use of fertilizers and other soil amendments; soil reaction; mineral deficiencies and toxicities in plants. Mr. Drake.

585. MICROBIOLOGY OF THE SOIL.
Soil microorganisms; their distribution, ecology and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium.
Prerequisite, Microbiol 250 or permission of instructor.
Mr. Gunner.

Political Science

GRADUATE FACULTY

Glen Gordon, *Professor and Chairman of the Department of Political Science*, B.A., New York University, 1952; M.A., Chicago, 1957; Ph.D., 1963.

Gerard Braunthal, *Professor and Graduate Program Director in Political Science*, B.A., Queens College, 1947; M.A., Michigan, 1948; Ph.D., Columbia, 1953.

Dean Alfange, Jr., *Associate Professor and Dean of Faculty of Social and Behavioral Sciences*, B.A., Hamilton, 1950; M.A., Colorado, 1960; Ph.D., Cornell, 1967.

Luther A. Allen, *Professor*, B.A., Williams, 1941; M.A., State University of Iowa, 1942; Ph.D., Chicago, 1952.

Stanley Bach, *Assistant Professor*, B.A., Chicago, 1966; M.Phil., Yale, 1969; Ph.D., 1972.

Loren P. Beth, *Professor*, B.A., Monmouth College, 1946; M.A., Chicago, 1948; Ph.D., 1949.

David A. Booth, *Professor*, B.S., London School of Economics, 1952; M.A., Virginia, 1953; Ph.D., 1957.

William E. Connolly, *Associate Professor*, B.A., Michigan at Flint, 1960; M.A., Michigan, 1962; Ph.D., 1965.

Philip B. Coulter, *Associate Professor*, B.A., Centre College, 1961; Ph.D., State University of New York at Albany, 1966.

Patrick Eagan, *Assistant Professor*, B.S., Regis, 1952; M.A., Colorado State, 1955; Ph.D., University of California, Riverside, 1971.

Eric Einhorn, *Assistant Professor*, B.A., Pennsylvania, 1965; M.A., Harvard, 1968; Ph.D., 1972.

Jean B. Elshtain, *Assistant Professor*, B.A., Colorado State University, 1963; M.A., University of Colorado, 1965; Ph.D., Brandeis University, 1973.

Edward E. Feit, *Professor*, B.A., Witwaterstrand, 1944; M.A., University of South Africa, 1949; Ph.D., Michigan, 1965.

John H. Fenton, *Commonwealth Professor of Government*, B.A., Kentucky, 1948; M.A., 1951; Ph.D., Harvard, 1956.

Peter J. Fliess, *Professor*, B.A., Stanford, 1944; M.A., Harvard, 1947; Ph.D., 1951.

Harvey L. Friedman, *Associate Professor*, J.D., Boston University, 1947.

Constance M. Friesen, *Assistant Professor*, B.A., Concordia College, 1967; M.A., Harvard University, 1969; Ph.D., 1972.

Edwin Andrus Gere, Jr., *Associate Professor*, B.A., Alfred, 1948; M.A., Pennsylvania State, 1956; Ph.D., State University of New York at Albany, 1968.

Sheldon Goldman, *Associate Professor*, B.A., New York University, 1961; M.A., Harvard, 1964; Ph.D., 1965.

Franklin W. Houn, *Professor*, B.A., National Chenchi University, 1946; M.A., Denver, 1950; Ph.D., Wisconsin, 1953.

Irving Howards, *Professor*, B.A., Wisconsin, 1953; M.A., 1955; Ph.D., 1957.

Jerome B. King, *Associate Professor*, B.A., Dartmouth, 1949; M.A., Stanford, 1954; Ph.D., 1958.

Harvey Kline, *Assistant Professor*, B.A., North Carolina, 1966; Ph.D., Texas, 1970.

Fred A. Kramer, *Assistant Professor*, B.A., Johns Hopkins University, 1963; M.A., Rutgers University, 1964; Ph.D., Syracuse University, 1969.

John W. Lederle, *Joseph B. Ely Professor*, B.A., Michigan, 1933; M.A., 1934; LL.B., 1936; Ph.D., 1942.

Guenter Lewy, *Professor*, B.S.S., City College of New York, 1951; M.A., Columbia, 1952; Ph.D., 1957.

Lewis C. Mainzer, *Professor*, B.A., New York University, 1948; M.A., Chicago, 1950; Ph.D., 1956.

John M. Maki, *Professor*, B.A., Washington, 1932; M.A., 1936; Ph.D., Harvard, 1948.

Leila Meo, *Associate Professor*, B.A., American University at Cairo, 1947; M.A., Syracuse, 1949; Ph.D., Indiana, 1961.

Jerome M. Mileur, *Assistant Professor*, B.A., Southern Illinois, 1955; M.A., University of Illinois, 1958 Ph.D., Southern Illinois, 1971.

Felix E. Oppenheim, *Professor*, Docteur-en-droit, Brussels, 1938; Ph.D., Princeton, 1942.

Karl W. Ryavec, *Associate Professor*, B.A., Miami University, 1957; M.A., Columbia, 1962; Ph.D., 1968.

Robert Anthony Shanley, *Associate Professor*, B.A., Columbia, 1946; M.A., 1948; Ph.D., Georgetown, 1955.

George T. Sulzner, *Associate Professor*, B.A., Muskingum College, 1959; M.A., Michigan, 1961; Ph.D., 1967.

Anwar H. Syed, *Professor*, B.A., University of the Panjab, 1946; M.A., 1951; M.A., Chicago, 1953; M.A., Pennsylvania, 1954; Ph.D., 1957.

Ferenc A. Vali, *Professor*, Doctor Juris, Budapest, 1927; Ph.D., London, 1932.

Howard J. Wiarda, *Professor*, B.A., Michigan, 1961; M.A., Florida, 1962; Ph.D., 1965.

The Department of Political Science offers graduate work leading to the Master of Arts, Master of Public Administration, and Doctor of Philosophy degrees. Detailed information on requirements for degrees may be obtained from the Department of Political Science.

The Department's courses are categorized in eight subfields. In many of these subfields there is a proseminar which prepares beginning students for the more specialized advanced seminars by acquainting them with the fundamental concepts, theories, modes of inquiry, and research findings. In all subfields there are tutorials and directed studies courses. The tutorial is basically a reading course, the content and format of which are arranged by agreement of one or more students and a professor. Generally, a tutorial treats a topic of their mutual interest which is not adequately covered by existing courses. The directed studies course is a specialized advanced seminar with regular meetings which covers a topic not covered in other seminars. It is an in-depth study of a particular aspect of a subfield, the content of which varies with the interests of professors and students.

The Master of Public Administration program, though academic in content, is especially suited to those planning, or currently embarked upon, a career in the public service. It typically necessitates one year of course work. An internship or public service work experience is required.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

701—709. AMERICAN GOVERNMENT AND POLITICS.

701. TUTORIAL IN AMERICAN GOVERNMENT AND POLITICS.

702. DIRECTED STUDIES IN AMERICAN GOVERNMENT AND POLITICS.

703. LEGISLATIVE BEHAVIOR.
Selected topics in American legislative systems, national and state; attention to major research techniques and recent theoretical developments. Mr. Bach.

704. AMERICAN POLITICAL PARTY SYSTEMS.
The structure and activities of American parties and their impact on individual and group political behavior and on government and public policy. Focus on both national and state party systems. Mr. Fenton.

705. PROSEMINAR IN AMERICAN GOVERNMENT AND POLITICS.

710—719. COMPARATIVE POLITICS.

710. PROSEMINAR IN COMPARATIVE POLITICS.

711. TUTORIAL IN COMPARATIVE POLITICS.

712. DIRECTED STUDIES IN COMPARATIVE POLITICS.

713. COMPARATIVE POLITICAL PARTIES.
The ideology, structure, and dynamics of diverse types of political parties, party systems, and electoral systems; their interrelationships. Mr. Braunthal.

714. MILITARY POLITICS.
Comparative study of contemporary problems in civilian-military relations. Mr. Feit.

720—729. INTERNATIONAL RELATIONS.

720. PROSEMINAR IN INTERNATIONAL RELATIONS.

721. TUTORIAL IN INTERNATIONAL RELATIONS.

722. DIRECTED STUDIES IN INTERNATIONAL RELATIONS.

723. PROBLEMS OF INTERNATIONAL RELATIONS.
Analysis of major problems in international relations.
Mr. Fliess, Mr. Vali.

724. INTERNATIONAL LAW AND ORGANIZATION.
Analysis of major problems in international law and organization. Mr. Vali.

725. THEORY OF INTERNATIONAL POLITICS.
Analysis and conceptualization of the forces and drives that condition politics among nations. Mr. Fliess.

726. NATIONALISM.
Analysis of nationalism as a political ideology with emphasis on its role in emergent nations. Mr. Fliess.

727. IMPERIALISM.
Analysis of imperialism as a recurrent phenomenon in international relations with emphasis on the relations between advanced and emergent nations. Mr. Fliess.

730—739. PUBLIC ADMINISTRATION.

730. PROSEMINAR IN PUBLIC ADMINISTRATION.

731. TUTORIAL IN PUBLIC ADMINISTRATION.

732. DIRECTED STUDIES IN PUBLIC ADMINISTRATION.

733. PUBLIC ADMINISTRATION: ORGANIZATION.
Behavior within governmental bureaucracy, in terms of the interaction between the individual and organizational influences.

734. PUBLIC ADMINISTRATION: RESPONSIBILITY.
The meaning and institutions of political responsibility of governmental bureaucracy. Mr. Mainzer.

735. COMPARATIVE PUBLIC ADMINISTRATION.
Comparative analysis of the government administrative systems of the U.S., Britain, Canada, France, the U.S.S.R., and other selected countries. Mr. Kramer.

736. PUBLIC BUDGETING AND SYSTEMATIC ANALYSIS.
The theory and techniques of budgeting and systematic analysis and the political processes that relate these techniques to decision-making within the governmental organization.
Mr. Kramer.

740—749. PUBLIC LAW.

740. PROSEMINAR IN PUBLIC LAW.

741. TUTORIAL IN PUBLIC LAW.

742. DIRECTED STUDIES IN PUBLIC LAW.

743. LAW AND THE POLITICAL PROCESS.
The interrelationships between law and politics, and the functions of law in organized societies.
Mr. Alfange, Mr. Beth, Mr. Goldman.

744. THEORIES OF LAW AND JUDICIAL BEHAVIOR.
The theories of law, jurisprudence, and/or judicial behavior.
Mr. Alfange, Mr. Beth, Mr. Goldman.

750—759. STATE AND LOCAL POLITICS.

750. PROSEMINAR IN STATE AND LOCAL POLITICS.

751. TUTORIAL IN STATE AND LOCAL POLITICS.

752. DIRECTED STUDY IN STATE AND LOCAL POLITICS.

753. URBAN POLITICAL SYSTEMS.
Comparative analysis of relationships among socioeconomic, environmental, and political structures and processes, and public policy outcomes in cities. Research applications of contemporary concepts and theories.
Mr. Booth, Mr. Howards.

754. THEORY OF LOCAL GOVERNMENT.
Theories of local government; general uniformities in the governmental process. Mr. Booth, Mr. Howards.

760—769. POLITICAL THEORY.

760. PROSEMINAR IN POLITICAL THEORY.

761. TUTORIAL IN POLITICAL THEORY.

762. DIRECTED STUDIES IN POLITICAL THEORY.

763. RECENT POLITICAL THEORY.
Contemporary theories about the possibilities and limits of operationalism, behavioralism, and the decision-making approach in political science. Mr. Oppenheim.

764. CHURCH AND STATE.
Relations between western and non-western religions and the state; analysis of the ideas and other forces underlying this relationship, especially since 1918. Mr. Lewy.

765. THE INDIVIDUAL AND THE STATE.
The problem of political obligation in political theory and in its historical and social contexts; the medieval right of resistance, the social contract, anarchism, resistance to totalitarianism, non-violent resistance, conscientious objection to war. Mr. Lewy.

766. PHILOSOPHICAL FOUNDATIONS OF POLITICAI SCIENCE.
Critical examination of the principal contemporary views concerning the methods of gaining knowledge of political phenomena. Mr. Connolly.

767. EMPIRICAL RESEARCH IN POLITICAL BEHAVIOR.
Introduction to research techniques as applied to special problems in the field of political behavior. Emphasis on various approaches to the study of the individual voter, the American politician, interest groups and legislatures. Mr. Fenton.

768. REVOLUTIONS AND REVOLUTIONARY MOVEMENTS.
The phenomenon of revolution in modern times; the theory and practice of revolution in Jacobinism, Marxism, anarchism, Leninism, syndicalism, fascism, Castroism. Mr. Lewy.

770—779. AREA STUDIES.

771. TUTORIAL IN AREA STUDIES.

772. DIRECTED STUDIES IN AREA STUDIES.

773. POLITICS OF SOUTH ASIA.
Selected problems relating to the government and politics of India, Pakistan, and Ceylon. Mr. Syed.

774. POLITICS OF EAST ASIA.
Selected problems relating to the politics of China, Japan, and other Asian countries. Mr. Houn, Mr. Maki.

776. AFRICAN POLITICS.
Selected contemporary problems in African government and politics. Mr. Feit.

777. LATIN AMERICAN POLITICS.
Comparative study of Latin American politics and government.
Mr. Kline, Mr. Wiarda.

778. EUROPEAN POLITICS.
Selected political cultures and systems in Europe.
Mr. Braunthal, Mr. King.

779. POLITICS AND FOREIGN POLICIES OF THE MIDDLE EAST AND NORTH AFRICA.
The regional and international politics of the Middle East and North Africa, focusing on questions and problems that promote conflict or collaboration in the area. Miss Meo.

800. MASTER'S THESIS. *Credit, 6.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

American National Government and Politics

505. THE PRESIDENCY IN AMERICAN GOVERNMENT.
The growth of the executive in the United States government. Varying conceptions of the presidential office. Constitutional and political aspects of the office in legislation, administration, and conduct of foreign and military affairs. The president as party leader.
Mr. Bach, Mr. Gordon, Mr. Kramer, Mr. Sulzner.

508. POLITICAL PARTIES AND ELECTIONS.
American political processes. Emphasis on parties, pressure groups and public opinion.
Mr. Fenton, Mr. Mileur, Mr. Shanley.

603. AMERICAN POLITICAL THOUGHT.
The development of American political thought from Colonial times to the present. Mr. Gere, Mr. King, Mr. Syed.

605. THE LEGISLATIVE PROCESS.
The role of the legislature in national and state government. The functions of legislatures; legislative procedures; the role of political parties and pressure groups in the legislative process. Mr. Bach, Mr. Gordon, Mr. Sulzner.

607. BLACK POLITICS.
Theoretical and historical analysis of the relationship of Black people to the American political system. The development of Black ideologies, political organizations, and strategies, and alternative forms of participation in the American political system.

608. PUBLIC OPINION IN POLITICS.
Opinion and communication as aspects of the political process. Emphasis on communication through mass media. The relations between mass attitudes and communication and political institutions and the formation of public policy.
Mr. Fenton.

State and Local Government and Politics

514. MUNICIPAL GOVERNMENT.
Survey of the structure and function of government in American municipalities.
Mr. Booth, Mr. Gere, Mr. Howards, Mr. Shanley.

517. MASSACHUSETTS POLITICS.
Analysis of the significant characteristics of Massachusetts politics as applied to political problems from an historical perspective with both a theoretical and practical base. Field work, readings, lectures, and discussions. Mr. Friedman.

519. STATE GOVERNMENT.
American state politics, organization, and functions. Emphasis on the role of the state in our federal system.
Mr. Booth, Mr. Gere, Mr. Howards, Mr. Shanley.

611. AMERICAN FEDERALISM.
An examination of the American system of federalism as it has developed and changed from the early days of the Republic to the present time, with emphasis on the shift from a legal to a programmatic orientation and an emerging complex of intergovernmental relations. Mr. Gere, Mr. Eagan.

614. METROPOLITAN POLITICS.
Problems of metropolitan areas; actual and possible political approaches to their solution. Emphasis on the role of parties, the development of political leadership, existing political institutions, and pressure group activity.
Prerequisite, Pol Sci 508 or permission of instructor.
Mr. Booth, Mr. Howards, Mr. Shanley.

Public Administration and Policy Studies

523. PUBLIC ADMINISTRATION.
Organization of bureaucracy, bureaucratic life, constitutional position, and political role of governmental bureaucracy.
Mr. Kramer, Mr. Lederle, Mr. Mainzer.

526. POLITICAL THEORY, IDEOLOGY, AND PUBLIC POLICY.
The evaluation of social policy; a consideration of normative issues raised in controversies concerning social and economic policy in the light of the main traditions of Western political thought and the logical and ethical aspects of social choice.
Mr. Eagan.

620. GOVERNMENT OF BUREAUCRACIES.
Inquiry into the meaning and possibility of "democracy" within large-scale organizations. Mr. Kramer, Mr. Mainzer.

623. PUBLIC PERSONNEL ADMINISTRATION.
The personnel function in bureaucracy; patronage and merit; career service and political executives; authority and informal organization; employee rights and collective action.
Mr. Kramer, Mr. Lederle, Mr. Mainzer.

624. ADMINISTRATIVE LAW.
Governmental activities in the regulation of industry, agriculture, and labor. Emphasis on the legal framework within which these activities operate. Mr. Lederle.

627. COMPARATIVE PUBLIC POLICY.
A comparative analysis of policy formation; the process of social and economic policy decision-making in selected industrial societies; the interaction of institutions, ideas, and power in decisions concerning social welfare, economic planning, and related policy areas. Mr. Einhorn.

Comparative Government and Area Studies

531. POLITICAL DEVELOPMENT AND MODERNIZATION.
Comparative analysis of political change and development in the emerging nations.
Mr. Coulter, Mr. Kramer, Mr. Maki, Mr. Syed, Mr. Wiarda.

533. GOVERNMENT AND POLITICS OF THE MIDDLE EAST.
A review of the dynamics of the traditional Islamic political system and of the transformation of that system under the impact of Western penetration of the Middle East. Contemporary Middle East politics with special reference to the politics of Israel, Syria, Lebanon and the UAR. Miss Meo.

535. EAST CENTRAL EUROPE.
Survey of the major governments in the East Central European area with emphasis on the nature of Communist Party control. Governments of Czechoslovakia, East Germany, Hungary, Poland, Rumania, Yugoslavia, and others.
Mr. Ryavec, Mr. Vali.

538. GOVERNMENT AND POLITICS OF SOUTH AND SOUTHEAST ASIA.
Comparative study of the institutions and dynamics of government and politics in South and Southeast Asia, especially India, Pakistan, Indonesia, and Malaysia, with reference to issues of political stability, economic development, and relations with the U.S. and other great powers.
Mr. Allen, Mr. Syed.

539. WEST EUROPEAN COMPARATIVE POLITICS.
Analysis of the political cultures, institutions, systems, and processes of selected West European countries. Emphasis on social and economic factors relating to contemporary political issues. Mr. Braunthal, Mr. Einhorn, Mr. King.

540. GOVERNMENT AND POLITICS OF SOUTH AMERICA.
Comparative analysis of the interest groups, political parties, and government institutions of the South American countries. Emphasis on the background and political culture in which Latin American politics and government takes place.
Mr. Kline, Mr. Wiarda.

541. GOVERNMENT AND POLITICS OF CENTRAL AMERICA AND THE CARIBBEAN.
Comparative analysis of the interest groups, political parties, and government institutions of the Central American and Caribbean countries. Emphasis on communism and the role of the U.S. Mr. Kline, Mr. Wiarda.

542. THE POLITICS OF SUB-SAHARAN AFRICA.
The organization and processes of African politics, centering on the general political problems facing contemporary African governments. Mr. Feit.

543. COMPARATIVE AFRICAN GOVERNMENTS.
Comparative study of the political process in five African states. Mr. Feit.

548. GREAT BRITAIN AND THE COMMONWEALTH.
The practice of parliamentary government in Great Britain and the Commonwealth countries. Emphasis on development of the conception of the Commonwealth, the institutions through which the Commonwealth operates, and its contemporary world politics.

634. GOVERNMENT AND POLITICS OF JAPAN.
Government and politics of modern Japan with emphasis on the post-1945 period; descriptive analysis of structure and function of government and political process. Mr. Maki.

636. GOVERNMENT AND POLITICS OF THE SOVIET UNION.
Historical and ideological influences on Soviet politics; the interconnection of social and political institutions and processes; membership, organization, and operation of the Communist Party; the state structure and law; and contemporary Soviet foreign policy.
Prerequisite, Pol Sci 131, or History 100-101, or permission of instructor. Mr. Ryavec, Mr. Vali.

637. GOVERNMENT AND POLITICS OF CHINA.
An analysis of the genesis and dynamics of the Chinese Communist movement, the ideology and organization of the party and the government, and major domestic and foreign policies since 1949, with special reference to the Maoist attempts to reform man and society as well as to achieve modernization. Mr. Houn.

640. POLITICS IN THE IBERIAN PENINSULA: THE POLITICAL SYSTEMS OF SPAIN AND PORTUGAL.
The unique aspects of the process of political development and/or decay in Spain and Portugal. Emphasis on the heritage of these two nations as reflected in their New World colonies in the Americas and on the present-day pattern of politics in the Iberian peninsula.
Prerequisites, Pol Sci 131 or permission of instructor.
Mr. Wiarda.

647. ARMED FORCES AND POLITICAL POLICY.
Comparative study of civilian-military relations in the Western and non-Western nations, concentrating both on regular and irregular armed forces. Mr. Feit.

International Relations

554. INTERNATIONAL RELATIONS.
The nation-state system and conceptions of national interest in modern world politics. Emphasis on forms and distribution

of power, the making of foreign policy, and the adjusting of international conflict.
Mr. Allen, Mr. Fliess, Ms. Friesen, Mr. Vali.

555. AMERICAN FOREIGN POLICY.
Constitutional, political, and administrative considerations which influence the formulation and execution of American foreign policy. Emphasis on current issues.
Mr. Allen, Ms. Friesen.

650. SOVIET FOREIGN POLICY.
An analysis of continuity and change in Soviet perceptions, goals, methods, and priorities in foreign policy. Emphasis on the period since World War II. Mr. Ryavec.

651. CHINESE FOREIGN POLICY.
Examination of the geographical, historical, ideological, economic, military, and other factors in Peking's foreign policy since 1949. Emphasis on mainland China's relations with various countries and her positions on major international issues. Mr. Houn.

656. INTERNATIONAL LAW.
The origin, character, and function of international law.
Mr. Fliess, Ms. Friesen, Mr. Vali.

657. INTERNATIONAL ORGANIZATION.
International organization in the 20th century. Emphasis on the United Nations and regional organization.
Ms. Friesen, Mr. Vali.

658. INTERNATIONAL RELATIONS: ASIA.
Introduction to general problems of Asian international relations since 1859, with detailed examination of problems since World War I. Emphasis on China, Japan, and the new nations. Mr. Houn, Mr. Maki.

659. WESTERN EUROPEAN FOREIGN POLICIES.
Analysis of the emerging institutional patterns of the West European communities. Emphasis on the major political, military, and economic regional organizations and their relations with Communist nations and the United States.
Mr. Braunthal, Mr. Einhorn.

Public Law and Judicial Process

560. CONSTITUTIONAL LAW.
The United States Supreme Court and leading cases interpreting the United States Constitution.
Mr. Alfange, Mr. Beth, Mr. Goldman.

561. CIVIL LIBERTIES.
The development in American Constitutional law of the concept of civil liberty, including the fields of free speech and religion, fair trial, and race discrimination. The function of courts in safeguarding these liberties.
Mr. Alfange, Mr. Beth, Mr. Goldman.

662. POLITICS, LAW AND JUDICIAL BEHAVIOR.
American court systems including examination of the processing of cases, judicial backgrounds and selection, judicial decisional behavior, some major court policies and the responses to them from groups and institutions within the larger political system. Mr. Alfange, Mr. Beth, Mr. Goldman.

Political Theory and Methodology

570. ANCIENT AND MEDIEVAL POLITICAL THOUGHT.
Development of political thought and its relation to cultural and institutional growth from the time of the Greeks to the end of the Middle Ages.
Mr. Connolly, Ms. Elshtain, Mr. King, Mr. Lewy, Mr. Oppenheim.

571. MODERN POLITICAL THOUGHT.
Development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present. Mr. Connolly, Ms. Elshtain, Mr. King, Mr. Lewy, Mr. Oppenheim, Mr. Syed.

574. PROBLEMS IN POLITICAL THOUGHT.
Some basic problems of political science, political ethics, and political philosophy through study of selected classical and modern political thinkers.
Mr. Connolly, Ms. Elshtain, Mr. Mileur, Mr. Oppenheim.

673. HUMAN NATURE AND POLITICS.
The role of the individual in the political process and especially with the problem of political perception, the way in which symbols structure reality, and the use of symbols to maintain stability or effect change in the political system.
Mr. Connolly, Mr. Feit.

678. DEVELOPMENT AND PRACTICE OF SOVIET MARXISM.
The philosophic and religious origins of Soviet Communism in Western and Eastern Europe. Analysis of the classics from Marx to Khrushchev. Mr. Fliess.

Polymer Science and Engineering

GRADUATE FACULTY

Roger S. Porter, *Professor and Head of the Department of Polymer Science and Engineering*, B.S., University of California at Los Angeles, 1950; Ph.D., University of Washington, Seattle, 1956.

Otto Vogl, *Professor and Graduate Program Director*, Ph.D., University of Vienna, 1950.

James C. W. Chien, *Professor of Chemistry.*

Frank E. Karasz, *Professor*, B.S., Imperial College, University of London, 1954; Ph.D., University of Washington, Seattle, 1957.

Robert L. Laurence, *Professor of Chemical Engineering.*

Robert W. Lenz, *Professor of Chemical Engineering.*

William J. MacKnight, *Associate Professor of Chemistry.*

Stanley Middleman, *Professor of Chemical Engineering.*

Seymour Newman, *Adjunct Associate Professor*, B.S., College of the City of New York, 1942; M.A., Columbia, 1947; Ph.D., Polytechnic Institute of Brooklyn, 1949.

Fraser P. Price, *Professor*, B.A., Columbia, 1938; Ph.D., 1941.

Isaac Sanchez, *Assistant Professor*, B.S., St. Mary's University, 1963; Ph.D., University of Delaware, 1969.

Richard S. Stein, *Commonwealth Professor of Chemistry and Director of the Polymer Research Institute.*

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Admission Requirements:

1. A B.S. or B.A. in chemistry, engineering, or physics.
2. Undergraduate work in two of the following areas:
   a. Organic chemistry.
   b. Physical chemistry.
   c. Thermodynamics.
   d. Electronics.
   e. Unit operations.
   f. Mechanics of materials.

Prescribed Program:

1. Undergraduate courses in areas under 2, above, where there have not been previous studies.
2. Core and basic requirements:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3
502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720—769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
780—3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.
786. RESEARCH PROPOSAL.	1 ea. sem.

Also, course electives (10-20 credits), language and comprehensive examinations as approved by the Polymer Science and Engineering Committee and as required by the Graduate School.

900. DISSERTATION.

THE MASTER OF SCIENCE DEGREE PROGRAM

Requirements for admission are the same as those for entry into Ph.D. Program.

Suggested Programs

With thesis:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3
502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720—769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
780—3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.
800. MASTER'S THESIS.	10

Without thesis:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3
502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720—769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
770. INTRODUCTION TO RESEARCH.	1-3
780—3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.

Also, course electives (seven credits) selected from suggested list for the Ph.D. program (brochure available from the Department upon request).

Both the master's and doctor's programs in Polymer Science and Engineering are interdisciplinary in nature and are designed to provide a broad and fundamental education in polymers. Entering students will normally have a bachelor's or master's degree in chemistry, engineering, or physics. Flexibility in the first year's curriculum allows for basic work in fields other than the student's undergraduate major and for prerequisites for advanced work in the PSE program. There is a basic core of courses within the PSE program, with sufficient electives to provide options for students with either a chemistry-physics emphasis or an engineering emphasis. The program requires an intermediate-level reading knowledge of one foreign language for all doctoral candidates.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

720—769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.
Lecture and seminar courses in which advanced aspects of some area pertinent to polymer science and engineering are intensively explored. The course rotates among staff members in the program and generally is in a field of particular interest to the staff members concerned.
Two or three class hours.
Prerequisites, PSE 501 and permission of instructor.
Credit, 2 or 3 each course.

721. MICROSCOPY AND MORPHOLOGY OF POLYMERS.
The use of the light and electron microscope. Phase contrast, interference methods, selected area diffraction, scattering techniques, and replication and decoration methods for the study and characterization of the morphology of polymeric structures.
Two class hours, four laboratory hours per week.
Prerequisites, PSE 501, general physics, optics desirable.
Mr. Price.

770. INTRODUCTION TO RESEARCH.
Independent student research on a specific project in polymer science or engineering, selected to teach research methods and techniques and to acquire new knowledge.
Requirement, approval of the department head.
Credit, 1-3.

780—783. POLYMER SCIENCE AND ENGINEERING SEMINAR.
Students, staff members, and visitors present seminars dealing with current research and literature reviews in polymer science and engineering and in related areas of materials science.
About two seminar hours per week.
Credit, 1 each semester.

786. RESEARCH PROPOSAL.
Students write and defend a proposal for an experimental investigation of a research problem not directly related to their thesis topic. The project selected requires approval of the thesis committee, and involves primarily library research.
Credit, 1 each semester.

790. ORGANIC POLYMERIZATION REACTIONS.
Mechanisms, kinetics, and thermodynamics of principal types of polymerization reactions.
Prerequisites, PSE 501; Chem 571 or equivalent. Mr. Vogl.

791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.
Structure of solid polymers, determination of molecular weights, sizes and shapes, mechanical properties of solid polymers, colligative properties of polymer solutions,

polyelectrolytes, and physical chemistry of proteins.
Prerequisite, Chem 785 or equivalent.

792. RHEOLOGY.
Definition and measurement of rheological properties; continuum mechanics and constitutive equations; molecular theories of polymer deformation; correlation and interrelation of material functions. Relation of the various approaches taken in describing the viscous and viscoelastic properties of polymers, evaluation of these approaches; the role of modern rheology in the characterization and processing of polymers.
Mr. Middleman, Mr. Porter.

793. POLYMER PROCESSING.
Application of principles of chemical engineering to analysis of polymer processes such as extrusion, roll coating, mixing, etc. Applied fluid dynamics; some attention to heat and mass transfer.
Prerequisite, PSE 792. Mr. Middleman, Mr. Porter.

800. MASTER'S THESIS. *Credit, 6-10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

501. INTRODUCTION TO POLYMER SCIENCE.
Physical and organic chemistry of polymers for persons with basic training in chemistry, physics, or engineering. A survey of preparative methods of polymers, means of preparation of polymers of controlled structure, the physical chemistry of polymer molecules in solution, liquid and solid phases, thermodynamics and statistics of polymers, methods of characterization, mechanical properties of polymeric solids and fundamentals of industrial preparative and fabrication techniques.
Prerequisite, one year of physical chemistry and one semester of organic chemistry or permission of instructor.

RELATED COURSES

Ch E 670. APPLIED POLYMER SCIENCE.

Biochem 728. PROTEIN PHYSICAL CHEMISTRY.

MAE 650. X-RAY DIFFRACTION.

MAE 709. MECHANICAL PROPERTIES OF MATERIALS.

MAE 881. SELECTED TOPICS IN MATERIALS.

Ch E 711—712. TRANSPORT PHENOMENA.

Psychology

GRADUATE FACULTY

RICHARD T. LOUTTIT, *Professor and Head of the Department of Psychology,* B.A., DePauw University, 1954; M.A., University of Michigan, 1959; Ph.D., 1961.

JEROME L. MYERS, *Professor and Graduate Program Director,* B.A., Syracuse, 1953; M.A., Wisconsin, 1955; Ph.D., 1957.

ICEK AJZEN, *Assistant Professor,* B.A., Hebrew University of Jerusalem, 1967; M.A., University of Illinois, 1967; Ph.D., 1969.

DANIEL ANDERSON, *Assistant Professor,* B.S., University of Wisconsin, 1966; M.A., Brown University, 1966; Ph.D., 1970.

DEE G. APPLEY, *Professor,* B.A., University of Denver, 1945; M.A., University of Michigan, 1949; Ph.D., 1952.

MORTIMER H. APPLEY, *Professor and Associate Provost and Dean of the Graduate School,* B.S., City College of New York, 1942; M.A., University of Denver, 1946; Ph.D., University of Michigan, 1950.

MICHAEL A. ARBIB, *Professor of Computer and Information Science and Psychology.*

JAMES R. AVERILL, *Associate Professor,* B.A., San Jose State College, 1959; Ph.D., University of California, Los Angeles, 1966.

JOHN J. B. AYRES, *Associate Professor,* B.A., William and Mary, 1961; M.A., University of Kentucky, 1963; Ph.D., 1965.

SAUL BALAGURA, *Associate Professor,* M.D., Facultad de Medicina, Universidad del Valle, 1964; M.A., Princeton University, 1966; Ph.D., 1967.

JOAN P. BEAN, *Assistant Professor,* B.A., San Jose State College, 1966; M.A., 1968; Ph.D., University of California, Berkeley, 1971.

SEYMOUR M. BERGER, *Professor,* B.A., Oklahoma A and M College, 1949; M.A., Columbia, 1950; Ph.D., Cornell University, 1959.

RICHARD S. BOGARTZ, *Professor,* B.A., University of California, Los Angeles, 1957; Ph.D., 1961.

NEIL CARLSON, *Assistant Professor,* B.A., University of Illinois, 1964; M.A., 1966; Ph.D., 1966.

SHELDON CASHDAN, *Associate Professor,* B.S., City College of New York, 1958; M.A., University of North Carolina, 1963; Ph.D., 1965.

JAMES I. CHUMBLEY, *Associate Professor,* B.A., Drake, 1960; M.S., Indiana University, 1963; Ph.D., 1967.

CHARLES E. CLIFTON, *Associate Professor and Associate Head of the Department of Psychology,* B.A., Stanford University, 1960; Ph.D., University of Minnesota, 1964.

RACHEL K. CLIFTON, *Associate Professor,* B.A., Berea College, 1959; M.A., University of Minnesota, 1960; Ph.D., 1963.

MARVIN DAEHLER, *Assistant Professor,* B.A., University of Illinois, 1964; M.A., University of Minnesota, 1966; Ph.D., 1968.

JOHN T. DANIELSON *Assistant Professor,* B.S., Rensselaer Polytechnic Institute, 1964; M.S., Brown, 1966; Ph.D., 1969.

JOHN W. DONAHOE, *Professor,* B.A., University of Kentucky, 1954; M.S., 1956; Ph.D., 1958.

J. WILLIAM DORRIS, *Assistant Professor,* B.A., University of California, Berkeley, 1966; M.A., University of California, Los Angeles, 1967; Ph.D., 1970.

WILLIAM J. DUFFY, *Associate Professor of Industrial Engineering and Psychology.*

ERNEST DZENDOLET, *Professor,* B.S., California Institute of Technology, 1951; M.S., Brown, 1957; Ph.D., 1959.

ALICE H. EAGLY, *Associate Professor,* B.A., Radcliffe, 1960; M.A., University of Michigan, 1963; Ph.D., 1965.

William Eichelman, *Assistant Professor,* B.A., University of Hartford, 1965; M.S., University of Oregon, 1968; Ph.D., 1970.

Seymour Epstein, *Professor,* B.A., Brooklyn College, 1948; M.A., University of Wisconsin, 1951; Ph.D., 1953.

Robert S. Feldman, *Professor,* B.S., University of Michigan, 1943; M.A., 1944; Ph.D., 1951.

Katherine V. Fite, *Assistant Professor,* B.S., Florida State University, 1963; M.S., Brown University, 1967; Ph.D., 1969.

Howard Gadlin, *Assistant Professor,* B.A., Queens College, 1962; Ph.D., University of Michigan, 1966.

Stuart Golann, *Professor,* B.A., Queens College, 1957; M.A., University of North Carolina, 1959; Ph.D., 1961.

Ronald K. Hambleton, *Assistant Professor of Education and Psychology.*

Morton G. Harmatz, *Associate Professor,* B.A., Ohio State University, 1960; M.A., University of Washington, 1962; Ph.D., 1963.

Harold Jarmon, *Associate Professor,* B.A., New York University, 1955; M.A., University of Kansas, 1959; Ph.D., 1962.

C. Dalton Jones, *Assistant Professor,* B.A., Rutgers University, 1962; M.S., Tufts University, 1965; Ph.D., Cornell University, 1973.

Alan C. Kamil, *Associate Professor,* B.A., Hofstra College, 1963; M.S., University of Wisconsin, 1966; Ph.D., 1967.

Alexandra Kaplan, *Assistant Professor,* B.A., University of Michigan, 1963; Ph.D., Columbia University, 1968.

Solis L. Kates, *Professor,* B.S., City College of New York, 1935; M.S., 1937; Ph.D., Columbia, 1948.

George Levinger, *Professor,* B.A., Columbia, 1946; M.A., University of California, Berkeley, 1951; Ph.D., University of Michigan, 1955.

Alan Lieberman, *Assistant Professor,* B.S., Brooklyn College, 1953; M.A., University of Connecticut, 1955; Ph.D., 1960.

John W. Moore, *Professor,* B.A., Lawrence College, 1958; Ph.D., Indiana University, 1962.

Stanley M. Moss, *Associate Professor,* B.A., Ohio State, 1957; M.A., 1958; Ph.D., 1962.

Nancy A. Myers, *Professor,* B.A., Mount Holyoke, 1952; M.A., Wisconsin, 1954; Ph.D., 1957.

Melinda Novak, *Assistant Professor,* B.A., University of Connecticut, 1967; M.A., University of Wisconsin, 1971; Ph.D., 1973.

John Gregory Olley, *Assistant Professor,* A.B., College of William and Mary, 1966; M.A., Wake Forest University, 1968; Ph.D., George Peabody College, 1972.

Alexander Pollatsek, *Assistant Professor,* B.S., University of Michigan, 1961; M.A., Harvard University, 1963; M.S., University of Michigan, 1964; M.A., 1965; Ph.D., 1969.

Harold Raush, *Professor,* B.A., University of Michigan, 1941; M.A., University of Michigan, 1942; Ph.D., Stanford University, 1950.

Stephen Reisman, *Assistant Professor,* B.A., City University of New York, 1966; M.A., University of North Carolina, 1969; Ph.D., 1970.

James M. Royer, *Assistant Professor,* B.A., Chico State College, 1967; M.A., University of Illinois, 1969; Ph.D., 1970.

Harry Schumer, *Associate Professor,* B.S., Ohio State, 1954; M.A., 1956; Ph.D., 1961.

Norman Simonson, *Associate Professor,* B.A., University of Rochester, 1960; Ph.D., Pennsylvania State University, 1968.

J. Alfred Southworth, *Professor,* B.S., U.S. Naval Academy, 1943; M.A., Harvard, 1955; Ph.D., 1956.

D. N. Spinelli, *Professor of Computer and Information Science and Psychology.*

Ervin Staub, *Associate Professor,* B.A., University of Minnesota, 1962; Ph.D., Stanford University, 1965.

Ivan Steiner, *Professor,* B.A., Central Michigan College, 1941; M.A., University of Michigan, 1948; Ph.D., 1952.

Bonnie Strickland, *Professor,* B.S., Alabama College, 1958; M.A., Ohio State University, 1960; Ph.D., 1962.

Beth Sulzer-Azaroff, *Associate Professor,* B.S., City College of New York, 1950; M.A., 1953; Ph.D., University of Minnesota, 1966.

Hariharan Swaminathan, *Assistant Professor of Education and Psychology.*

David M. Todd, *Assistant Professor,* B.A., Alma College, 1965; Ph.D., University of Michigan, 1971.

Gilbert C. Tolhurst, *Professor of Speech and Psychology.*

Barbara F. Turner, *Assistant Professor of Human Development and Psychology.*

Castellano B. Turner, *Assistant Professor,* B.A., DePaul University, 1957; M.A., 1963; University of Chicago, 1966.

George N. Wade, *Assistant Professor,* B.S., Pennsylvania State University, 1967; Ph.D., University of California, Berkeley, 1970.

Norman Watt, *Professor,* B.A., Northwestern University, 1957; M.A., Ohio State University, 1960; Ph.D., 1962.

Arnold Well, *Assistant Professor,* B.S., McGill University, 1961; M.S., University of Alberta, 1963; M.A., University of Oregon, 1966; Ph.D., 1969.

Robert H. Willoughby, *Assistant Professor,* B.A., Gettysburg College, 1960; M.S., Pittsburgh, 1962; Ph.D., Minnesota, 1967.

Patricia A. Wisocki, *Assistant Professor,* B.A., Marygrove College, 1965; Boston College, 1967; Ph.D., 1971.

VISITING GRADUATE FACULTY

LAURENCE P. MILLER, *Visiting Associate Professor*, B.A., University of California at Los Angeles, 1963; M.A., California State at Northridge, 1966; Ph.D., Ohio State, 1968.

The aim of the Graduate Program in Psychology is to train scientists who will pursue careers in the following general areas: Biopsychology (including animal and comparative, physiological, and sensory), Cognitive Processes, Clinical* (including behavior modification, child-clinical, community mental health, and counseling), Developmental, Education (a joint program with the School of Education), Personality, and Social. Students may develop programs of study which cut across these established areas, *e.g.*, between Biopsychology and Cognitive Processes, with the approval of the Graduate Program Director.

The aim of the program is implemented by a variety of course offerings. All students are requested to take, directly or by examination, some courses outside their primary area of study in order to gain breadth of knowledge in psychology. These "core" courses are complemented by specialized offerings, including field experience where applicable. A strong emphasis is placed on research, first with faculty, and then on individual student research which culminates in the doctoral dissertation. In addition, because a large percentage of our Ph.D.'s pursue their careers in an academic setting, all students are encouraged to participate in one teaching practicum. Qualified students may also be allowed to assume complete responsibility for small independent sections of larger courses. The "core" consists of six courses: Two in statistics, one in Systematic Psychology (which may be waived for students having received a grade of A or B in an undergraduate course in history of psychology), and three outside one's area of specialization.

All students are admitted to work toward the Ph.D. degree. However, the Master of Science degree is ordinarily earned after completion of 30 credits of study, including a Master's thesis. The M.S. is usually attained in two years, and the Ph.D. in four, except for the Ph.D. in Clinical Psychology for which an additional year's internship is required. Students may complete these requirements in less time.

There is no University nor department-wide foreign language requirement for either the Master's or Ph.D. degree. However, the department may require that the student be examined in a foreign language if, in the opinion of his Guidance Committee, competence in a foreign language is necessary for the student's program of study and research. Similarly, the satisfactory completion of a basic course in Computer Science, or some other technical course, may be required for the Ph.D. degree. Such a course is usually completed early in the student's program of study so that it can serve subsequently as a research tool.

For admission, applicants should have 18 credits or semester hours of psychology courses beyond an introductory course. Included in these courses should be one in statistics, and one in experimental psychology. The latter may be a laboratory course in either physiological, sensory, emotion and motivation, or learning and thinking. Applicants who have done outstanding work in other areas of study, but do not have the required undergraduate credits in psychology, are urged to apply for admission to graduate work. They may be asked to make up some credits or courses. After satisfactory completion of a semester's work of advanced undergraduate courses, such students may petition the Department to waive any remaining undergraduate deficiencies.

In addition to the other Graduate School admission requirements, applicants should also submit to the Department the results of the Miller Analogies Test.

*APA approved

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. PROBLEM IN PSYCHOLOGY.
A research project which may be taken in lieu of the master's thesis or by doctoral students as minor research.
Credit, 3 each semester; maximum credit, 12.

706. DEVELOPMENTAL PSYCHOLOGY.
Selected issues, both historical and contemporary, in developmental psychology.

711. SENSORY PROCESSES I.
Auditory, cutaneous senses, and labyrinthine senses; the fundamental data with their implications concerning functioning of these systems.
Prerequisites, Psych 210 or 6 credits of advanced psychology or equivalent.

712. SENSORY PROCESSES II.
Visual, gustatory, and olfactory senses; the fundamental data with their implications concerning functioning of these systems.
Prerequisites, Psych 210 or 6 credits of advanced psychology or equivalent.

715. PERCEPTION.
Primarily vision and audition. Stress on perceptual processes, as opposed to sensory processes. The perception of form, space, depth; perceptual development and learning, etc.
Prerequisite, Psych 510 or equivalent.

720. LEARNING.
Basic phenomena and current research in animal and human learning.

721. CONDITIONING.
The basic laws of classical conditioning. Topics include the physiological bases of conditioning and related phenomena, the relationship of conditioning to more complex behavior, and relevant research techniques for animal and human experimentation. Lectures and laboratories.

723. ANIMAL LEARNING.
The implication of the basic laws of learning for explaining complex aspects of animal learning. Examples or topics may include application of classical conditioning models to instrumental situations, aversive control, discrimination learning, and primate learning.

725. HUMAN INFORMATION PROCESSING I.
Basic processes in human cognition and performance. Topics include attention, judgment, choice, short-term memory, and long-term memory.
Prerequisite, Psych 720 or permission of instructor.

726. HUMAN INFORMATION PROCESSING II.
Complex aspects of human cognition and performance. Topics include sequential behavior, concept formation, thinking, and psycholinguistics.
Prerequisite, Psych 725 or permission of instructor.

731. EMOTION AND MOTIVATION.
The nature, determinants, and interrelationships of emotion and motivation; techniques involved in investigating these phenomena. Lectures and laboratories.

735. SYSTEMATIC PSYCHOLOGY.
The general structure of psychological theory and an historical and comparative consideration of the backgrounds, viewpoints on scientific methodology, research interests and techniques, and the component variables, hypotheses, and laws of structural, Gestalt, functional, and behavioristic movements.

741. CORRELATIONAL TECHNIQUES.
Reasoning and assumptions underlying correlation analyses; inference; introduction to multivariate techniques; partial correlation; multiple correlation and regression, introduction to factor analysis.
Prerequisite, Psych 545, previously or concurrently, or permission of instructor.

742. PSYCHOLOGICAL SCALING.
Theories underlying measurement and scaling in psychology and the social sciences; models of judgment and choice; models of psychological similarity; models of attitudes and abilities; a comparison of unidimensional multidimensional approaches. Emphasis on relating models to real problems.
Prerequisite, Psych 545, previously or concurrently, or permission of instructor.

744. FACTOR ANALYSIS.
Theory and methods of factor analysis in psychological research. Lectures and laboratory exercises.
Prerequisite, Psych 741 or equivalent.

745. ADVANCED APPLIED STATISTICS.
Various experimental designs, the assumptions underlying their use, and the appropriate statistical analysis; orthogonal and randomized designs, trend analysis, nonparametric techniques, and multivariate analysis.
Prerequisite, Psych 545 or equivalent.

746. QUANTITATIVE METHODS IN PSYCHOLOGY.
Mathematical descriptions of psychophysical and time-dependent data; parameter estimation; stochastic processes.
Prerequisites, Psych 545 and Math 123 or equivalent.

750. PHYSIOLOGICAL PSYCHOLOGY.
An intensive overview of the field. Topics include an introduction to neuroanatomy, techniques used in investigations of brain function, the physiological bases of emotion, motivation, reward and punishment, species-typical behavior, learning, and memory.

751. ADVANCED PHYSIOLOGICAL PSYCHOLOGY.
In-depth analysis of modern concepts in the study of the physiological and biochemical bases of behavior.
Prerequisite, permission of instructor.

752. THE NEUROANATOMICAL BASIS OF BEHAVIOR.
Structure and function of the mammalian nervous system as they relate to sensory-motor and motivational systems.
Prerequisite, Psych 550 or equivalent, or permission of instructor.

753. PSYCHOPHARMACOLOGY.
The mechanisms of drug behavior interactions. Topics are: neuronal ultrastructure, basic neurochemistry and neurophysiology, synaptic transmission, drugs that affect mood and behavior, chemical theories of mental disease, clinical and experimental psychopharmacology, drug dependence and addiction.
Prereqnisite, Psych 550 or 552 or equivalent.

760. THEORIES OF CHILD DEVELOPMENT.
The more relevant theories of child development, specifically those which have served as the impetus for experimental research with children. Theoretical analysis of the personality; social and cognitive development of children.

762. LEARNING AND MEMORY PROCESSES IN CHILDREN.
Theoretical and experimental approaches to topics in learning and memory.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 721 or 262 or permission of instructor.

763. COGNITIVE PROCESSES IN CHILDREN.
Piagetian, behavioristic, and information-processing approaches to research in conceptual development.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 721 or 262 or permission of instructor.

764. PERCEPTUAL DEVELOPMENT IN CHILDREN.
An introduction to theories of perceptual development, consideration of sensory and perceptual capacities of the infant, and analysis of developmental changes in perception in the infant and older children.

766. PERSONALITY AND SOCIAL DEVELOPMENT IN CHILDREN.
Review and analysis of the literature on personality development and the socialization process in children.
Prerequisites, Psych 262, 270, or equivalent.

775. THE PSYCHOLOGY OF EXCEPTIONAL CHILDREN.
The etiology, diagnosis, and treatment of exceptional children, with emphasis on intellectual, social, physical, and sensory deviation.
Prerequisites, Psych 262, 325, or permission of instructor.

777. DIAGNOSIS AND TREATMENT OF BEHAVIOR DISORDERS IN CHILDREN.
The diagnosis and treatment of pyschological maladjustments in infancy and childhood; treatment procedures, resources, and methods used in dealing with behavior and personality problems. Lectures, discussions, practicum sessions.
Prerequisites, Psych 325, 262 or 762, and 833.

780. ADVANCED SOCIAL PSYCHOLOGY.
An overview of theory and experimental research in social psychology. Topics include social perception, attitude structure and change, dyadic interaction, and group processes.

781. ATTITUDES.
Theory, method, and data concerned with the nature and structure of attitudes and opinions, the formation of attitudes, attitude change in response to communication and interpersonal influence.
Prerequisite, Psych 780.

782. SOCIAL JUDGMENT AND INTERPERSONAL PERCEPTION.
The influence of culture, values, needs, and attitudes on perceptual judgments; judgmental and inferential processes about persons and interpersonal behavior.
Prerequisites, Psych 780 and 710, permission of instructor.

783. SOCIAL LEARNING.
Concentration on theories of social learning, particularly those concerned with the analysis of the effectiveness of social reinforcement and observational learning.
Prerequisite, Psych 720 or equivalent.

784. GROUP DYNAMICS.
Interpersonal and group processes; attraction, influence, group structure, communication, cooperation, leadership, group performance. Focus on theory, experimentation, and special problems of the field.
Prerequisite, Psych 780.

793. ADVANCED EDUCATIONAL PSYCHOLOGY.
The psychological principles and concepts of development learning as related to educative process and their application to teaching. Primarily intended for graduate students in Education including MAT candidates.
Prerequisite, Psych 301 or equivalent, or permission of instructor.

794. SOCIAL PSYCHOLOGY IN THE SCHOOLS.
Review and analysis of the social psychological literature as it pertains to school and educational issues. Emphasis on social interaction in the classroom.
Prerequisite, Psych 280 or equivalent, or permission of instructor.

795. PSYCHOLOGY OF CLASSROOM LEARNING.
Review and analysis of the findings of psychology that pertain to introduction. Emphasis on the practical control of learning activities especially as seen in the classroom.
Prerequisite, Psych 280 or equivalent, or permission of instructor.

821. PERSONALITY.
The basic concepts and principles in the study of personality, including theoretical research issues. Emphasis on recent research in specific areas of personality.

830. CLINICAL I.
Roles and functions of clinicians in various settings, current professional issues. Introduction to assessment as related to alternative view of abnormality and personality. Lecture and laboratory. *Credit, 6.*

831. CLINICAL II.
Logic and process of assessment and description of behavior. Basic models and descriptive systems in conjunction with skill development in the use of exemplary techniques including objective and projective tests and naturalistic observation. Relation of models and techniques to models of abnormal behavior and personality.
Lecture and laboratory.
Prerequisite, Psych 830. *Credit, 6.*

833. CLINICAL III.
Problem-formulating and problem-solving within various clinical situations and clinical models. Integration and communication of findings from psychological assessment. Lecture and laboratory.
Prerequisite, permission of instructor. *Credit, 6.*

834. OBJECTIVE PERSONALITY, INTEREST, AND APTITUDE ASSESSMENT.
Review and analysis of the psychological literature pertaining to structured personality, interest, and aptitude tests.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 832 or equivalent.

835. CLINICAL IV.
The theory of the individual techniques of psychotherapy and demonstration of these techniques through video and other tapes, and role-playing. Psychotherapeutic techniques considered may include psychoanalytic, ego psychoanalytic, behavior therapy, operant conditioning, socially oriented, rational-emotive, existential-humanistic, and client-centered.
Three lecture hours and two hours of laboratory.
Prerequisite, Psych 833. *Credit, 4.*

836. CLINICAL V.
Theoretical and research approaches to group and family therapies. Laboratory provides practicum experiences in these techniques.
Three lecture hours and three hours of laboratory.
Prerequisite, Psych 835. *Credit, 4.*

840. SEMINAR IN CLINICAL PRACTICE.
A topic concerned with the practice of clinical psychology. *Credit, 2.*

841. SEMINAR IN PERSONALITY.
A topic concerned with the area of personality. *Credit, 2.*

842. SEMINAR IN CLINICAL RESEARCH.
A topic concerned with research in clinical psychology. *Credit, 2.*

843. SEMINAR IN CLINICAL SPECIALTY.
A topic concerned with a specialty area within clinical psychology. *Credit, 2.*

852. SEMINAR IN COGNITIVE PROCESSES.
Advanced consideration of selected topics in human cognition and performance. Topics chosen from attention, judgment, choice, memory, sequential behavior, concept formation, and psycholinguistics.
May be repeated for credit. *Credit, 1-9.*

853. SEMINAR IN QUANTITATIVE THEORIES OF BEHAVIOR.
Examination and evaluation of quantitative theories of selected behavioral phenomena. Topics selected from choice, detection and recognition, judgment, memory, learning, and concept-formation.
Prerequisite, Psych 746 or permission of instructor. May be repeated for credit. *Credit, 1-9.*

860. BASIC CONCEPTS IN COUNSELING PSYCHOLOGY.
Introductory review and analysis of the psychological literature related to the practice, research, and training functions in counseling psychology.
Prerequisite, 18 credits of psychology or permission of instructor.

865. COUNSELING THEORIES AND TECHNIQUES.
Detailed consideration of current theories and techniques employed in counseling psychology.
Prerequisites, Psych 270, 311, or permission of instructor.

866. THE PSYCHOLOGY OF VOCATIONAL DEVELOPMENT.
Review and analysis of the psychological literature concerning the psychological basis for vocational choice.
Prerequisite, Psych 834 or equivalent.

868. GROUP COUNSELING AND PSYCHOTHERAPY.
Review and analysis of the psychological literature in conjunction with experience in multiple counseling and therapeutic processes.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 835 or 865 or equivalent.

871 (I), 872 (II). PRACTICUM.
Practice in the application of psychological techniques to clinical settings and counseling; and practice in teaching in any area of psychology. Either semester may be elected independently.
Taught with the staffs of cooperating institutions and agencies. *Credit, 3-12.*

873 (I), 874 (II). TEACHING PRACTICUM IN PSYCHOLOGY.
Required of all doctoral candidates. Experience in procedures, leading discussion groups and teaching labs. Close supervision by faculty members. Students meet once a week to discuss problems in teaching. *Credit, 3-12.*

891 (I), 892 (II). SEMINAR.
Selected topics of current significance in psychology. Research studies analyzed and theoretical advances explored. Either semester may be elected independently. Both may be taken only with a change in topic.
Prerequisite, permission of instructor.
Credit, 2 each semester; maximum credit, 6.

895 (I), 896 (II). RESEARCH METHODOLOGY.
Study and evaluation of research methods and of problems in the major fields of psychology.
Credit, 2 each semester.

800. MASTER'S THESIS. *Credit, 8-10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

542. ADVANCED EXPERIMENTAL PSYCHOLOGY.
Instrumentation, methods, and techniques of experimental psychology.

Offered spring semester.
Prerequisites, Psych 101, 141.
May be repeated for maximum of 6 credits.

545. STATISTICAL INFERENCE IN PSYCHOLOGY.
Application of statistical procedures to analysis of psychological data and to problems of measurement in psychology and related fields.
Two class hours, one 2-hour laboratory period.
Offered fall semester.
Prerequisites, Psych 101; Psych 145 or Stat 121.

550. PHYSIOLOGICAL PSYCHOLOGY.
Neural bases of behavior, current issues in physiological psychology; psychobiological investigations of learning, sensory processes, motivation, and instinctive behavior.
Prerequisites, Psych 101 and Zool 101 or permission of instructor.

551. LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY.
Development of skills in laboratory techniques used in physiological psychology, including animal neurosurgery, electrophysiological stimulation and recording, and assessment of drug-behavior interactions.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and Psych 250. *Credit*, 2.

552. DRUGS AND BEHAVIOR.
The psycho-biological foundations of drug-behavior interactions. The neural and neurochemical basis of behavior, basic pharmacology, drugs that affect mood and their mode of action, the psychological and physical bases of drug dependence and addiction, experimental approaches to psychopharmacology.
Offered spring semester.
Prerequisites, Psych 250 or permission of instructor.

563. PSYCHOLOGY OF ADOLESCENCE.
The development and emotional, social, and intellectual adjustment of the individual during the adolescent years.
Prerequisite, Psych 101.

589. ORGANIZATIONAL PSYCHOLOGY.
An introduction to the field of organizational psychology; conceptions of schools, hospitals, prisons, industries, and other organizations as complex social systems; individual adaptation in organizational settings; organizational development and personal change.
Offered spring semester.

590. INDUSTRIAL PSYCHOLOGY.
Psychological principles underlying personnel selection and training, communication, and decision-making in industry.
Offered fall semester.
Prerequisite, Psych 101.

606 (I). COMPARATIVE PSYCHOLOGY.
Emphasis on experimental investigations in a wide range of species. Topics include sensory and physiological systems, learning, and early experience.
Offered fall semester.
Prerequisite, permission of instructor.

611. PSYCHOLOGICAL TESTS.
Survey of tests of intelligence, aptitude, interest, personality, and adjustment. Test rationale, construction, characteristics, uses, and evaluation emphasized.
Two class hours, one 2-hour laboratory period.
Offered spring semester.
Prerequisite, Psych 101.

645. INTRODUCTION TO QUANTITATIVE THEORIES OF BEHAVIOR.
Introduction to quantification of theories of learning, retention, choice, perception, and the interaction of individuals in group situations.
Offered spring semester.
Prerequisite, Psych 145, 305, or permission of instructor.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in psychology)

501. PSYCHOLOGY OF ADJUSTMENT.
Problems of personality development and adjustment. Psychological nature of man, conflict, and thinking and adjustment.
Prerequisite, Psych 101.

510. SENSATION AND PERCEPTION.
Methods, data, and theories of the functioning of various sensory systems. Topics include a survey of basic sensory processes in the cutaneous sense, audition, vision, gustation, and olfaction, and higher perceptual processes in selected senses.
Prerequisite, Psych 101.

511. LABORATORY IN SENSATION AND PERCEPTION.
Selected laboratory exercises in audition and vision and a semester project chosen by the student, with the aid of the instructor, in some area of sensation or perception.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 210. *Credit*, 2.

520. LEARNING AND THINKING.
A general survey of animal and human learning and performance. Topics include factors affecting acquisition, generalization, discrimination, extinction, and transfer in animals and humans; memory; and higher cognitive processes in humans.
Prerequisite, Psych 101.

521. LABORATORY IN HUMAN LEARNING.
Introduction to methods used in investigating rote verbal learning, concept formation, short-term retention, verbal conditioning, artificial language, learning, motor-skills, and other phenomena in human learning and retention.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 220. *Credit*, 2.

522. LABORATORY IN ANIMAL LEARNING.
Introduction to methods used in investigating classical conditioning and operant behavior primarily using laboratory animals as subjects. Topics include: acquisition, generalization, discrimination, extinction, and transfer phenomena.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 220. *Credit*, 2.

530. EMOTION AND MOTIVATION.
Introduction to theories and research on the nature and determinants of motivation. Topics include instinct, behavior energization concepts, biological and acquired bases of emotions and motives, frustration, conflict, and stress.
Prerequisite, Psych 101.

531. LABORATORY IN MOTIVATION.
Methods of investigating motivation, including both laboratory and field studies using human and animal subjects. Includes individual and small group projects.
Two 2-hour laboratory periods.
Prerequisites, Psych 141, 230. *Credit*, 2.

560. CHILD BEHAVIOR AND DEVELOPMENT.
Psychological development of the child, including theories, methods, and data of child-behavior studies.
Prerequisite, Psych 101.

561. LABORATORY IN CHILD BEHAVIOR AND DEVELOPMENT.
Selected experiments investigating perceptual, conceptual, learning, and social processes in children.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 260. *Credit*, 2.

562. CHILD PSYCHOLOGY.
Psychological development of the child, including language, emotions, intelligence, social behavior, motivation and

personality.
Not open to psychology majors.
Prerequisite, Psych 101.

565. INTRODUCTION TO THE STUDY OF EXCEPTIONAL CHILDREN.
The etiology, diagnosis, characteristics, education, and prognosis of deviations in mental, physical, and socio-emotional development.
Prerequisites, Psych 101, 262, or permission of instructor.

570. PERSONALITY.
Introduction to the scientific study of personality. Personality development, structure, and dynamics from major theoretical orientations.
Prerequisite, Psych 101.

571. EXPERIMENTAL STUDY OF PERSONALITY.
Review and evaluation of research approaches to the study of personality. Data, theories, and methods of investigation. Selected projects.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 270. *Credit*, 2.

580. SOCIAL PSYCHOLOGY.
Introduction to the principles and study of social behavior. The psychological factors involved in attitude formation and change, communication and persuasion, and small group processes.
Prerequisite, Psych 101.

581. LABORATORY IN ATTITUDES AND OPINIONS.
Methods and research concerning attitude formation and change, attitude and opinion measurement, communication and persuasion.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 280, or permission of instructor. *Credit*, 2.

582. LABORATORY IN GROUP BEHAVIOR.
Methods and research concerning the behavior of individuals in groups. Interpersonal attraction, social interaction and influence, power and conflict, communication, group structure, leadership, and productivity.
Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 280, or permission of instructor. *Credit*, 2.

601. EDUCATIONAL PSYCHOLOGY.
Psychological facts and principles of development, learning, and measurement as applied to educational situations.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 101.

605. HISTORICAL AND CONTEMPORARY SYSTEMS.
General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems.
Prerequisite, Psych 101.

625. ABNORMAL PSYCHOLOGY.
Etiology, symptoms, and therapy of behavior abnormalities including neuroses, psychoses, epilepsies, speech disorders, and mental deficiency.
Prerequisite, Psych 101

631. CLINICAL PSYCHOLOGY.
Introduction of the theoretical approach and methods used in understanding and treating the psychologically-disturbed individual.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 325 or permission of instructor.

665. THEORIES AND PRACTICE IN COUNSELING.
Theories, techniques, and tests necessary in counseling and guidance. Practice in organization and evaluating relevant data in the analysis of illustrative cases.
Two class hours, one 2-hour laboratory period.
Offered spring semester.
Prerequisite, Psych 270 or 311 or permission of instructor.

RELATED COURSES

Computer and Information Science

603. FUNDAMENTALS OF CYBERNETICS.

683. ARTIFICIAL INTELLIGENCE.

782. COMPUTATIONAL CYBERNETICS.

784. PATTERN RECOGNITION.

Education

516. EVALUATION MODELS.

705. SEMINAR-APPLIED MULTIVARIATE ANALYSIS.

705. SEMINAR-PSYCHOMETRIC MODELS.

705. SEMINAR-EVALUATION DESIGN.

731. FACTOR ANALYSIS.

735. TEST THEORY.

820. RESEARCH PRACTICUM IN EDUCATION.

Entomology

595. EVOLUTION.

611. INSECT BEHAVIOR.

Sociology

725. SYMBOLIC INTERACTION SEMINAR.

729. SOCIOLOGY OF SMALL GROUPS.

784. ADVANCED SOCIOLOGICAL THEORY.

785. COMPLEX ORGANIZATIONS.

797. SURVEY DESIGN AND ANALYSIS.

Communication Studies

792. THEORIES OF HEARING.

Zoology

540. PRINCIPLES OF GENETICS.

600. VERTEBRATE ZOOLOGY.

650. ANIMAL BEHAVIOR.

670. COMPARATIVE PHYSIOLOGY.

680. DEVELOPMENTAL BIOLOGY.

750. SELECTED TOPICS IN ANIMAL BEHAVIOR.

755. SYSTEMATICS AND EVOLUTIONARY MECHANISMS.

770. COMPARATIVE NEUROPHYSIOLOGY.

780. PHYSIOLOGICAL REGULATORY MECHANISMS.

784. ENDOCRINOLOGY.

Public Health

GRADUATE FACULTY

William A. Darity, *Professor, Director of the Division of Public Health and Graduate Program Director,* B.S., Shaw University, 1948; M.S.P.H., North Carolina Central University, 1949; Ph.D., University of North Carolina at Chapel Hill, 1964.

June D. Butts, *Associate Professor,* B.S., Spellman College, 1948; M.A., Columbia University, 1949; Ed.D., 1969.

Tyzz-Lang Chen, *Assistant Professor,* B.Ed., National Taiwan N. University, 1962; M.A., University of Maryland, 1966; Ph.D., Ohio State University, 1970; M.P.H., University of California, Berkeley, 1971.

Salvatore DiNardi, *Assistant Professor,* B.A., Hofstra University, 1965; Ph.D., University of Massachusetts, 1971.

Robert W. Gage, *Professor,* B.S., Massachusetts, 1938; M.D., Harvard, 1942.

Joyce Goggin, *Assistant Professor,* D.V.M., Washington State University, 1962; M.P.H., Johns Hopkins University School of Hygiene and Public Health, 1965.

Alan J. Gross, *Associate Professor,* B.A., University of California, Los Angeles, 1956; M.A., 1957; Ph.D., University of North Carolina, 1962.

David W. Hosmer, *Assistant Professor,* B.A., University of Vermont, 1966; M.A., 1968; Ph.D., University of Washington, 1971.

Warren Litsky, *Commonwealth Professor of Environmental Sciences and Public Health,* B.A., Clark 1945; M.S., Massachusetts, 1948; Ph.D., Michigan State University, 1951.

Gary S. Moore, *Assistant Professor,* B.S., University of Massachusetts, 1966; M.S., 1969; Dr.P.H., University of North Carolina at Chapel Hill, 1971.

A. Taher Moustafa, *Associate Professor,* M.D., Cairo University, 1954; M.P.H., University of Alexandria, 1959; Dr.P.H., University of California at Berkeley, 1962.

Jesse S. Ortiz, *Asssociate Professor,* B.Ph., Northwestern University, 1961; M.S., Loyola University, 1965; M.P.H., University of Michigan, 1968; Dr.P.H., 1970.

Howard A. Peters, *Associate Professor,* B.A., University of Omaha, 1951; M.P.H., University of North Carolina at Chapel Hill, 1958; Ph.D., 1965.

Jerome S. Peterson, *Adjunct Professor,* B.S., Syracuse, 1925; M.D., College of Physicians and Surgeons, Columbia, 1931; M.P.H., Harvard School of Public Health, 1939.

Richard B. Reynolds, *Associate Professor,* B.A., University of Colorado, 1958; M.P.H., University of California at Berkeley, 1967; Dr.P.H., 1973.

Paula Stamps, *Assistant Professor,* B.S., University of Missouri, 1968; M.S., University of Oklahoma, 1970; Ph.D., 1972.

Robert W. Tuthill, *Assistant Professor,* B.A., University of Massachusetts, 1956; M.A., University of Pennsylvania, 1961; Ph.D., University of North Carolina at Chapel Hill, 1970.

COURSE OF STUDY

Students interested in obtaining graduate preparation in the various areas of public health will be accepted in the Division of Public Health if their previous academic background indicates an aptitude for graduate study. Applicants must satisfy the entrance requirements of the Graduate School. Usually applicants will be best prepared by having completed an undergraduate major in either the physical sciences, biological sciences, public health, or the social and behavioral sciences. For all students a minimum background is essential in both the social and behavioral sciences and the biological sciences. In special circumstances, students will be accepted with other undergraduate study majors.

The course of study is organized to prepare students for concentration in:

1. Air pollution.
2. Biostatistics and/or health statistics.
3. Epidemiology.
4. Community health education.
5. Environmental health.
6. Health laboratory science.

The course of study leads to the Master of Science degree. Students will also be prepared for advanced graduate studies. The Division encourages an interdisciplinary academic and research approach and will arrange a cooperative program with other departments when this is in the interest of the student. Students who have completed undergraduate study in public health or have followed courses similar or parallel to the Public Health 500-600 series will not be permitted to take such courses for graduate credit.

Also, students who have deficiencies in certain specific, essential, undergraduate courses will be required to take such courses without graduate credit.

Each applicant's situation is handled on an individual basis.

Examples of typical programs of study in each of the areas of concentration are available.

Interested persons may secure this information by writing to the Division.

RESEARCH

All graduate students in the Division of Public Health must carry out some form of investigation or research as a requirement for the Master of Science degree. This will be in the form of a thesis or a special problem conducted under the direction of a departmental faculty member who is also a member of the Graduate Faculty. Before receiving the Master of Science degree, all students must pass an oral comprehensive examination. This examination is given by at least three members of the Graduate Faculty. The comprehensive examination covers the research project as well as the subject matter the student will have covered leading up to the Master of Science degree.

COURSES REQUIRED OF ALL STUDENTS FOR MASTER OF SCIENCE DEGREE

The following courses, with some minor adjustments, are required of all Public Health majors:

	Credits
PH 620. Introduction to Health Administration.	4
PH 660. Principles of Environmental Health.	3
PH 630. Principles of Epidemiology.	3
PH 640. Public Health Statistics.	3
PH 740. Evaluation of Public Health Research.	3
PH 795 and 796. Seminar.	1 ea. sem.
PH 700. Special Problems. or PH 800. Masters Thesis.	1-6 or 6-12

Courses to fulfill requirements for concentration in the area of public health elected by the student (air pollution, biostatistics and/or health statistics, health administration, community health education, environmental health, epidemiology or health laboratory science) are selected in cooperation with the faculty adviser. The total program and the topic for investigation or research must have the approval of the Division's Graduate Coordination Committee. Two academic years is the normal period required for satisfying requirements for the Master of Science degree in the Division of Public Health. Students following the community health education sequence in preparation to become a community health educator must take Public Health 782. (This program is accredited by the American Public Health Association. Public Health 782 is one aspect of accreditation.)

MASTER OF ARTS IN TEACHING (MAT) PROGRAM IN PUBLIC HEALTH

The Master of Arts in Teaching degree (MAT) is offered in cooperation with the School of Education to candidates who are interested in health-education teaching at the secondary school level.

The program requires 39 graduate credits, distributed as follows: Education courses, nine credits. Education practicum, nine credits. At least 12 credits in Public Health, to include at least two courses and two seminars. The remaining credits (at least nine) will be taken in the Department of Public Health or must be courses approved by the Department of Public Health.

The degree is also offered to candidates interested in general health teaching and health-technology teaching (medical technology, environmental health, etc.) at the community-college level.

For the community-college level option, 45 graduate credits are required, distributed as follows: 24 credits in the field of Public Health, 12 credits in professional Education courses, and nine credits for teaching practicum.

Prerequisites for admission: For all candidates, a bachelor's degree in an appropriate discipline or equivalency.

For Medical Technology candidates, the MT (ASCP) certification and at least one year's experience on a professional level, or its equivalency. Applicants interested in the MAT in public health should be sure to indicate this on their application and also designate public health as their major interest.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS IN PUBLIC HEALTH.
Special investigational or research problems for advanced students. The scope of the work can be varied to meet specified conditions. *Credit, 3-6.*

702. ADVANCED METHODS IN HEALTH EDUCATION.
Health education efforts that have influenced community health. Individual study, programming and research methods.
Prerequisite, permission of instructor. Mr. Chen.

708. RESEARCH METHODS IN COMMUNITY HEALTH EDUCATION.
Logic and techniques of research methods as they apply to health education. Emphasis on formulating research problems, developing research designs, collecting, analyzing and reporting data as they relate to the solution of community health problems.
Prerequisite, permission of instructor. Mr. Chen.

720. ORGANIZATION AND MANAGEMENT OF MEDICAL CARE.
Prevailing organizational patterns for delivery of medical care services. Cost and methods of payment, health personnel and facilities, planning and evaluation of medical care-health amendments to the Social Security Act, national and international trends.
Prerequisite, permission of instructor. Mr. Moustafa.

730. EPIDEMIOLOGICAL INVESTIGATION.
A detailed examination of vital statistics and their use in epidemiological investigations. Students formulate and carry out an epidemiological analysis using secondary data.
Prerequisite, PH 630.

734. HEALTH PROGRAM EVALUATION.
The major approaches to evaluating categorical health programs. Class members undertake a systematic analysis of previous evaluation efforts in health areas of individual interest.
Prerequisite, permission of instructor. Mr. Tuthill.

735. SOCIAL EPIDEMIOLOGY.
The links between the life styles of populations and the risks to which individuals in these populations are vulnerable. Models linking social stress and physiological responses, psychosocial mediators, and social support systems as they promote or reduce susceptibility to disease.
Prerequisite, permission of instructor. Mr. Tuthill.

737. ADVANCED EPIDEMIOLOGY.
The application of epidemiological techniques to the study of a specific health problem.
Prerequisite, PH 730.

740. EVALUATION OF PUBLIC HEALTH RESEARCH.
Principles of statistics applied to the evaluation of public health research. Mr. Gross.

741. SURVIVAL THEORY IN PUBLIC HEALTH AND SCIENCE.
Application of statistical distribution theory to assess and predict survival in human beings and animals who are, for example, exposed to a radiation hazard, as well as electrical and mechanical equipments.
Prerequisites, PH 640 and Math 616 or permission of instructor. Mr. Gross.

742. ADVANCED METHODS IN BIOMETRIC RESEARCH.
Applications of advanced statistical procedures such as Hotellings' T^2 statistic, nonlinear regression, and stepwise linear regression to problems in biology, medicine and public health.
Prerequisites, PH 640, Math 616, and FORTRAN programming ability, or permission of instructor. Mr. Gross.

760. ENVIRONMENTAL HEALTH PLANNING.
Principles of environmental health as translated into community programs planned to meet desirable objectives. Different surveys and rating systems as measuring devices for the

effectiveness of programs.
Prerequisite, PH 660 or equivalent. Mr. Peters.

761. TOPCS IN RADIATION PROTECTION.
Details of man's radiation environment, including the impact of nuclear power generation radioisotope releases, medical radiation, and applications of radiation processing of materials and foods.
Prerequisite, permission of instructor of PH 663.

773. AIR SAMPLING AND ANALYSIS.
Applications of fluid mechanics and gas laws to measurement and collection of gaseous atmospheric pollutants including those which are injurious to health. Manual and automated analysis of these pollutants by electrochemical, spectrophotometric and gravimetric techniques.
Prerequisite, PH 662 or permission of instructor.
Mr. DiNardi.

780. PUBLIC HEALTH LAW.
Constitutional and social bases for public health law. The development of statutes and regulations and their effects on social problems, including review of court decisions and the preparation of administrative regulations. Mr. Hartzler.

782. SUPERVISED FIELD TRAINING (INTERNSHIP).
For majors. Opportunity for supervised field observation and professional experience in selected public health agencies. Assignment in either associate function or internship. Departmental staff; consultants in public health agencies.
Credit, 3-12.

795, 796. SEMINAR.
Lectures and reports on current literature and special topics.
Credit, 1 each semester; maximum credit, 4. Mr. Berger.

800. MASTER'S THESIS.
Independent research leading to a thesis on a public health subject. Results should be suitable for publication.
Credit, 3-10.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

560. THE ENVIRONMENT AND PUBLIC HEALTH.
The relationship of public health to various environmental problems. Consideration of the technological, social, economic and political resources needed to effect an improvement. Not open to Public Health graduate students. Mr. DiNardi.

563. INSTITUTIONAL HYGIENE AND SANITATION.
Application of bacteriology to the prevention of food poisoning events. Evaluation of sanitary measures designed to prevent disease transmission via food and institutional environments. Role of governmental agencies. Mr. Wisnieski.

564. MICROSCOPY OF WATER.
Microscopic forms of life, exclusive of bacteria. Counting and control of plankton in potable waters. Elements of limnology.
3 class hours, one 2-hour laboratory period. Mr. Wisnieski.

601. PRINCIPLES OF COMMUNITY HEALTH EDUCATION.
Exploration of methods and approaches to community health, community dimensions, and community potential. Types and use of various methods leading to community action.
3 class hours, one 2-hour laboratory period.
Prerequisite, permission of instructor.
Credit, 4. Mr. Reynolds.

602. COMMUNITY DEVELOPMENT IN HEALTH EDUCATION.
Latest approaches in community development and community organization procedures. Exploratory readings, field assignments; emphasis on leadership development and coordinated community action.
Prerequisite, permission of instructor.

604. SCHOOL HEALTH.
The principal concepts, methods and dynamics of the organization of a school health program at the elementary and secondary levels. Stress on the planning and teaching in problem areas through the efforts of all leadership persons in the school and in the community.
Prerequisite, permission of instructor. Mr. Chen.

605. CURRENT ISSUES IN HEALTH EDUCATION.
Emphasis on controversial issues such as sex, drugs, and suicide education. Mr. Chen.

611. HUMAN SEXUALITY AND SEX EDUCATION.
Human sexuality in relation to modern life. Emphasis on sexuality as it may appear in the infant, the child, the adolescent, and the young married adult; examination and clarification of one of the crucial dynamics of the present era.
Prerequisite, permission of instructor. Ms. Butts.

612. PUBLIC HEALTH AND FAMILY PLANNING.
Public health problems associated with family health and population limitation. Historical factors, limitation methods, and barriers and facilitators related to family health and size.
Prerequisite, permission of instructor. Mr. Darity.

620. INTRODUCTION TO HEALTH ADMINISTRATION.
Introduction to the philosophy, nature, and scope of modern health services. Discussion of major health issues and programs. Organization of health services by local, national and international health agencies.
Prerequisites, Soc 101 and Zool 101, or permission of instructor.
Credit, 4. Mr. Moustafa, Ms. Stamps.

621. ORGANIZATION AND ADMINISTRATION OF HEALTH PROGRAMS.
The organization of health programs to meet the needs of the people. Emerging health problems and approaches to solving these problems. Emphasis on comprehensive planning and evaluation procedures.
Prerequisite, PH 620 or permission of instructor.
Credit, 4. Mr. Moustafa.

630. PRINCIPLES OF EPIDEMIOLOGY.
An epidemiological perspective of health. Approaches for (1) describing patterns of disease in groups of people and (2) elucidating processes creating differing health levels in human groups. Mr. Tuthill, Ms. Goggin.

632. CHRONIC DISEASE EPIDEMIOLOGY.
An analysis of the impact of selected chronic diseases on modern society. Current theories of cause and prevention related to present and future needs in health care and research efforts.
Prerequisite, PH 630 or permission of instructor.
Ms. Goggin.

633. COMMUNICABLE DISEASE EPIDEMIOLOGY.
A review of selected infectious diseases; emphasis on current theories of distribution, transmission and control.
Ms. Goggin.

640. PUBLIC HEALTH STATISTICS.
Principles of statistics applied to the evaluation of public health practices.
Three class hours, one 1-hour laboratory period.
Prerequisite, permission of instructor. Mr. Gross.

650. BASIC PUBLIC HEALTH LABORATORY PROCEDURES.
Standard methods used in present day applied bacteriology; soils, dairy products, water and shellfish, and air.
Two class hours, two 2-hour laboratory periods.
Prerequisite, Microbiol 140 or permission of instructor.
Mr. Litsky.

651. ADVANCED PUBLIC HEALTH LABORATORY PROCEDURES.
Field collection of samples, stream pollution study, food poisoning and infection, standard methods of food analysis.
One 4-hour and one 2-hour laboratory period.
Prerequisite, PH 650 or permission of instructor. Mr. Ortiz.

652. CLINICAL BACTERIOLOGY.
Procedures in clinical laboratory work.
One class hour, two 2-hour laboratory periods.
Prerequisites, Microbiol 250 or permission of instructor.
Mr. Ortiz.

660. PRINCIPLES OF ENVIRONMENTAL HEALTH.
The application of scientific knowledge to the control of man's environment as applied to human health. The physical, chemical and biological aspects of the air, water, land, food, housing, and occupation environments.
Public health or science majors with junior standing, or permission of instructor. Mr. Peters.

661. ENVIRONMENTAL HEALTH PRACTICES.
The concepts of control methods used by the environmental health and engineering practitioner. Topics include: water, wastewater, solid wastes, food sanitation, vector control, housing, and accident control measures.
Limited to environmental health and engineering majors. Other science majors by permission of instructor.
Mr. Peters.

662. PRINCIPLES OF AIR POLLUTION.
Air pollution as a major public health problem. Topics include: air pollutants, and their sources, health and economic effects, meteorology, sampling and analysis, air quality criteria and standards, control technology, control regulations and programs.
Limited to public health and engineerings majors. Other science majors by permission of instructor. Mr. Peters.

663. PRINCIPLES OF RADIATION PROTECTION.
Effect and control of radiation in the mammalian system. Includes sources, measurements, radiosensitivity, radiation chemistry, cellular effects and acute and delayed effects in occupational, medical, and environmental exposures.
Prerequisite, permission of instructor.

670. PRINCIPLES OF OCCUPATIONAL HEALTH.
The relation of the occupational environment to the health, efficiency, and well-being of workers. Emphasis on industrial hygiene, including toxic materials, physical stresses and control methods.
Limited to public health and engineering majors. Other science majors by permission of instructor. Mr. Peters.

PARTIAL LIST OF COURSES IN OTHER SCHOOLS AND DEPARTMENTS FOR WHICH MAJOR CREDIT WILL BE GIVEN IN THE DIVISION OF PUBLIC HEALTH

Biochem. 523, 524. General Biochemistry.

Bus. Ad. 742. Operations Management.

Bus. Ad. 751. Organizational Behavior.

Bus. Ad. 752. Business Policy.

Chem.Eng. 660. Air Pollution Control Processes.

Civ. Eng. 571. Introduction to Environmental Pollution Control.

Civ. Eng. 672. Environmental Engineering Analysis I.

Civ. Eng. 674. Radiological Health Engineering.

Civ. Eng. 675. Surface Water Quality Control.

Econ. 562. American Economic History.

Econ. 566. Economic Development.

Econ. 571. Comparative Economic Systems.

Educ. 516. Evaluation Models.

Educ. 518. Research Methods in Education.

Educ. 535. Education Media, Technology, and Systems.

Educ. 550. Conceptions of Liberal Education.

Educ. 551. Foundations of Education.

Educ. 554. Educational Anthropology.

Educ. 655. Introduction to Statistics and Computer Analysis.

Educ. 713. Human Appraisals and Evaluation.

Educ. 744. History of Higher Education in America.

Educ. 881. Comparative Education.

Educ. 884. Educational Sociology.

Microbiol. 580. Pathogenic Bacteriology.

Microbiol. 610. Immunology.

Microbiol. 620. Virology.

Microbiol. 710. Advanced Immunology.

Psych. 580. Social Psychology.

Psych. 601. Educational Psychology.

Psych. 780. Advanced Social Psychology.

Sociol. 547. Elementary Statistics.

Sociol. 551. Urban Sociology.

Sociol. 561. Population Problems.

Sociol. 587. Sociology of Mental Disorders.

Sociol. 660. Techniques of Demographic Analysis.

Sociol. 722. Sociology of Education.

Sociol. 731. Socio Gerontology.

Sociol. 732. Sociology of Medicine.

Sociol. 757. Seminar in the Family.

Sociol. 764. Population Characteristics and Socio-Economic Change.

Sociol. 766. Human Ecology: Community Structure and Interrelations.

Stat. 531, 532. Introduction to Fundamentals of Statistical Inference (I) (II).

Stat. 551. Elementary Least Squares, Regression, and Analysis of Variance.

Stat. 561. Design of Experiments (Methods).

Stat. 571. Survey Sampling.

Stat. 581. Multivariate Analysis (Methods).

Zool. 530. Systems of the Human Body.

Slavic Languages and Literatures

GRADUATE FACULTY

Maurice I. Levin, *Professor and Head of the Department of Slavic Languages and Literatures*, B.A., Boston University, 1953; M.A., Harvard, 1958; Ph.D., 1964.

George Ivask, *Professor*, Ph.D., Harvard, 1955.

J. Joseph Lake, *Assistant Professor,* B.A., Georgetown University, 1964; M.A., Yale, 1968; Ph.D., 1969.

Ludmilla I. Ostrorog, *Assistant Professor,* Ph.D., University of Washington, 1969.

Robert A. Rothstein, *Associate Professor,* B.S., Massachusetts Institute of Technology, 1960; M.A., Harvard, 1961; Ph.D., 1967.

Laszlo M. Tikos, *Professor,* M.A., University of Debrecen, Hungary, 1954; Ph.D., University of Tübingen, Germany, 1962.

MASTER OF ARTS

Prerequisites for admission: A bachelor's degree with a major in Russian language and literature or area studies, plus an indication of ability to do successful graduate work. Deficiencies in literary background and/or insufficient command of spoken or written Russian must be remedied before the candidate can be admitted to certain courses required for the degree.

Language: For this degree the student must have, or must acquire, a reading knowledge of at least one major language other than Russian or English, preferably French or German. In addition, the student is required to demonstrate proficiency in speaking, understanding, reading and writing contemporary standard Russian.

Program of study: A total of 30 credits, at least 24 of which must be earned in this Department. The student is required to pass a comprehensive examination in order to demonstrate 1) proficiency in the language itself; 2) familiarity with the whole body of Russian literature; 3) thorough knowledge of the structure and history of the Russian language; 4) knowledge of Russian and Soviet history and culture.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

SLAVIC

700. PROBLEMS COURSE.
Directed study in some special area of literature or linguistics. *Credit, 3-12.*

710. OLD CHURCH SLAVIC.
Introduction to the phonology, morphology, and syntax of Old Church Slavic; selected readings and textual analysis.
Required of all first-year graduate students. Mr. Lake.

770. PROSEMINAR I. BIBLIOGRAPHY AND METHODOLOGY.
An introduction to tools and methods of research. Designed to acquaint students with major reference works, scholarly publication, and basic approaches to literary criticism. Required of all candidates for graduate degree. Offered first semester.

770. PROSEMINAR II AND III. INTERPRETATION OF TEXTS.
Problems in philology or in literary interpretation. Reports and papers on selected texts.
Prerequisite, Slavic 770. *Credit, 3 each semester.*

780. SEMINAR.
Close study of a single topic, author or work. One main purpose is to suggest projects for independent research to advanced students. Subject matter varies from year to year.
Credit, 3-9.

RUSSIAN

711. READINGS IN RUSSIAN LITERATURE OF THE EARLY PERIOD.
Close reading and analysis of the major works of Russian literature before Pushkin. Emphasis on the place of each in the development of Russian literature. Conducted in Russian with readings in the original. Mr. Tikos.

712. READINGS IN RUSSIAN LITERATURE SINCE PUSHKIN.
Close reading and analysis of the major works of Russian literature since Pushkin. Emphasis on the place of each in the development of Russian literature. Conducted in Russian with readings in the original. Mr. Ivask.

800. MASTER'S THESIS. *Credit, 6-9.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

SLAVIC

559. THE SLAVIC PEOPLES, THEIR LANGUAGES AND CIVILIZATIONS.
A survey of the historical, social, intellectual, and cultural evolution of the Slavic peoples from the earliest times to the present. Emphasis on the non-Russian Slavs. Conducted in English; no language prerequisite. Mr. Rothstein.

RUSSIAN

553. DOSTOEVSKY.
Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Mr. Tikos.

554. TOLSTOY.
Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Mr. Tikos.

556. RUSSIAN DRAMA.
Drama in the originals from the beginning to the establishment of a national theatre culminating in plays of Ostrosvky, Chekhov, Gorky.
Prerequisite, proficiency in Russian. Mr. Tikos.

557. SOVIET LITERATURE.
The beginnings and development of Soviet prose, drama, and criticism from Gorky to Sholokhov and Pasternak. Mr. Tikos.

558. RUSSIAN POETRY.
Russian poetry in the originals, from the early 19th century to the present. Emphasis on the major poetic trends.
Prerequisite, proficiency in Russian. Mr. Ivask.

566. RUSSIAN PHONETICS.
Detailed analysis of the Russian sound system. Articulation and intonation, largely in comparison with the English sound system. Recommended for those preparing to teach Russian.
Prerequisite, proficiency in Russian. Mr. Levin.

610. THE TEACHING OF RUSSIAN.
A systematic analysis of the major linguistic problems facing the teacher of Russian and the methods used in solving them.
Prerequisite, Russian 665 or permission of instructor. Mr. Levin.

619. PUSHKIN.
The most important works of Pushkin, prose and poetry. *Eugene Onegin, Boris Godunov, The Captain's Daughter, The Bronze Horseman, Poltava,* and others. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating. Mr. Ivask.

620. GOGOL.
The most important works of Gogol: *The Inspector-General, Dead Souls, The Overcoat,* and selected passages from his *Correspondence with Friends,* and other works. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating.
Mr. Ivask.

631. NINETEENTH-CENTURY RUSSIAN CRITICISM.
Criticism of the 19th century: Belinsky, Chernyshevsky, Dobrolyubov, Pisarev, and others. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating. Mr. Ivask.

663. THE HISTORY OF THE RUSSIAN LANGUAGE.
Historical development of the Russian language, its relation to other languages, changes in sound, form, and vocabulary from the earliest period to the present.
Prerequisite, proficiency in Russian. Mr. Lake.

665. STRUCTURE OF RUSSIAN.
Descriptive analysis of the morphology of contemporary standard Russian; emphasis on selected problems of derivation.
Prerequisite, proficiency in Russian. Mr. Levin.

666. CONTRASTIVE STRUCTURES OF RUSSIAN AND ENGLISH.
Contrastive analysis of Russian and English with emphasis on those elements of Russian structure that differ significantly from English.
Prerequisite, Russian 665. Mr. Rothstein.

COURSES NOT FOR MAJOR CREDIT

419, 429, 439. RUSSIAN READING COURSE.
Intensive study of Russian grammar. Emphasis on developing reading ability only. Appropriate for graduate students preparing for their reading examinations. *No credit.*

449. RUSSIAN EXPOSITORY PROSE.
Readings in non-literary Russian texts from a wide variety of scientific and technical fields. Emphasis on developing reading skill in the student's specialized field.
Prerequisite, three semesters of Russian or equivalent.
No credit.

Sociology

GRADUATE FACULTY

N. Jay Demerath, III, *Professor and Chairman of the Department of Sociology,* B.A., Harvard, 1958; M.A., University of California at Berkeley, 1961; Ph.D., 1964.

Lewis M. Killian, *Professor and Graduate Program Director in Sociology,* B.A., University of Georgia, 1940; M.A., 1941; Ph.D., Chicago, 1949.

Albert Chevan, *Assistant Professor,* B.S., Cornell, 1953; M.S., Connecticut, 1957; Ph.D., University of Pennsylvania, 1968.

Roland J. Chilton, *Associate Professor,* B.A., Monmouth, 1951; M.A., Wisconsin, 1958; Ph.D., Indiana, 1962.

Edwin D. Driver, *Professor,* B.A., Temple, 1945; M.A., University of Pennsylvania, 1947; Ph.D., 1956.

Robert R. Faulkner, *Assistant Professor,* B.A., University of California at Los Angeles, 1963; M.A., 1965; Ph.D., 1968.

Hilda H. Golden, *Associate Professor,* B.A., Skidmore, 1942; M.A., Duke, 1944; Ph.D., 1950.

Milton M. Gordon, *Professor,* B.A., Bowdoin, 1939; M.A., Columbia, 1940; Ph.D., 1950.

Anthony R. Harris, *Assistant Professor,* B.A., Queens College, 1964; M.A., Cambridge, 1966; Ph.D., Princeton, 1972.

John P. Hewitt, *Associate Professor,* B.A., State University of New York at Buffalo, 1963; M.A., Princeton, 1965; Ph.D., 1966.

Paul Hollander, *Associate Professor,* B.A., University of London, 1959; M.A., University of Illinois, 1960; M.A., Princeton, 1962; Ph.D., 1963.

Christopher J. Hurn, *Associate Professor,* B.S., London, 1960; M.A., Northwestern, 1965; Ph.D., 1968.

J. Henry Korson, *Professor,* B.A., Villanova, 1931; M.A., Yale, 1942; Ph.D., 1947.

Robert K. Leik, *Professor,* B.A., Oregon, 1953; M.S., Wisconsin, 1957; Ph.D., 1960.

Michael Lewis, *Associate Professor,* B.A., Brooklyn College, 1959; M.A., Princeton, 1962; Ph.D., 1967.

John W. Loy, Jr., *Associate Professor of Physical Education.*

John F. Manfredi, *Associate Professor,* B.A., University of Pennsylvania, 1942; M.A., Harvard, 1948; Ph.D., 1951.

Surinder K. Mehta, *Associate Professor,* B.A., Oregon, 1952; M.A., 1955; Ph.D., Chicago, 1959.

John F. O'Rourke, *Assistant Professor,* B.A., Massachusetts, 1956; Ph.D., Yale, 1963.

Charles H. Page, *Robert M. MacIver Professor of Sociology and Government,* B.A., University of Illinois, 1931; Ph.D., Columbia, 1940.

Peter Park, *Professor,* B.A., Columbia, 1953; M.A., Yale, 1955; Ph.D., 1958.

Eugene B. Piedmont, *Associate Professor and Associate Dean of the Graduate School,* B.S., State University of New York, 1956; M.A., Rochester, 1959; Ph.D., Buffalo, 1962.

Gerald M. Platt, *Associate Professor,* B.A., Brooklyn College, 1955; M.A., 1957; Ph.D., University of California at Los Angeles, 1964.

W. Clark Roof, *Assistant Professor,* B.A., Wofford College, 1961; M.A., North Carolina, 1969; Ph.D., 1971.

Jon E. Simpson, *Associate Professor,* B.A., Ohio Wesleyan, 1954; M.A., Ohio State, 1958; Ph.D., 1961.

Randall G. Stokes, *Assistant Professor,* B.A., California State College at San Diego, 1966; M.A., Duke, 1967; Ph.D., 1971.

Gordon F. Sutton, *Associate Professor,* B.A., Wayne State, 1953; M.A., 1955; Ph.D., University of Michigan, 1959.

Curt Tausky, *Associate Professor,* B.A., Portland State, 1959; Ph.D., Oregon, 1963.

Richard C. Tessler, *Assistant Professor,* B.A., Wisconsin, 1968; M.S., 1970; Ph.D., 1972.

Thomas O. Wilkinson, *Professor*, B.A., North Carolina, 1945; M.A., Duke, 1950; Ph.D., Columbia, 1957.

James D. Wright, *Assistant Professor*, B.A., Purdue University, 1969; M.S., University of Wisconsin, 1970; Ph.D., 1973.

Sonia R. Wright, *Lecturer*, B.S., Purdue University, 1965; M.S., 1967; Ph.D., 1973.

David W. Yaukey, *Professor*, B.A., Oberlin, 1949; M.A., Washington State, 1950; Ph.D., University of Washington, 1956.

The graduate program in sociology is divided into two tracks. One is for Master of Arts candidates; the other is for students who have been accepted into the Doctor of Philosophy degree program. These two tracks, however, are not completely separate programs; no courses are designed specifically for either track. Although students entering with a bachelor's degree are usually required to obtain a Master of Arts degree en route to the Ph.D., the M.A. student may petition the Graduate Studies Committee for a waiver of the thesis requirement and thereby transfer to the doctoral program.

Students working toward either the Master of Arts or the Doctor of Philosophy degree in sociology must fulfill the general requirements of the Graduate School. The Doctor of Philosophy degree, while it has no specific course requirements, utilizes as its guiding principle the effective preparation of candidates to excel at two tasks: (1) the Comprehensive Examination and (2) the dissertation. The Comprehensive Examination is both written and oral. Since no relationship is assumed to obtain between specific courses taken and the high expectations of the Comprehensive Examination, course requirements are deliberately flexible. The written portion of the Comprehensive Examination covers two "special fields" selected by the student from areas of particular Department expertise, plus two required sections on sociological theory-methodology and research methods-statistics. A general oral examination, following the written sections, is an integral part of this requirement.

The Comprehensive Examination may not be taken until a minimum of 30 credits of graduate course work has been completed. Upon successfully passing the Comprehensive Examination, the student is admitted to candidacy for the Ph.D. degree and may proceed with the dissertation. A public oral final examination, not necessarily limited to the dissertation, is also required at its completion.

There is no general foreign-language requirement for degree qualification in sociology. Doctoral students may be expected to demonstrate satisfactory levels of competence in one or more languages other than English in those cases where such a requirement is deemed desirable by the faculty (*e.g.*, a specific dissertation project).

Master's degree candidates must complete a minimum of 30 credits. Of these at least 24 credits must be for coursework; six are awarded for successfully completing a thesis. Normally, *at least one* of the required eight courses shall be taken in sociological theory, *at least one* in research methods, and *another* in statistics. The thesis, followed by a final oral examination, is required of all terminal master's degree candidates and, normally, all doctoral candidates.

Applicants for admission to graduate study in sociology are expected to be familiar with fundamental sociological concepts and literatures. Candidates may be asked to remove deficiencies, without receiving graduate credit, prior to or after admission.

Applications for admission will *not* be evaluated until *all* credentials have been received. These include Graduate Record Examination scores (both Aptitude and Advanced), two letters of recommendation, and transcripts of all previous academic study. Students requesting any form of financial aid are responsible for ensuring that all application materials are on file in the Graduate School by February 1 (for fall entrance) and October 1 (for spring entrance). The respective deadlines for filing applications for admission are March 1 and October 1, but early submission is strongly encouraged.

Applicants from countries whose native tongue is not English must, in addition to submitting all the above credentials, take the Test of English as a Foreign Language (TOEFL). The Graduate School also requires all foreign students to take an English examination at the beginning of their initial semester, after admission. Remedial work may be prescribed on the basis of this examination.

A brochure, "Graduate Studies Program," which details the basic emphases and requirements of the Department's programs, is available on request to the Graduate Program Director.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.
A special project in sociology.
Prerequisite, permission of instructor.

712. SOCIAL CHANGE.
Analysis of change as a process, especially the factors making for acceptance or rejection of innovations. Intrasocietal sources of change. Consequences of contacts between societies, with emphasis on underdeveloped areas.
Prerequisite, Soc 272 or permission of instructor.

713. SOCIOLOGY OF KNOWLEDGE.
Seminar for advanced students. The intellectual and social background of Karl Mannheim's and Max Scheler's *Sociology of Knowledge*. Discussion of selected writings. Comparisons with Durkheim, Sorokin, Mead. Influence of Mannheim's *Sociology of Knowledge* in Europe and America. Mr. Speier.

714. CRIMINOLOGY.
Criminological theories, past and present, with emphasis on present research trends as they relate to theoretical formulations.
Prerequisite, permission of instructor.
Mr. Chilton, Mr. Driver, Mr. Simpson.

717. JUVENILE DELINQUENCY.
Theories of causation and treatment of delinquency.
Prerequisite, Soc 278 or permission of instructor.
Mr. Chilton, Mr. Driver, Mr. Simpson.

718. INDUSTRIAL SOCIOLOGY.
The role, status, and function of the worker in the industrial community; the impact of technological change on the community; analysis of selected occupational functions. Mr. Tausky.

719. THE SOCIOLOGY OF RELIGION.
The relations of religious ideology and ecclesiastical organization to the total social institutional system. Attention to the religions of larger civilizations, especially

Islam, Buddhism, medieval Christianity, Gentile paganism, Protestantism, and Judaism. Mr. Manfredi, Mr. Roof.

720. CONTEMPORARY BELIEF SYSTEMS.
Comparative belief systems in modern industrial societies, including both theoretical and methodological considerations. Major topics include: problems of defining "religion" in contemporary society, traditional religion versus new forms of belief and ritual, theoretical approaches for analyzing modern belief systems, and problems of method and analysis.
Mr. Roof.

722. SOCIOLOGY OF EDUCATION.
Educational characteristics of an industrial population; comparative social structures and their school systems; educational selection and social stratification; educational development as effect and cause of social change; the internal organization and culture of schools and universities.
Prerequisites, one graduate course in sociological theory and one course in research methods.

725. SYMBOLIC INTERACTION SEMINAR.
The symbolic interactionist approach to social psychology and the social structure, including historical as well as contemporary contributions. Emphasis on the relation of symbolic interaction to other approaches in sociology, including ethno-methodology, the sociology of knowledge, and more positivist approaches to social psychology. Mr. Hewitt.

729. SOCIOLOGY OF SMALL GROUPS.
Small human groups viewed as relatively permanent relational structures which emerge out of the process of social interaction. Theoretical discussion of concepts and logic of the process of emergence. Methodological discussion and readings on types, utility, and validity of experimental approaches to the explanation of development of relational structures. Emphasis on the ways in which situational factors contain and shape the group.
Prerequisites, one prior graduate course in social psychology or permission of instructor. Mr. O'Rourke.

731. SOCIAL GERONTOLOGY.
Implications of aging for society and the individual. Position of the aged in nonindustrial and industrialized societies. Changing roles of older people in the American family and the community.
Prerequisites, Soc 257 or permission of instructor.
Mr. O'Rourke.

732. SOCIOLOGY OF MEDICINE.
A survey of theory and research concerned with medical care as a social institution. The relation of social factors to illness, and social processes involved in medical education.
Prerequisite, Soc 286 or permission of instructor.
Mr. Piedmont.

733. POLITICAL SOCIOLOGY.
Analysis of the major topics and problems of political sociology in a comparative context. Special attention to contemporary social movements, political pluralism and extremism, the social roots of totalitarian and democratic societies, and the interaction between the political and nonpolitical institutions of society. Mr. Hollander.

735. SOCIAL MOVEMENTS.
Analysis of the genesis, career, values, norms, structure, and endproducts of social movements, including studies of selected movements. Mr. Killian.

736. COLLECTIVE BEHAVIOR.
The processes of interaction through which new social norms and forms of social organization emerge in the crowd, the public, and the social movement. Emphasis on principles of collective behavior as exemplified in the crowd, compact and diffuse. Mr. Killian.

737. SEMINAR ON PUBLIC POLICY AND SOCIAL SCIENCES.
The mobilization of the social sciences for the solution of domestic social problems. More concerned with the strategy of applied social science in the context of social policy than with substantive issues. Topics include: evaluation as research, values in pursuit of research, support of research and the "knowledge for what" problem, and the relationship of science to planned social change. Mr. Sutton.

740. CRISIS RESOLUTION AND COMMUNICATION.
Discussion of relevant concepts. Case studies on international crises from 1947—1968 with attention to the calculations of decision-makers. Mr. Speier.

750. BLACK MAN IN AMERICA.
A socio-historical analysis of the interaction of the Black man and the American environment, from slavery to his migration to urban areas and subsequent isolation in the black ghetto. The role of power in the nature of black-white relations.

757. SEMINAR IN THE FAMILY.
Cross-cultural examination of family systems: their development, factors influencing changes, and directions of changes. Comparison of theoretical frames of relevance for theory construction and research: structural-functional, institutional, developmental, situational, and interactional. Review of methodological trends and developments: prediction studies surveys, demographic analyses.
Prerequisite, Soc 257 or permission of instructor.
Mr. Korson, Mr. Lewis, Mr. Piedmont.

758. FAMILY AND KINSHIP COMPONENTS IN CONTEMPORARY SOCIAL PROBLEMS.
Relative importance of family and kinship in the analyses of contemporary sociologists; how this analysis informs inquiry into problems such as political and economic modernization, urbanization, stratification, the institutionalization of poverty, deviance, social control, and the community. Specific topics selected after consultation with students.
Mr. Lewis.

759. SOCIAL STRATIFICATION.
The major contemporary writers and their contribution to this area. Research techniques in the analysis of social class and social mobility.
Prerequisite, Soc 259 or permission of instructor.
Mr. Gordon.

762. DEMOGRAPHY.
An analysis of the demographic transition from peasant-agriculturalism to urban industrialism. Emphasis on the consequences of this transition for patterns of settlement and for fertility, mortality, and migration. Special studies are made of the demographic characteristics of non-industrialized nations as factors in their potential development.
Prerequisite, Soc 561 or permission of instructor.
Mrs. Golden, Mr. Wilkinson.

764. POPULATION CHARACTERISTICS AND SOCIOECONOMIC CHANGE.
Analysis of relationship between selected demographic characteristics and socioeconomic changes, with attention to the sociological uses of statistical information on the world's countries.
Prerequisite, Soc 561 or permission of instructor.
Mrs. Golden.

766. HUMAN ECOLOGY: COMMUNITY STRUCTURE AND INTERRELATIONS.
Theory and research of community functions and systems of communities with special reference to ecological organization and change. Mr. Mehta.

772. POPULATION OF INDIA AND PAKISTAN.
Trends in population growth and its distribution among various social strata. The relative influence of fertility, mortality, migration, social organization, and cultural values on growth patterns.
Prerequisites, Soc 561 and 795. Mr. Driver.

781. HISTORY OF SOCIOLOGICAL THEORY.
A survey of literature from classical times to the Utilitarians.
Prerequisite, Soc 282 or permission of instructor.
Mr. Manfredi.

782. THE DEVELOPMENT OF SOCIOLOGICAL THEORY.
Selected European and American contributors and their

systems of theory, in biographical, historical, and sociological perspective.
Prerequisite, permission of instructor. Mr. Page.

783. CONTEMPORARY SOCIOLOGICAL THEORY.
The literature from 1900 to the present.
Prerequisite, Soc 282 or permission of instructor.
Mr. Gordon.

784. ADVANCED SOCIOLOGICAL THEORY.
A methodological analysis of contemporary sociological theory. Emphasis on theory construction, formalization and evaluation.
Prerequisite, Soc 282 or permission of instructor. Mr. Roof.

785. COMPLEX ORGANIZATIONS.
Major theories of organization. Emphasis on recent findings on the determinants of individual behavior and organizational effectiveness. Mr. Tausky.

792. PROBLEMS OF THEORETICAL ANALYSIS IN CONTEMPORARY SOCIOLOGY.
Alternative theoretical orientations, including neopositivism, functionalism, systems theory, phenomenology; problems of intellectual style, sociology and other disciplines; human perspectives; sociology of knowledge and of sociology.
Prerequisite, permission of instructor. Mr. Page.

794. COMPUTER METHODS IN SOCIOLOGY.
A survey of computer-oriented analytical tools and data-processing systems available to the sociologist. The pace of the computer in research and the development of mathematical sociology. Students program and test a statistical or mathematical model.
Prerequisite, knowledge of some computer language.
Mr. Chevan.

795. RESEARCH METHODS.
Logical analysis of sociological inquiry; survey of major research techniques and examination of principal methodological problems in sociology. Mr. Chevan, Mr. Chilton, Mr. Park.

796. RESEARCH METHODS.
Research techniques in sociology, including: formulating research objectives; collecting, processing, and analyzing data for a project organized around the problems of measurement in sociology.
Prerequisites, Soc 547 and 795.
Mr. Chevan, Mr. Chilton, Mr. Park.

797. SURVEY DESIGN AND ANALYSIS.
Design and analysis of descriptive and explanatory sample surveys. Special attention to the problems of longitudinal studies designed to evaluate the effects of a complex experience.
Prerequisite, Soc 795. Mr. Chevan.

798. TECHNIQUES OF DATA COLLECTION IN SOCIAL RESEARCH.
The validity and reliability for various purposes of a number of observational techniques, including: the interview, the paper and pencil questionnaire, content analysis, and participant observation.
Prerequisite, Soc 795. Mr. Chevan.

800. MASTER'S THESIS. *Credit, 6.*

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

547. ELEMENTARY STATISTICS.
Basic statistical principles and techniques with special reference to application in sociology. Mr. Mehta, Mr. Park.

548. SOCIAL STATISTICS.
Introduction to principles of multivariate techniques, including sociology and related fields.
Prerequisite, Soc 547 or equivalent. Mr. Mehta, Mr. Park.

551. URBAN SOCIOLOGY.
A comparative analysis of world urbanization with special reference to demographic characteristics of urban populations, urban ecology, and urban social structure.
Prerequisite, Soc 101 or permission of instructor.
Mrs. Golden, Mr. Mehta.

552. URBANIZATION AND THE CITY.
A comparative analysis of world urbanization, its trends, causes, and consequences. Regional variations in the nature of urbanization and trends in major countries analyzed and related to major aspects of the spatial and social structure of cities.
Prerequisite, Soc 101. Mrs. Golden.

556. RACE RELATIONS.
Social, economic, and political aspects of racial problems in the U.S., with particular reference to the Negro and major ethnic groups. Problems resulting from contact of races in Asia, Africa, and South America. Mr. Gordon.

557. FAMILY.
Development of the customs of courtship and marriage of the contemporary American family; basic causes of changes and trends of the family including mate selection, marriage laws, marital prediction, husband-wife relations, and the role of the child. Mr. Korson.

558. SOCIAL INTERACTION.
The processes leading to the socialization of the group member, with emphasis on role properties, play, control models, and power definitions. Mr. Hewitt, Mr. O'Rourke.

561. POPULATION PROBLEMS.
Physical and social factors which influence population change through births, deaths, and migration, with emphasis on the population problems of underdeveloped areas in the world today. Mr. Wilkinson.

565. THE POPULATION OF JAPAN.
A demographic survey of the history and development of modern Japan. Emphasis on the similarities and contrasts between Japan's demographic transition and that of the West, and the relevance of Japanese experience for contemporary underdeveloped nations.
Prerequisite, Soc 261 or equivalent. Mr. Wilkinson.

570. SOCIAL STRUCTURE OF INDIA.
Origins, distribution, and cultural traits of the major groups in India. Marriage, family, and caste patterns, and their relation to and positions in the economic and political system.
Mr. Driver.

575. SOCIAL PROBLEMS.
Incidence, distribution, and interrelations among the major types of social tensions in human societies. Research and field trips likely. Mr. Lewis.

580. SOVIET SOCIETY.
Survey of the major social institutions, processes, and problems of Soviet society. Special reference to official and popular values and norms, stratification, social controls, the family, types of socialization and social problems (*i.e.*, crime, delinquency, the misuse of leisure, rural migration, etc.). The nature and usefulness of various theoretical models of Soviet society. Mr. Hollander.

587. SOCIOLOGY OF MENTAL DISORDERS.
Influence of social factors on diagnosis, treatment, and possible etiology of mental disorders. Application of sociological concepts and methods in considering the nature and extent of mental disorders, epidemiology, resources for dealing with mental illness, mental hospitals, and the community in rehabilitation.
Prerequisite, Soc 286 or permission of instructor.
Mr. Piedmont.

592. BACKGROUND TO THE STUDY OF SOCIAL WELFARE.
Primarily for upper division and graduate students. Historical development and current status of British and American concerns about poverty in the context of the Industrial Revolution; sociological perspectives concerning differentials in

access to economic security and social rewards; problems of measurement and planning as related to social policies.
Mr. Sutton.

593. ISSUES IN SOCIAL POLICY PLANNING.
Primarily for upper division and graduate students. Focus on systematic policy planning; the role of research and development, and the role of the scientific community in domestic policy programming; and on selected substantive issues.
Mr. Sutton.

660. TECHNIQUES OF DEMOGRAPHIC ANALYSIS.
The methods for gathering population data and the uses of these data to measure mortality, fertility, migration, and population composition. The theoretical interrelations among these factors. Methods for making population estimates and projections.
Prerequisite, Soc 261 or a course in statistics, or permission of instructor.
Mr. Yaukey.

663. FERTILITY AND SOCIETY.
A review of past and present trends in fertility on a worldwide basis, an analysis of the social determinants and consequences of these trends, and an assessment of likely future trends.
Prerequisites, Soc 261 and permission of instructor.
Mr. Yaukey.

667. POPULATION THEORIES AND POLICIES.
The major theories concerning population growth, distribution, internal and international migration, and population quality. Theorists include the pre-Malthusians, Malthus, Marx, Keynes, Stouffer, Petersen, Myrdal, Clark, Coale, Keyfitz, Spengler, Davis, and others. The direct and social population policies; the unintended demographic consequences of the latter. Special attention to a cross-cultural analysis of the relations among sex status, social status, and human reproduction.
Mr. Driver.

INTERDEPARTMENTAL COURSES

SOCIAL SCIENCES 550. AFRICA, SOUTH OF THE SAHARA.
Introductory study of recent political, economic, and social developments in the principal countries in Africa, south of the Sahara.
Prerequisites, at least two courses in one or more of the following fields: government, economics, sociology.
Mr. Driver.

SOCIAL SCIENCES 569. INDIA AND SOUTH ASIA.
Introductory study of recent political, economic, and social developments in India and the countries of South Asia.
Prerequisites, at least two semester courses in one or more of the following fields: government, economics, sociology, anthropology.
Mr. Driver.

RELATED COURSES

PSYCH 780. ADVANCED SOCIAL PSYCHOLOGY.

PSYCH 781. ATTITUDES.

PSYCH 784. GROUP DYNAMIQS.

PUBLIC HEALTH 735. SOCIAL EPIDEMIOLOGY.

Theatre

GRADUATE FACULTY

DAVID M. KNAUF, *Professor and Chairman of the Department of Theatre*, B.F.A., Ohio University, 1958; M.A., 1960; Ph.D., Iowa, 1962.

DORIS E. ABRAMSON, *Associate Professor and Graduate Program Director*, B.A., Massachusetts, 1949; M.A., Smith, 1951; Ph.D., Columbia, 1967.

MARYA BEDNERIK, *Assistant Professor*, B.A., Bennington, 1957; M.A., Bowling Green, 1962; Ph.D., Iowa, 1968.

JON R. FARRIS, *Assistant Professor*, B.A., Harding College, 1964; M.A., Wisconsin, 1967.

JEFFREY A. FIALA, *Assistant Professor*, B.S., Wisconsin, 1967; M.F.A., 1970.

JUNE B. GAEKE, *Assistant Professor*, B.S., Wisconsin, 1969; M.F.A., 1971.

JOHN J. GALBREATH, *Assistant Professor*, B.A., Westminster College, 1970; M.F.A., Wisconsin, 1973.

CAROL T. KORTY, *Associate Professor*, B.A., Antioch, 1959; M.A., Sarah Lawrence, 1966.

HARRY E. MAHNKEN, *Assistant Professor*, B.A., Geneva College, 1951; M.F.A., Carnegie Institute of Technology, 1955.

ARTHUR E. NIEDECK, *Professor*, B.A., Ithaca College, 1930; M.A., Cornell, 1942.

GARY L. STEWART, *Associate Professor*, B.S., Brigham Young, 1961; M.S., 1962; Ph.D., Iowa, 1968.

The Department of Theatre offers graduate work leading to the M.A. and M.F.A. degrees. Concentrations are possible in acting, direction, scenography, playwriting, and dramaturgy. Each plan of study is individually fitted to the student's particular needs and interests.

Focus is on the liberal rather than the conservatory arts. All courses of instruction in criticism, history, theory, literature, and performance technique are conducted with small groups of students selected according to level of achievement and experience in direct conjunction with the generation and production of stage performances. Graduate students assist in teaching and performance in all courses and production projects.

Detailed information on admissions and requirements for degrees may be obtained from the Graduate Program Director in Theatre.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.
Independent study in special subjects. *Credit, 1-3.*

741. ADVANCED SCENE DESIGN.
Special problems in conceiving the visual elements of theatre. Experimental design and design for atypical theatre structures emphasized.
Prerequisite, Theatre 241/541 or equivalent.

742. HISTORY OF THEATRICAL COSTUME I.
Period costumes from primitive man to the 17th century; projects in design from a number of these periods.
Prerequisite, Theatre 242/542 or equivalent.

743. HISTORY OF THEATRICAL COSTUME II.
Period costume from the 17th century to the present; projects in design from a number of these periods.
Prerequisite, Theatre 242/542 or equivalent.

744. ADVANCED ACTING.
Investigation of an experimentation with various actor-character relationships.
Prerequisite, Theatre 244/544 or equivalent.

745. ADVANCED DIRECTING.
Various styles of staging period and contemporary dramas; examination of these styles within their historical contexts.
Prerequisite, Theatre 246/546 or equivalent.

747. TOPICS IN THEATRE HISTORY.
Detailed study of selected eras in the development of theatre.

748. TOPICS IN CONTEMPORARY THEATRE.
Distinctive 20th-century theatrical concepts in Europe and the United States.

756. THEATRE MANAGEMENT.
Modern theatrical-production organization, economics, special contractural problems, and administration.

757. ADVANCED STAGE LIGHTING.
Aesthetics of stage lighting and the problems and practices of the lighting designer. Emphasis on the lighting of selected plays.
Prerequisite, Theatre 257/557 or equivalent.

758. THEATRE PRACTICUM.
Conception and execution of two creative theatrical assignments selected with and supervised by the student's adviser. The number of hours varies depending on the projects. Typically, the sequence would be three hours credit for each of the M.F.A. candidate's first two semesters. *Credit, 1-6.*

761. CONTEMPORARY DRAMATIC THEORY AND CRITICISM.
Important theories of dramatic art from 1900 to the present.
Prerequisite, Theatre 261/561 or equivalent.

763. THEATRE AND RITUAL.
Relationship of ritual and theatre from primitive man to Genet.

765. THE RHETORIC OF THEATRE.
Theories of rhetoric and poetic as relevant to drama and (of specific approaches) to the rhetorical criticism of plays.

800. MASTER'S THESIS. *Credit, 3-6.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

540. TECHNICAL PRODUCTION.
The materials and methods in construction for the stage.
Prerequisites, Theatre 115 and 140.

541. PRINCIPLES OF SCENE DESIGN.
Intensive study and application of scene design principles to a series of design projects. Practical experience through laboratory work in scene painting and decoration.
Prerequisites, Theatre 115 and 140.

542. DESIGN AND CONSTRUCTION OF COSTUME.
Silhouette, draping, color, texture, drafting of patterns, construction, and the application of these basic principles to a series of design projects.
Prerequisites, Theatre 115 and 140.

544. ACTING II.
Character analysis and development with attention to the interrelationship of characters.
Prerequisites, Theatre 115 and 243.

546. DIRECTING II.
Problems in the interpretation and staging of various types of contemporary drama. Attention to rehearsal and performance procedures.
Prerequisite, Theatre 245.

547. THEATRE HISTORY I.
The history of the theatre in western civilization from its beginnings to 1642; an investigation of the classical, medieval, and Renaissance theatres. Emphasis on the origins and development of drama, spectacle, theatre production, and theatre architecture.

548. THEATRE HISTORY II.
History of the theatre in western civilization. Emphasis on the 18th and 19th centuries, the Continental, English, American and modern theatres.

551. ORAL INTERPRETATION OF CHILDREN'S LITERATURE.
Selection and interpretation of literary materials for children.

552. ADVANCED ORAL INTERPRETATION OF LITERATURE.
Concentration on the philosophical and technical bases for reading the lyric poem, fiction, drama, and documentary materials.
Prerequisite, Theatre 152.

553. CHILDREN'S DRAMA I.
Informal dramatics, without an audience, in classroom and recreation programs, serving children's need for creative outlets and furthering awareness, self-expression, self concepts, and social growth through imagination, pantomime, and improvised story dramatization.

554. CHILDREN'S DRAMA II.
Formal aspects of children's theatre, the selection and presentation, by adults or older young people, of suitable plays for the child audience.

557. STAGE AND TELEVISION LIGHTING.
Principles, practices, and equipment involved in stage and television lighting.
Prerequisites, Theatre 115 and 140.

561. HISTORY OF DRAMATIC THEORY.
A survey of important trends and documents in the history of dramatic theory from Plato to 1900.
Prerequisite, Theatre 260.

562. THE BLACK PRESENCE IN AMERICAN DRAMA.
Selected works by American white and black playwrights, from mid-19th century to the present.

564. HISTORY OF THE AMERICAN THEATRE AND DRAMA.
The history of the American theatre from its beginnings in the 18th century to the present. Concerned in each period with the drama itself, the building in which it is performed, scenic effects, and the contribution of actor and director.

660. PLAYWRITING.
The problems of translating idea into dramatic action.
Prerequisite, permission of instructor.

Wildlife and Fisheries Biology

GRADUATE FACULTY

Donald R. Progulske, *Professor and Head of the Department of Forestry and Wildlife Management,* B.S., University of Massachusetts, 1950; M.S., Virginia Polytechnic Institute, 1952; Ph.D., University of Missouri, 1956.

Charles F. Cole, *Professor of Fisheries Biology and Graduate Program Director in Fisheries,* B.A., Cornell, 1950; Ph.D., 1957.

Frederick Greeley, *Associate Professor of Wildlife Biology and Graduate Program Director in Wildlife,* B.A., Kenyon College, 1941; M.S., Wisconsin, 1949; Ph.D., 1954.

Carl A. Carlozzi, *Associate Professor of Resource Planning.*

WENDELL E. DODGE, *Associate Professor of Wildlife Biology*, B.A., New Hampshire, 1955; M.S., Massachusetts, 1958; Ph.D., 1967.

JAMES E. JOHNSON, *Assistant Professor of Fisheries Biology*, B.S., Purdue, 1962; M.S., Butler, 1965; Ph.D., Arizona State, 1969.

JAMES J. KENNELLY, *Associate Professor of Wildlife Biology*, B.S., Cornell, 1958; M.S., 1960; Ph.D., 1964.

JOSEPH S. LARSON, *Associate Professor of Wildlife Biology*, B.S., Massachusetts, 1956; M.S., 1958; Ph.D., Virginia Polytechnic Institute, 1966.

ROGER J. REED, *Associate Professor of Fisheries Biology*, B.S., Pittsburgh, 1951; M.S., 1953; Ph.D., 1956.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM IN WILDLIFE AND FISHERIES BIOLOGY

Students completing the master's degree at the University or elsewhere may be accepted into our doctoral program but are formally admitted to candidacy only after the completion of a successful written and oral preliminary comprehensive examination based on concepts in general biology, ecology, fisheries and wildlife biology, and such other areas as may be stipulated by the student's Guidance Committee. Selection of courses is done by the student and his Guidance Committee and usually extends into areas beyond biology, leading the student towards competency in independent research in either fisheries or wildlife biology. Candidates are required to demonstrate reading knowledge at the journal level in one foreign language. The degree normally requires three years of study beyond the master's degree.

THE MASTER OF SCIENCE DEGREE PROGRAM IN EITHER FISHERIES BIOLOGY OR WILDLIFE BIOLOGY

Students may be accepted into the master's degree program leading to a degree either in fisheries biology or in wildlife biology. Applicants normally come from undergraduate biological backgrounds or from applied biological areas such as fisheries or wildlife. Students with backgrounds in areas tangential to the field of resource conservation may apply with the understanding that deficiencies could extend their time in the program; normally, two years are required for the completion of the master's degree. Candidates normally write theses worth 10 hours of credit and are given a final oral examination upon its completion. Occasional wildlife biology students completing a degree without a thesis must pass both a written and an oral examination. Students completing a thesis must offer in addition a minimum of 20 graduate credits, at least 6 of which must be earned in 701-800 series courses. There is no language requirement for the master's degree.

GENERAL INFORMATION

The Forestry and Wildlife Management Department offers graduate work leading to the Master of Science degree either in wildlife or in fisheries biology and the Doctor of Philosophy in wildlife and fisheries biology. Staff and facilities are available for supporting research in upland and wetland avian biology, mammalian biology and management; and estuarine, anadromous, and warmwater fisheries research as well as in the broader areas of natural resource management. Graduate training is required for professional entrance into state, federal, and private employment in resource management and into teaching positions stressing applied ecological principles in both secondary and college-level programs. Most applicants come from biological backgrounds as undergraduates; occasional exceptions can be made, with the provision that deficiencies be made up. Applicants are encouraged to correspond with the Graduate Program Director in the Department for answers to specific questions, but all application materials should be sent directly to the Graduate School; scores from the Graduate Record Examination, including the Advanced Biology, must accompany all applications. The application must clearly indicate whether the candidate wishes to enter the wildlife biology or the fisheries biology degree program. Research support at both the master's and doctoral level is frequently available either from grants to individual faculty members or through support provided by the Cooperative Wildlife and Fishery Units; this latter support is provided by the Massachusetts Division of Fisheries and Game, the Massachusetts Division of Marine Fisheries, the United States Bureau of Sport Fisheries and Wildlife, and the Wildlife Management Institute. Undergraduates receiving wildlife or fisheries degrees from the University of Massachusetts are strongly urged to apply to other universities in order to vary their professional training.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS IN WILDLIFE OR FISHERIES BIOLOGY.
Credit, 3 per semester; maximum credit, 6.

701, 702. SEMINAR IN WILDLIFE AND/OR FISHERIES BIOLOGY.
Review and discussion of the literature, including such subjects as population dynamics and manipulation, fish and game law and administration, Afro-Eurasian problems, influence of land-use, and Arctic environments.
Credit, 1-3 per semester; maximum credit, 6.

712. SHIPBOARD OCEANOGRAPHIC OPERATIONS.
The planning and execution of an integrated research training cruise on board a research vessel. Familiarizes students with standard oceanographic procedures and normal shipboard equipment and its use.
Prerequisite, graduate status in a basic or applied science related to the sea. One two-hour class per week and a 3-5 day training cruise (also listed as Marine Sci 712).
Mr. C. F. Cole.

745. DYNAMICS OF EXPLOITED FISH POPULATIONS.
The development and manipulation of mathematical models of fish stocks to demonstrate sustained yield principles.
Two one-hour lectures and one two-hour discussion-practice session.
Prerequisite, permission of instructor. Mr. C. F. Cole.

756. FISHERIES BIOMETRICS.
The statistical treatment of fisheries research problems, including studies on age and growth, food habits, population estimates, condition factors, and population dynamics.
Prerequisites, Fish Biol 565 and Stat 121 or permission of instructor.

757. ADVANCED FISHERIES MANAGEMENT.
Scientific basis for modern fisheries management, empha-

sizing coldwater fishes, anadromous species, large reservoir and river fisheries, and conflicts of interest with other water uses.
Prerequisites, Fish Biol 565 and 756, or permission of instructor.

758. ADVANCED WILDLIFE MANAGEMENT.
Interrelationships of wildlife and forestry, grazing, cultivation, pollution, and other uses of natural resources.

800. MASTER'S THESIS. *Credit, 6-10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

561. PRINCIPLES OF WILDLIFE BIOLOGY.
Fundamental ecology and principles of wildlife management, with emphasis on population characteristics and responses.
Lecture only, for non-majors. *Credit, 2.* Mr. Greeley.
Lecture and laboratory, for majors. *Credit, 3.* Mr. Greeley.

562. TECHNIQUES OF WILDLIFE BIOLOGY.
Methods of collecting and interpreting data in wildlife management, with emphasis on field and laboratory experience in census methods and criteria for determining sex, age, and other characteristics of wild birds and mammals.
Prerequisites, one course in Statistics and Wild Biol 561 or permission of instructor. Mr. Larson.

563. MANAGEMENT OF WETLAND WILDLIFE.
The origin and distribution of wetlands in North America; identification and habitat requirements of wetland wildlife; public and private management of wetland environments.
Prerequisites, Wild Biol 561 or permission of instructor.
Mr. Larson.

564. MANAGEMENT OF UPLAND WILDLIFE.
Life histories, identification, and habitat requirements of upland game birds, game mammals, and furbearers; management of upland habitats. Mr. Greeley.

565. TECHNIQUES OF FISHERIES BIOLOGY.
Principles and techniques of fishery management, stressing population and growth dynamics, and field procedures.
Mr. Johnson.

567. LABORATORY IN PRINCIPLES OF FISHERY BIOLOGY.
Field techniques in fishery biology; operation and use of fishery research and management equipment. Laboratory analysis of field-collected data using automatic data processing; manuscript preparation.
Corequisite, Fish Biol 565.
One 4-hour laboratory. *Credit, 1.* Mr. Johnson.

570. ECOLOGY OF FISHES.
Biological responses of fishes to the environment. Aspects of feeding, home range, breeding behavior, and other responses to the environment.
Prerequisites, Fish Biol 565 and Zool 602 or permission of instructor. Mr. Johnson.

572. INTRODUCTION TO MARINE FISHERIES.
Factors affecting world marine fisheries resources and development. Review of selected species of commercial importance and of selected world fisheries. Several overnight field trips requiring Saturday attendance by arrangement.
Prerequisites, Fish Biol 565 and Zool 600 or permission of instructor. Mr. C. F. Cole.

Zoology

GRADUATE FACULTY

Harold Rauch, *Professor and Chairman of the Department of Zoology,* B.S., Queens College, 1944; M.S., Illinois, 1947; Ph.D., Brown, 1950.

Larry S. Roberts, *Associate Professor and Graduate Program Director,* B.S., Southern Methodist University, 1956; M.S., Illinois, 1958; D.Sc., Johns Hopkins, 1961.

Lawrence M. Bartlett, *Professor,* B.S., Massachusetts, 1939; M.S., 1942; Ph.D., Cornell, 1949.

George H. Dersham, *Assistant Professor,* B.S., University of Colorado, 1963; M.S., 1967; Ph.D., University of Oregon, 1970.

Mac V. Edds, *Professor,* B.A., Amherst, 1938; M.A., 1940; Ph.D., Yale, 1943.

D. Craig Edwards, *Associate Professor,* B.S., Swarthmore, 1961; Ph.D., Chicago, 1965.

Donald Fairbairn, *Professor,* B.A., Queens University, Canada, 1938; Ph.D., Rochester, 1942.

Bronislaw M. Honigberg, *Professor,* B.A., California at Berkeley, 1943; M.A., 1946; Ph.D., 1950.

Mindaugas S. Kaulenas, *Associate Professor,* B.Sc., University of London, 1961; Ph.D., 1964.

David J. Klingener, *Associate Professor,* B.A., Swarthmore, 1959; A.M., Michigan, 1961; Ph.D., 1964.

Joseph G. Kunkel, *Assistant Professor,* B.A., Columbia, 1964; Ph.D., Case Western Reserve University, 1968.

Bruce R. Levin, *Associate Professor,* B.S., University of Michigan, 1963; M.S., 1964; Ph.D., 1967.

Stuart D. Ludlam, *Associate Professor,* B.A., Cornell, 1960; Ph.D., 1964.

Arthur P. Mange, *Associate Professor,* B.S., Cornell, 1954; M.S., Wisconsin, 1958; Ph.D., 1963.

John G. Moner, *Professor,* B.A., Johns Hopkins, 1949; M.A., Princeton, 1951; Ph.D., 1953.

Drew M. Noden, *Assistant Professor,* B.A., Washington and Jefferson; Ph.D., Washington, 1972.

William B. Nutting, *Professor,* B.S., Massachusetts, 1940; M.S., 1948; Ph.D., Cornell, 1950.

W. Brian O'Connor, *Associate Professor,* B.S., St. Michael's, 1962; M.S., Purdue, 1966; Ph.D., 1967.

Herbert E. Potswald, *Associate Professor,* B.A., University of Minnesota, 1959; Ph.D., University of Washington, 1964.

John L. Roberts, *Professor,* B.S., Wisconsin, 1947; M.S., 1948; Ph.D., California at Los Angeles, 1952.

H. Duncan Rollason, Jr., *Professor,* B.A., Middlebury, 1939; M.A., Williams, 1941; M.A., Harvard, 1943; Ph.D., 1949.

Theodore D. Sargent, *Associate Professor,* B.S., Massachusetts, 1958; M.S., Wisconsin, 1960; Ph.D., 1963.

FRANCISCO M. SCUDO, *Associate Professor*, Ph.D., University of Padua (Italy), 1961.

DENNIS G. SEARCY, *Assistant Professor*, B.S., Oregon State, 1964; Ph.D., California at Los Angeles, 1968.

JAMES G. SNEDECOR, *Professor*, B.S., Iowa State, 1939; Ph.D., Indiana University, 1947.

DANA P. SNYDER *Associate Professor*, B.S., Illinois, 1947; M.S., 1948; Ph.D., Michigan, 1951.

ALASTAIR M. STUART, *Professor*, B.Sc., University of Glasgow, 1953; Ph.D., Harvard, 1961.

CHRISTOPHER L. F. WOODCOCK, *Assistant Professor*, B.Sc., University College, London, 1963; Ph.D., 1966.

GORDON A. WYSE, *Associate Professor*, B.S., Swarthmore, 1961; M.S., University of Michigan, 1963; Ph.D., 1967.

JAMES R. ZIEGLER, *Assistant Professor*, B.A., California State, Fresno, 1966; Ph.D., Chicago, 1972.

The Zoology Department offers graduate work leading to the Master of Science and Doctor of Philosophy degrees. Facilities are available for advanced study in the major fields of zoology including genetics, cytology, physiology and biochemistry, vertebrate and invertebrate zoology, limnology, ecology and behavior, developmental biology, and parasitology. Graduate training prepares students for university teaching and research, federal and state positions in the biological fields, research positions with industrial and pharmaceutical and biomedical institutions, and high school and junior college teaching.

Requests for information pertaining to the graduate program should be directed to the Zoology Department.

Advanced Degrees.

Applications are accepted from students who have demonstrated superior ability as undergraduates. Undergraduate preparation should include at least 10 hours in biology, preferably including courses in genetics, comparative anatomy, embryology, invertebrate zoology, and physiology, as well as courses in mathematics through elementary calculus, general physics, organic chemistry, and a foreign language (French, German, or Russian). Early in his graduate career, the graduate student must demonstrate his proficiency, by examination, in major areas of zoology.

Preparation for such examinations can be made by formal enrollment in appropriate courses or by independent study of recommended readings.

Since teaching experience is regarded as an important part of graduate training, all students are required to teach halftime for two semesters unless equivalent experience has been obtained previously at another university.

All graduate students must enroll in Zoology 850, Seminar. A minimum of one credit per year up to a total of four is required.

THE MASTER OF ARTS AND MASTER OF SCIENCE DEGREE PROGRAMS

One of three plans may be followed in fulfillment of the requirements for the master's degree:

A. The student may write a thesis based on original research. In addition to the thesis, the student must offer a minimum of 20 graduate credits, at least six of which must be earned in 701-900 series courses (excluding Zoology 800).

B. The student may undertake a program of original research, offering a total of nine credits of Zoology 700, Special Problems, but not a thesis. In addition, 21 graduate credits must be offered, of which at least six must be earned in 701-900 series courses.

C. The student may offer three credits of Zoology 700, Special Problems, to be completed in one semester. Twenty-nine additional credits are required, and at least 12 of these credits must be earned in the 701-900 series (excluding Zoology 850, Seminar).

All candidates must pass the graduate reading examination at the intermediate level in one foreign language (ordinarily French, German, or Russian) and a final oral examination.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

A student is formally admitted as a candidate for the doctorate when he has demonstrated general proficiency as previously described and has successfully completed an oral preliminary examination based on advanced concepts in one major and two minor areas selected from the following: genetics, developmental biology, cytology, cell physiology and biochemistry, ecology, behavior, physiology, parasitology, systematics, and evolution.

With the consent of his Guidance Committee and the approval of the Department Graduate Affairs Committee, he may substitute equivalent work in another department as one minor area. Selection of courses is not restricted to the subjects to be presented for examination. All students must complete the departmental language requirement before taking the oral preliminary examination. This requirement is 1) reading proficiency at the intermediate level in two foreign languages, or 2) reading proficiency at the advanced level in one foreign language. Foreign students whose native language is not English are required to demonstrate reading proficiency at the intermediate level in one foreign language. Foreign languages are usually selected from French, German, or Russian.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS. *Credit, 1-9.*

702. GENERAL CYTOLOGY.
The morphological features of cells in relation to their function. Lectures, seminar reports and individual laboratory work.
Offered spring semester.
Prerequisite, Zool 523.

708. ELECTRON MICROSCOPY.
A practical approach to the electron microscopy of biological specimens in which each student will undertake a lab project. Basic theory will be presented in lecture sessions.
Offered fall semester.
Prerequisite, permission of instructor. Mr. Woodcock.

710. FINE STRUCTURE AND FUNCTION OF CELLS.
Lectures, discussions, reading, and reports on fine structure of cells and dynamic morphology.
Offered spring semester.
Prerequisites, Zool 523, 660.

720. EXPERIMENTAL EMBRYOLOGY.
Lectures and discussions on the causal analysis of animal development. Laboratory on *in vivo* and *in vitro* culture methods.
Offered fall semester.
Prerequisites, Zool 680 or 527.

724. ADVANCED DEVELOPMENTAL BIOLOGY.
Molecular basis of cell and tissue differentiation. Emphasis on gene action, synthesis and function of macromolecules, and hormonal control of developmental processes.
Offered spring semester.
Prerequisites, Biochem 523 or Zool 660; Zool 540.
Mr. Kaulenas.

730. PHYSIOLOGICAL GENETICS.
The nature of the gene and its action in the developmental and physiological processes of the organism.
Offered spring semester.
Prerequisites, Zool 540 and permission of instructor.
Mr. Kaulenas, Mr. Rauch.

740. ADVANCED INVERTEBRATE ZOOLOGY.
Continuation of Zoology 582. Emphasis on development.
Offered spring semester.
Prerequisite, Zool 582. Mr. Potswald.

744. METAZOAN SYMBIOSIS.
Host-symbiont relationships of mutuals, commensals, and parasites. Systematics, morphology, life histories, and physiology of metazoan symbionts of animals. Laboratory on research techniques.
Offered fall semester.
Prerequisites, a course in invertebrate zoology or parasitology; permission of instructor. Mr. L. S. Roberts.

750. SELECTED TOPICS IN ANIMAL BEHAVIOR.
Topics selected from active areas of current research (*e.g.*, communication, development, systems analysis, sociobiology) with an emphasis on critical analyses of theory and methodology.
Three hours lecture-discussion-reports.
Offered spring semester.
Prerequisite, Zool 650, or permission of instructor.
Mr. Sargent, Mr. Stuart.

751. BIOLOGY OF ANIMAL POPULATIONS.
Organization and process in the local population. The viewpoint is holistic, emphasizing the population as an integrated functional unit of life. Extensive student participation in discussion and presentation of critiques of current concepts.
Offered fall semester.
Prerequisites, Zool 757 and either 546, 650, or 755; or equivalent background; permission of instructor.
Mr. Snyder.

755. SYSTEMATICS AND EVOLUTIONARY MECHANISMS.
A theoretical consideration of evolution and systematics at and above the species level.
Offered fall semester.
Prerequisite, Zool 540. Mr. Klingener.

757. POPULATION AND COMMUNITY ECOLOGY.
Distribution patterns of organisms, population growth and regulation, interspecific competition and other population interactions, and community structure and energetics. Sampling methods, use of models, individual and group projects in the laboratory.
Two hours lecture-discussion, one laboratory.
Offered spring semester.
Prerequisites, one course each in ecology, invertebrate zoology, Math 124; statistics desirable. Mr. Edwards.

770. COMPARATIVE NEUROPHYSIOLOGY.
Sensory and nervous function in invertebrates and vertebrates. Emphasis on integrative mechanisms underlying animal behavior.
Offered fall semester.
Prerequisites, a year of chemistry and physics, and cell physiology or physiological psychology; or permission of instructor. *Credit, 3.* Mr. Wyse.

780. PHYSIOLOGICAL REGULATORY MECHANISMS.
Physiological regulation and its basis in cells and organisms.
Prerequisite, Zool 660 or equivalent.
Credit, 2-4 per semester.
Mr. J. L. Roberts, Mr. Moner.

784. ENDOCRINOLOGY.
The importance of the endocrines in their control over normal functions (growth, metabolism, reproduction, etc.) in a variety of animals.
Two class hours, one 3-hour laboratory period.
Offered spring semester.
Prerequisite, Zool 666. Mr. Snedecor.

790. WRITING FOR THE LIFE SCIENCES.
Principles and techniques of scientific writing for students in the life sciences whose researches are well advanced.
Offered spring semester.
Prerequisite, permission of instructor. Mr. Fairbairn.

810. TOPICS IN ZOOLOGY.
One or more topics of special or current interest covered in lectures and discussion. *Credit, 1-6 per semester.*

850. SEMINAR.
Each semester a topic from each of the following areas is chosen for discussion: cytology, genetics, and developmental biology; physiology and biochemistry; environmental and systematic biology. *Credit, 1 per semester.*

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 15*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

521. COMPARATIVE VERTEBRATE ANATOMY.
Structure and phylogeny of vertebrates. Laboratory work illustrating evolutionary trends and specializations. Experience in dissection.
Two class hours, one 3-hour laboratory period.
Prerequisite, Zool 101 or 540. Mr. Klingener.

523. HISTOLOGY.
Structure of cells, tissues and organs as related to function, with emphasis on the mammal; introduction to microtechnique.
Two class hours, one 3-hour laboratory period.
Prerequisite, Zool 101 or 540. Mr. Potswald, Mrs. Rollason.

527. EMBRYOLOGY.
A survey of embryonic development combining descriptive and analytical approaches. Developmental concepts and mechanisms are emphasized. Laboratories cover both descriptive and experimental embryology, utilizing living organisms whenever possible.
Offered spring semester.
Two class hours, one 3-hour laboratory period.
Prerequisite, Zool 101 or 540. Mr. Noden.

530. SYSTEMS OF THE HUMAN BODY.
Lectures on human anatomy and physiology, based on an integrated discussion of systems of the body. Laboratories emphasize the functional properties of the human organism; supplemental exercises in gross anatomy of the cat and rat. For students in Medical Technology and Public Health. A limited number of students in the engineering and physical

science fields allowed by permission of instructor.
Three class hours, one 3-hour laboratory period.
Offered spring semester.
Prerequisites, Chem 111, 112; Zool 101, 223 (or 223 concurrently). *Credit, 4.* Mr. O'Connor.

540. PRINCIPLES OF GENETICS.
Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution.
Prerequisites, Chem 111 and one semester of biological science. Mr. Levin, Mr. Mange, Mr. Scudo, Mr. Rauch.

543. INTRODUCTORY POPULATION BIOLOGY.
An evolutionary and integrated introduction to the demographic, ecological, genetic, and geographic aspects of the biology of populations. Consideration of social implications and utility. Background in probability theory, statistics, and mathematical and numerical modelling is presented.
Prerequisites, Zool 145 or 540 or equivalent, and 1 semester of mathematics.
Two class hours and one 2-hour period for discussion and problem solving. Mr. Levin, Mr. Scudo.

546. POPULATION GENETICS.
The causes of evolution, emphasizing genetical, ecological, and behavioral aspects. Some problems approached through mathematical models, stressing their biological implications.
Offered fall semester.
Prerequisites, Zool 540 and Math 123 or 135; and permission of instructor. Mr. Scudo.

550. MATHEMATICAL IDEAS IN BIOLOGY.
An introduction to some biological problems using mathematical concepts and techniques as tools. Emphasis on biology; topics are introduced at an elementary level. They include "thinking" machines and artificial intelligence, energetics and locomotion of animals, and elementary models for populations. Intended for biologists, pre-meds, biophysicists, and mathematicians.
Prerequisite, Zool 551 and 552 concurrently or equivalent background.

551. BIOLOGY REVIEW FOR ZOOLOGY 550.
A survey of basic aspects of cytology, life cycles, anatomy, genetics, behavior, and populations. Concurrent registration in Zool 550 required. Intended for students with an adequate mathematical background but weak in biology.

552. MATHEMATICS REVIEW FOR ZOOLOGY 550.
A survey of basic aspects of sets, functions, derivation and integration, qualitative study of difference and differential equations. Concurrent registration in Zool 550 is required. Intended for students with an adequate biological background but weak in mathematics.

575. BIOLOGY OF PROTOZOA.
Morphology and physiology of Protozoa; the contributions made to basic problems of biology through studies of these organisms. Lectures, readings, laboratory demonstrations and exercises. Exact format varies from year to year. Total, 5 hours lecture and laboratories.
Offered spring semester.
Prerequisites, Chem 262 and 264. Mr. Honigberg.

581. BIOLOGY OF LOWER INVERTEBRATES.
Survey of invertebrate animals based on evolutionary and phylogenetic considerations. Ecological roles and physiological functions of the various groups are stressed. Includes the Protozoa, Porifera, Cnidaria, Platyhelminthes, Nematoda, Mollusca, etc.
Two class hours, one 3-hour laboratory.
Offered spring semester.
Prerequisites, Zool 101 or 540.
Mr. Nutting, Mr. L. S. Roberts.

582. BIOLOGY OF HIGHER INVERTEBRATES.
Survey of invertebrate animals based on evolutionary and phylogenetic considerations. Ecological roles and physiological functions of the various groups are stressed. Includes the Annelida, Arthropoda, Ectoprocta, Echinodermata, etc.
Two class hours, one 3-hour laboratory.
Offered fall semester.
Prerequisites, Zool 101 or 540.
Mr. Nutting, Mr. L. S. Roberts.

583. GENERAL PARASITOLOGY.
Morphology, life cycles, and physiology of protozoan and helminth parasites. Emphasis on broad aspects of parasitism.
Two class hours, one 3-hour laboratory period.
Offered fall semester.
Prerequisites, Zool 101 or 540; Chem 112 or 114.
Mr. Honigberg.

600. VERTEBRATE ZOOLOGY.
History, relationships, patterns of distribution, classification of vertebrates with emphasis on fishes.
One class hour, two 2-hour laboratory periods, field trips.
Offered fall semester.
Prerequisite, Zool 101 or 540. Mr. Andrews.

602. ICHTHYOLOGY.
Morphology, ecology, and relationships of fishes, and their distribution in space and time.
Two class hours, one 3-hour laboratory period.
Not offered in 1974-75.
Prerequisite, Zool 521 or 600. Mr. Andrews.

606. ORNITHOLOGY.
Avian biology including structural and functional adaptations; emphasis on behavioral patterns. Laboratory includes field trips.
Two class hours, one 3-hour laboratory period.
Offered spring semester.
Prerequisite, Zool 521 or 600. Mr. Bartlett, Mr. Sargent.

608. MAMMALOGY.
Evolution, distribution, classification and ecology of mammals. Laboratory includes identification of local fauna and selected ecological techniques.
Two class hours, one 3-hour laboratory period.
Offered spring semester.
Prerequisites, Zool 521 or 600. Mr. Snyder.

635. LIMNOLOGY.
The physical, chemical, and biological aspects of inland waters.
Two class hours, one 3-hour laboratory or field trip.
Offered spring semester.
Prerequisites, Bot 100, Zool 101, Chem 112, and Phys 103. Mr. Ludlam.

637. ECOLOGY.
A rigorous and comprehensive survey of modern ecology. Topics covered are: energy and nutrient budgets, community ecology, species diversity, population growth and regulation, and species interactions. Both theoretical and experimental examples are presented.
Two class hours, and one 3-hour laboratory period (field trips and experimentation).
Offered fall semester.
Prerequisites, Introductory zoology, genetics, introductory calculus, and an invertebrate or vertebrate zoology course, or permission of instructor.

650. ANIMAL BEHAVIOR.
The biological bases of animal behavior, with an analysis of the methods and objectives of current research.
Three class hours.
Offered fall semester.
Prerequisites, Zool 101 or 540 and Psych 101; or Psych 215; or permission of instructor. Mr. Sargent, Mr. Stuart.

660. CELL PHYSIOLOGY.
The structure and function of cells. Emphasis on membrane systems, including active transport, nucleic acid and protein synthesis, and the mechanisms involved in the control of cellular processes.
Two class hours, one 3-hour laboratory period.
Prerequisites, one year of biology and Biochem 223 or equivalent.
Mr. Kaulenas, Mr. Kunkel, Mr. Moner, Mr. Searcy.

666. VERTEBRATE PHYSIOLOGY.
Function of organs and organ systems in vertebrates.
Three class hours, one 3-hour laboratory period.
Offered fall semester.
Prerequisite, Zool 660 or Chem 520 or 523. Mr. Snedecor.

670. COMPARATIVE PHYSIOLOGY.
Physiological principles involved in adaptations of animals to their environment; emphasis in the laboratory on experimental methods used to study adaptive mechanisms.
Three class hours, one 3-hour laboratory period.
Offered spring semester.
Prerequisite, Zool 660. Mr. J. L. Roberts.

680. DEVELOPMENTAL BIOLOGY.
Lectures emphasize physiological and biochemical aspects of development. Laboratory period used for demonstrations, discussions, and literature reviews, as well as for experimental work.
Two class hours, one 3-hour laboratory period.
Prerequisite, Zool 660. Mr. Kaulenas, Mr. Kunkel.

PARTIAL LIST OF COURSES IN OTHER DEPARTMENTS WHICH MAY BE TAKEN FOR MAJOR CREDIT

AN SCI 706. QUANTITATIVE INHERITANCE AND SELECTION.

AN SCI 724. ADVANCED AVIAN PHYSIOLOGY.

AN SCI 725. MAMMALIAN REPRODUCTION.

BOTANY 711, 712. ADVANCED PLANT PHYSIOLOGY.

BOTANY 721. ADVANCED PLANT ECOLOGY.

BIOCHEM 726. EXPERIMENTAL ENZYMOLOGY.

BIOCHEM 729. ENZYMES.

ENT 611. INSECT BEHAVIOR.

ENT 803. INSECT DEVELOPMENT.

ENT 814. ADVANCED ANIMAL ECOLOGY.

MICROBIOL 710. ADVANCED IMMUNOLOGY.

MICROBIOL 720. MAMMALIAN VIROLOGY.

MICROBIOL 770. MICROBIAL GENETICS.

AN SCI 621. PHYSIOLOGY OF REPRODUCTION.

BOTANY 521. PLANT ECOLOGY.

BOTANY 611. CYTOLOGY.

BIOCHEM 523, 524. GENERAL BIOCHEMISTRY.

CHEM 544. RADIOCHEMISTRY.

CHEM 581, 582. ELEMENTARY PHYSICAL CHEMISTRY.

GEOL 540. INVERTEBRATE PALEONTOLOGY.

MICROBIOL 550. GENERAL MICROBIOLOGY.

MICROBIOL 610. IMMUNOLOGY.

MICROBIOL 620. VIROLOGY.

PSYCH 550. PHYSIOLOGICAL PSYCHOLOGY.

Faculty Emeriti

AGRICULTURAL AND FOOD ECONOMICS

Ellsworth W. Bell, *Professor Emeritus* (1969).

Fayette Hinds Branch, *Extension Professor Emeritus of Agricultural Economics and Farm Management.*

Adrian Herve Lindsey, *Professor Emeritus of Agricultural Economics and Head Emeritus of the Department of Agricultural Economics and Farm Management.*

David Rozman, *Research Professor Emeritus.*

Ruth Evelyn Sherburne, *Instructor Emeritus.*

ANIMAL SCIENCE

Luther Banta, *Professor Emeritus* (1959).

Kenneth Bullis, *Professor Emeritus* (1961).

Fred P. Jeffrey, *Professor Emeritus* (1971).

William Sanctuary, *Professor Emeritus* (1958).

Henry Van Roekel, *Professor Emeritus* (1965).

BUSINESS ADMINISTRATION

Harold E. Hardy, *Professor Emeritus of Marketing.*

Henry Benjamin Kershin, *Dean Emeritus of the School of Business Administration.*

Rudolf Harold Kizler, *Associate Professor Emeritus of Business Administration.*

Harold William Smart, *Associate Professor Emeritus of Business Law.*

CHEMICAL ENGINEERING

Hans C. Duus, *Professor Emeritus.*

CHEMISTRY

Emmett Bennett, *Professor Emeritus.*

Charles Adams Peters, *Professor Emeritus.*

CIVIL ENGINEERING

Elmer C. Oscood, *Professor Emeritus* (1973).

ELECTRICAL ENGINEERING

Joseph W. Langford, *Professor Emeritus* (1972).

ENGLISH

Ellsworth Barnard, *Professor Emeritus* (1973).

Marie Campbell, *Professor Emeritus* (1973).

H. Leland Varley, *Professor Emeritus* (1973).

ENTOMOLOGY

Charles P. Alexander, *Professor Emeritus* (1959).

Frank R. Shaw, *Professor Emeritus* (1970).

Marion E. Smith, *Associate Professor Emeritus* (1971).

Harvey L. Sweetman, *Professor Emeritus* (1966).

Ellsworth H. Wheeler, *Professor Emeritus* (1969).

FOOD AND AGRICULTURAL ENGINEERING

Gerald A. Fitzgerald, *Professor Emeritus* (1970).

FOOD SCIENCE AND TECHNOLOGY

Arthur S. Levine, *Professor Emeritus* (1968).

FORESTRY AND WOOD TECHNOLOGY

Robert Powell Holdsworth, *Professor Emeritus of Forestry* (1958).

J. Harry Rich, *Professor Emeritus of Forestry* (1958).

FRENCH

Stowell C. Goding, *Professor Emeritus.*

GERMANIC LANGUAGES AND LITERATURES

Frederick C. Ellert, *Professor Emeritus* (1970).

HISTORY

Theodore C. Caldwell, *Professor Emeritus* (1970).

Harold Cary, *Professor Emeritus* (1969).

HOME ECONOMICS

Gladys Mae Cook, *Associate Professor Emeritus* (1968).

May Estella Foley, *Extension Professor Emeritus.*

Barbara Higgins, *Extension Professor Emeritus* (1968).

N. May Larson, *Extension Professor Emeritus.*

Mary E. Lojkin, *Associate Professor Emeritus* (1969).

H. Ruth McIntire, *Professor Emeritus.*

Helen Swift Mitchell, *Dean Emeritus of the School of Home Economics* (1960).

Anne Williams Wertz, *Commonwealth Professor Emeritus of Research* (1963).

PHILOSOPHY

Roger W. Holmes, *Mary Lyon Professor Emeritus* (1971) (Mount Holyoke College).

Alice A. Lazerowitz, *Sophia and Austin Smith Professor Emeritus* (1972) (Smith College).

Morris Lazerowitz, *Sophia and Austin Smith Professor Emeritus* (1973) (Smith College).

Clarence Shute, *Professor Emeritus* (1971).

PLANT PATHOLOGY

Walter M. Banfield, *Professor Emeritus* (1972).

Emil Frederick Cuba, *Commonwealth Professor Emeritus.*

Linus Hale Jones, *Assistant Research Professor Emeritus.*

PLANT AND SOIL SCIENCES

John S. Bailey, *Professor Emeritus* (1964).

Arthur P. French, *Professor Emeritus* (1961).

Louis F. Michelson, *Professor Emeritus* (1971).

Grant B. Snyder, *Professor Emeritus* (1963).

Clark L. Thayer, *Professor Emeritus* (1957).

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SLAVIC LANGUAGES AND LITERATURE

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WILDLIFE AND FISHERIES BIOLOGY

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David Samuel Schwarz, *Assistant Professor of Philosophy*, B.A., Ripon College, 1965; B.Phil., University of St. Andrews, 1968; Ph.D., University of California at Berkeley, 1972.

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Bulkeley Smith, Jr., *Professor of Sociology*, B.A., Yale, 1947; M.A., 1954; Ph.D., 1958.

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Isabelle B. Sprague, *Professor of Biological Sciences*, A.B., Mount Holyoke, 1937; M.A., 1939; Ph.D., University of Kansas, 1953.

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George Tovey, *Professor of Philosophy*, A.B., Lafayette, 1942; Ph.D., Columbia, 1950.

Jane K. Townsend, *Professor of Biological Sciences*, B.S., Beloit College, 1944; M.A., University of Wisconsin, 1946; Ph.D., University of Iowa, 1950.

Edwin S. Weaver, *Professor of Chemistry*, B.S., Yale, 1954; Ph.D., Cornell, 1959.

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Smith College

Maria N. Banerjee, *Associate Professor of Russian*, Baccalaureat d'études secondaires, University of Paris, 1955; M.A., University of Montreal, 1957; Ph.D., Harvard University, 1962.

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Taffee Tanimoto, *Professor of Mathematics*, A.B., California, 1942; S.M., Chicago, 1946; Ph.D., Pittsburgh, 1950.

Glenn Tinder, *Professor of Politics*, B.A., Pomona, 1943; M.A., Claremont, 1948; Ph.D., California at Berkeley, 1952.

Francois Vuilleumier, *Associate Professor of Biology*, License es Sciences, University of Geneva, 1961; Ph.D., Harvard, 1957.

Chi-Hua Wang, *Professor of Chemistry*, B.S., St. John's, 1945; M.S., Catholic University, 1947; Ph.D., St. Louis University, 1951.

James N. Weaver, *Professor of Biology*, A.B., Southwestern, 1941; M.S., Texas A. & M., 1943; Ph.D., 1953.

Walter E. Weibrecht, *Assistant Professor of Chemistry*, B.S., Franklin & Marshall College, 1959; Ph.D., Cornell, 1963.

Harold Wolozin, *Professor of Economics*, B.A., Tufts, 1942; Ph.D., Columbia, 1955.

Robert C. Wood, *Professor and President of the University*, A.B., Princeton, 1946; M.P.A., Harvard, 1947; M.A., 1948; Ph.D., 1950.

Leverett J. Zompa, *Associate Professor of Chemistry*, B.S., Merrimack, 1959; M.S., College of the Holy Cross, 1960; Ph.D., Boston College, 1964.

University of Massachusetts Medical School at Worcester

Wadi A. Bardawil, *Lecturer in Pathology*, M.D., National University (Mexico), 1946.

Norman E. Beisaw, *Assistant Professor of Orthopedic Surgery*, A.B., Bowdoin, 1958; M.D., New York University, 1962.

Cyril A. Bergman, *Assistant Clinical Professor of Pediatrics*, M.D., Louisville, 1948.

Paul E. Berman, *Clinical Associate in Medicine*, B.A., Michigan, 1959; M.D., State University of New York Upstate Medical Center, Syracuse, 1963.

Paul E. Boyle, *Visiting Professor of Oral Pathology*, D.M.D., Harvard, 1923.

Neal C. Brown, *Associate Professor of Biochemistry*, D.V.M., Cornell, 1962; Ph.D., Yale, 1966.

William M. Burke, *Assistant Professor of Community Medicine*, A.B., Holy Cross, 1960; M.D., Vermont, 1964.

Reginald W. Butcher, *Professor and Chairman of the Department of Biochemistry*, B.S., United States Naval Academy, 1953; Ph.D., Western Reserve, 1963.

Wallace H. Chang, *Assistant Professor of Surgery*, M.D., Duke, 1963.

Francis J. Chlapowski, *Assistant Professor of Biochemistry and Anatomy*, B.A., Massachusetts, 1965; Ph.D., Michigan State, 1969.

Richard B. Clark, *Assistant Professor of Biochemistry*, B.A., New Hampshire, 1964; M.S., Maine, 1966; Ph.D., Virginia, 1971.

Sam L. Clark, Jr., *Professor and Chairman of the Department of Anatomy*, M.D., Harvard, 1949.

William J. Cooke, III, *Assistant Professor of Physiology and Biochemistry*, B.S., St. Bernadine of Siena College, 1962; M.S., College of St. Rose, 1966; Ph.D., State University of New York Upstate Medical Center, Syracuse, 1970.

John M. Cummings, Jr., *Clinical Instructor in Pediatrics*, M.D., Tufts, 1947.

Robin I. Davidson, *Assistant Professor of Neurosurgery*, B.S., Bates, 1960; M.D., Rochester, 1964.

Charles J. DeWan, *Lecturer in Pathology*, M.D., Jefferson, 1947.

Saul K. Dopkeen, *Assistant Clinical Professor of Pediatrics*, M.D., Boston University, 1939.

Kenneth Farbman, *Assistant Professor of Medicine and Microbiology*, A.B., M.A., Brandeis, 1959; M.D., Boston University, 1964.

Frederic S. Fay, *Associate Professor of Physiology*, A.B., Cornell, 1965; Ph.D., Harvard, 1969.

Joel D. Feinblatt, *Assistant Professor of Physiology and Biochemistry*, B.S., Brooklyn College, 1964; Ph.D., Pennsylvania, 1969.

Jean-Pierre Flatt, *Professor of Biochemistry*, B.S., Gymnase Cantonal Lausanne, Switzerland, 1952; Ph.D., University of Lausanne, Switzerland, 1959.

John J. Frey, *Assistant Professor of Community Medicine*, B.A., Notre Dame, 1966; M.D., Northwestern, 1970.

Hugh S. Fulmer, *Professor and Chairman of the Department of Community Medicine*, A.B., Syracuse, 1948; M.D., State University of New York Upstate Medical Center, Syracuse, 1951; M.P.H., Harvard, 1961.

H. Maurice Goodman, *Professor and Chairman of the Department of Physiology*, A.B., Brandeis, 1956; Ph.D., Harvard, 1960.

Leonard S. Gottlieb, *Lecturer in Pathology*, A.B., Bowdoin, 1946; M.D., Tufts, 1950; M.P.H., Harvard, 1969.

Peter Grigg, *Assistant Professor of Physiology*, B.S., Rensselaer, 1961; M.S., Syracuse, 1966; Ph.D., State University of New York Upstate Medical Center, Syracuse, 1969.

Clifford R. Guptill, *Assistant Clinical Professor of Pediatrics*, M.D., Tufts, 1937.

Ian D. K. Halkerston, *Associate Professor of Biochemistry*, B.Sc., University of Reading, England, 1941; Ph.D., Boston University, 1960.

Charles W. Hays, *Assistant Professor of Community Medicine*, A.B., Oregon State, 1963; M.D., Kansas, 1967.

John B. Herrmann, *Professor of Surgery*, A.B., Dartmouth, 1954; M.D., Harvard, 1957.

Arthur T. Hertig, *Lecturer in Pathology*, B.S., Minnesota, 1928; M.D., Harvard, 1930.

Roger B. Hickler, *Professor and Chairman of the Department of Medicine*, M.D., Harvard, 1949.

Karl J. Hittelman, *Associate Professor of Biochemistry*, A.B., Reed, 1958; M.S., Oregon, 1961; Ph.D., California, Los Angeles, 1967.

Mahlon B. Hoagland, *Research Professor of Biochemistry*, M.D., Harvard, 1948.

John Izsak, *Clinical Associate in Pediatrics*, B.A., Vermont, 1958; M.D., 1963.

Robert B. Keller, *Assistant Professor of Orthopedic Surgery*, A.B., Dartmouth, 1958; M.D., Cornell, 1961.

Lewis A. Kelly, *Instructor in Biochemistry*, B.S., Muskingum College, 1965; Ph.D., Pittsburgh, 1970.

Narinder N. Khanna, *Assistant Clinical Professor of Pediatrics*, M.D., All India Institute of Medical Sciences, India, 1960.

Thelma W. Lebeaux, *Instructor in Psychology*, B.A., Michigan, 1938; M.A., Columbia, 1939.

Leslie Lipworth, *Associate Professor of Community Medicine*, M.B., B., Ch., Witwatersrand, Johannesburg, 1942.

John W. Littlefield, *Lecturer in Genetics*, M.D., Harvard, 1947.

Richard A. MacDonald, *Professor of Pathology*, A.B., Albion, 1951; M.D., Boston University, 1954.

H. Edward MacMahon, *Visiting Professor of Pathology*, B.A., Western Ontario, London, 1922; M.D., 1925.

Guido Majno, *Professor and Chairman of the Department of Pathology*, M.D., Milan, Italy, 1947.

Sandy C. Marks, Jr., *Associate Professor of Anatomy*, B.S., Washington and Lee, 1960; D.D.S., North Carolina, 1964; Ph.D., Johns Hopkins, 1968.

Thomas C. McBride, *Assistant Professor of Community Medicine at Amherst*, A.B., Dartmouth, 1953; M.D., Vermont, 1957.

Morris Medalie, *Assistant Clinical Professor of Pediatrics*, M.D., M.B., B., Ch., Witwatersrand, Johannesburg, 1941; M.R.C.P., Edinburgh, London, England, 1948.

Donald P. Miller, *Clinical Associate in Pediatrics*, A.B., Dartmouth, 1957; M.D., Vermont, 1962.

Thomas B. Miller, Jr., *Assistant Professor of Biochemistry*, B.A., George Peabody, 1966; Ph.D., Vanderbilt, 1970.

Donald J. Morton, *Assistant Professor of History of Medicine and Head Librarian*, B.S., Delaware, 1952; M.S., Louisiana State, 1954; Ph.D., University of California, Berkeley, 1958; M.L.S., Simmons, 1969.

Robert G. Neuhardt, *Clinical Associate in Pediatrics*, B.S., Yale, 1956; M.D., Columbia, 1960.

Harvey L. Ozer, *Lecturer in Microbiology*, A.B., Harvard, 1960; M.D., Stanford, 1965.

Arthur M. Pappas, *Professor and Chairman of Orthopedic Surgery*, A.B., Harvard, 1953; M.D., Rochester, 1957.

Liberto Pechet, *Associate Professor of Medicine and Pathology*, M.D., Hebrew University, Jerusalem, 1952.

Peter G. Pletka, *Assistant Professor of Medicine*, M.B., B.S., University of Melbourne, Victoria, 1962; M.R.C.P., Royal, London, 1967.

David T. Purtilo, *Assistant Professor of Pathology*, B.A., Minnesota, 1961; M.S., North Dakota, 1963; M.D., Northwestern, 1967.

Edward P. Richardson, Jr., *Lecturer in Neuropathology*, A.B., Harvard, 1939; M.D., 1943.

Stanley L. Robbins, *Lecturer in Pathology*, B.S., Massachusetts Institute of Technology, 1936; M.D., Tufts, 1940.

Robert B. Rossi, *Clinical Instructor in Pediatrics*, B.S., Tufts, 1949; M.S., 1950; M.D., 1954.

Charles A. Roy, *Assistant Clinical Professor of Pediatrics*, B.A., Norwich, 1944; M.D., Tufts, 1947.

Louis E. Roy, *Assistant Clinical Professor of Family Practice*, B.A., Norwich, 1943; M.D., Tufts, 1946.

Richard H. Saunders, Jr., *Associate Professor of Medicine and Associate Dean for Academic Affairs*, B.A., Richmond, 1939; M.D., Rochester, 1943.

Gary B. Schneider, *Instructor in Anatomy*, B.S., Wisconsin, 1969; Ph.D., Massachusetts, 1973.

Joel M. Seidman, *Assistant Professor of Medicine and Physiology*, B.A., Harvard, 1960; M.D., 1964.

H. Herman Shuman, *Associate Clinical Professor of Pediatrics*, B.S., Vermont, 1932; M.D., 1935.

Joshua J. Singer, *Assistant Professor of Physiology*, S.B., S.M., E.E., Massachusetts Institute of Technology, 1966; Ph.D., Harvard, 1970.

Robert H. Singer, *Assistant Professor of Anatomy*, B.A., Oberlin, 1966; Ph.D., Brandeis, 1970.

Jan F. Steele-Perkins, *Clinical Associate in Pediatrics*, M.D., Guy's, London, 1958.

John F. Stockwell, *Associate Professor of Hospital Administration and Associate Dean for Administrative Affairs and Hospital Director*, A.B., Dartmouth, 1949; M.H.A., Minnesota, 1953.

Robert L. Taber, Jr., *Assistant Professor of Microbiology*, B.A., Harpur, 1964; Ph.D., Pittsburgh, 1969.

Donald J. Tipper, *Professor and Chairman of the Department of Microbiology*, B.Sc., Birmingham, England, 1956; Ph.D., 1959.

John V. Walsh, *Assistant Professor of Physiology*, A.B., Boston College, 1964; M.D., Harvard, 1970.

Richard F. Walton, *Associate Professor of Community Medicine*, A.B., Bates, 1959; M.D., Queen's, Kingston, 1961.

James H. Warram, Jr., *Lecturer in Community Medicine*, B.S., Oklahoma, 1957; M.D., Harvard, 1961; S.M., 1965.

William S. Weir, *Clinical Associate in Neurology*, A.B., Louisville, 1955; M.D., Northwestern, 1963.

Federico Welsch, *Associate Research Professor of Biochemistry*, B.A., Barcelona, Spain, 1950; M.D., Valencia, Spain, 1955; D.Med.Sc., 1957; Ph.D., Dartmouth, 1968.

H. Brownell Wheeler, *Professor and Chairman of the Department of Surgery*, M.D., Harvard, 1952.

Merrill K. Wolf, *Professor of Anatomy*, A.B., Yale, 1945; M.D., Western Reserve, 1956.

Rosalie S. Wolf, *Lecturer in Sociology*, B.S., Wisconsin, 1949.

Alfred Yankauer, *Professor of Community Medicine*, A.B., Dartmouth, 1934; M.D., Harvard, 1938; M.P.H., Columbia, 1947.

Index

GRADUATE SCHOOL
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University of Massachusetts
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THIRD CLASS MAIL

1973-1974
University of Massachusetts
at Boston

University of Massachusetts Bulletin

It is the policy of the University of Massachusetts at Boston that any and all acceptance of students for admission be without regard to sex, creed, race, color or national origin.

1973-1974
University of Massachusetts
at Boston

Contents

Academic Calendar (1973-1974)

First Semester

August 27–31	Monday–Friday	Freshman Orientation
September 5	Wednesday	Classes begin
October 8	Monday	Holiday
October 22	Monday	Holiday
October 23	Tuesday	Monday schedule
November 21	Wednesday	Thanksgiving recess after last class
November 26	Monday	Classes resume
Nov. 27–Dec. 7	Tuesday–Friday	Pre-registration
December 7	Friday	Classes end
December 8–12	Saturday–Wednesday	Reading period
December 13–21	Thursday–Friday	Exam period
Dec. 21–Jan. 27	Friday–Sunday	Vacation

Second Semester

January 28	Monday	Classes begin
February 18	Monday	Holiday
Mar. 22–Apr. 1	Friday–Sunday	Vacation
April 15	Monday	Holiday
April 16	Tuesday	Monday schedule
Apr. 22–May 3	Monday–Friday	Pre-registration
May 8–14	Wednesday–Tuesday	Reading period
May 15–23	Wednesday–Thursday	Exam period
June 6—Graduation		

Message from the Chancellor

Today American higher education faces its hardest task in the urban centers and in terms of what it will do for those who so far have not had an opportunity for a college education. At UMass-Boston, we face squarely both these issues. We are in the midst of an urban center and we are by mandate the people's university.

It is in this context that I intend to make UMass-Boston a determining experience in the life of the students from Boston and from the Commonwealth who sincerely seek an education.

A university's fundamental function is the search for truth and knowledge, their preservation and dissemination. This truth and this knowledge that we discover must be brought out in the sunlight for all to see in a market-place of ideas where each individual must make his own judgments and choices.

I hope that each student's stay at UMass-Boston will be an exciting adventure in this process of search and decision. It is our responsibility to sustain the students in their efforts by providing them with the best possible education that can be achieved within our resources and our abilities. This year we are moving into a new campus, into first-rate educational facilities that the Commonwealth has provided for us. We move into a new community and there we must be a positive force, a good influence, a creative experience for all concerned. I pledge my every effort to these ends.

CARLO L. GOLINO

Foreword

The University of Massachusetts at Boston is a young urban university founded in 1965 to provide high quality educational opportunities and services at low cost to the people of Greater Boston, particularly for low and moderate income residents. The University has centered its efforts in high quality liberal arts and pre-professional education at the undergraduate level. It has begun modest Master's programs in Mathematics, English, Chemistry, and Biology. The student body is enrolled in the liberal arts Colleges I and II, and in 1973 the first class in the College of Public and Community Service was accepted. In each of the colleges a good faculty-student ratio has been kept to perform the perennial tasks of Western universities: to preserve and transmit what is known, to inquire into what is unknown, and to educate a new generation for its own inquiries into the known and unknown.

In seeking to graduate liberally educated men and women, the colleges encourage their students to seek mastery over language and to gain insight into the culture that languages express; to probe the value of formal thought; to learn more about animate and inanimate nature; to become more aware of the methods and results of disciplines that investigate man, his institutions, his culture, and his physical world; to test man's aspirations against his experience.

In addition to complete offerings in the arts and sciences, the campus offers a Teacher Certification Program that meets the state's standards, and a concentration in Afro-American Studies, Religious Studies, Urban Affairs, and Women's Studies.

The Dean, faculty, and students of each of the three colleges will be developing the distinctive character of the school, especially in matters of curricula. Other colleges will be developed, bringing new programs into the curricula; ultimately five colleges are planned. While it is expected that the college to which a student has been assigned will ultimately become the source of most of his social and educational experiences, various course offerings in the individual colleges may be open to all students of the University. In studying the offerings in this catalogue, you should keep in mind that it is not just the particular college but the University that offers you such a rich curriculum.

This University is a place of change, with major involvement by students and faculty in its governance.

In the present academic year the University is located at its new and exciting campus by the sea in Dorchester. The University also maintains its downtown Boston campus in the Park Square area at 100 Arlington Street.

At the Dorchester campus is a complex of six buildings: the two liberal arts colleges, the central library, the science center, administration and service buildings. Future buildings will include a recreation-sports center, a multi-

purpose academic and student activities building, and the future colleges of the University.

The new campus of 100 acres is bordered by Dorchester Bay and the Columbia Point Housing Project and is some three miles from the downtown campus. It is near the Columbia MBTA station.

The College of Public and Community Service this year is located at the 100 Arlington Street site, and will remain at this location until its new facility is constructed in Dorchester. It will have all the collegiate amenities that students will have at the new campus. Transportation facilities include the Arlington Street MBTA station, two bus terminals and the Back Bay railroad station.

The University of Massachusetts at Boston is part of the state-wide university system which includes the university campus at Amherst and the Medical School in Worcester. Each unit of the system abides by the policy that acceptance of students is based without regard to race, color, creed, sex, or national origin.

General Information

Major Degree Programs Available:

Anthropology
Art
Biology
Chemistry
Classics
Economics
English
French
German
Greek
Italian
Latin
Mathematics
Music
Philosophy
Physics
Politics
Psychology
Russian
Sociology
Spanish
Theatre Arts

Programs are also available in Afro-American Studies, Religious Studies, Urban Social Service, Women's Studies and Teacher Certification for the elementary and secondary schools. Advisors are available to those wishing to pursue Pre-Law, Pre-Medical, Pre-Dental, Pre-Engineering, or Pre-Veterinary programs.

Library

The University Library book collection contains approximately 200,000 volumes. Over 2,500 domestic and foreign journals are received currently in the periodical room. The Main Library is a spacious building which provides room for housing books, seating students and conducting library operations. In addition, a Science Library, containing the collections in Biology, Chemistry, Mathematics, and Physics, is located in the University's Science building.

The library is easily accessible from all of the University buildings and forms a natural nucleus in its present site. In the main reading room and the periodical room, individual carrels provide seating for the students. The library's resources support the teaching programs of the University on every level.

Audio-Visual Center

Within the realm of the Audio-Visual Center are located "hands on" equipment, television production equipment, language laboratories, individual study room, and one of the largest audio and video tape collections in the country available on an information retrieval system.

The language laboratories have the most modern electronic equipment available. Tapes used in laboratory sessions are closely correlated with classroom studies and the recordings made by students during laboratory sessions

can be played on standard recorders at home for additional individual study. The subject matter offered to students and faculty is greatly varied and can be found in the Audio Visual Catalog, printed yearly.

Bookstore

Located in the Administration Building, the Bookstore carries all textbooks required for courses plus a complete line of school supplies, candy, cigarettes and gift items. Also carried is a selection of paperbacks. Special orders can be made for almost any other book in print.

Bookstore hours are 9 a.m. to 4:45 p.m., Monday-Friday, when school is in session.

Admissions

APPLICATIONS

Applications for admission may be obtained from the Admissions Office, Boston, Massachusetts 02125. Out-of-state and foreign applicants should return their completed forms *before* February 1 for September admission and October 1 for January admission. In-state freshman applications should be returned by March 1 for September admission and by November 1 for January admission, transfer applications by April 1 for September and November 1 for January. *No application fee is required.*

Applicants are invited to visit the campus where group meetings are held daily at 3:30 p.m. This is an appropriate time to tour the campus and ask questions. An applicant should be assured, however, that if he is unable to visit Boston his application will be in no way disadvantaged.

A personal conference may be scheduled if the University deems it necessary or if the candidate or his guidance counselor has a question that cannot readily be resolved otherwise.

TESTING PROCEDURE

All applicants must take the Scholastic Aptitude Test given by the College Entrance Examination Board. The University also recommends three College Board Achievement tests, including English Composition and a language. All College Board Test reports must be sent directly to the Admissions Office, University of Massachusetts at Boston, Boston, Massachusetts 02125, from the College Board Testing Center. The applicant himself must notify the Board that he wishes his scores sent to this University. Applicants who have been out of school for more than two years should take the Scholastic Aptitude Tests again.

VETERANS

The University of Massachusetts at Boston seeks to serve Massachusetts vet-

erans recently discharged from the Armed Services through evaluation based primarily on recent Scholastic Aptitude Test scores (no more than two years old) and increased level of maturity. The requirement of new SATs must be met.

FOREIGN AND OUT-OF-STATE STUDENTS

Since the University of Massachusetts at Boston has a five percent limit on out-of-state and foreign students, the competition among these candidates is always extremely keen.

All foreign students whose schooling has been in English are required to submit results of Scholastic Aptitude Tests. In addition, students whose native language is not English should submit results of the Test of English as a Foreign Language. Information regarding test centers and dates for both the SAT and the TOEFL can be obtained from the College Entrance Examination Board, P.O. Box 592, Princeton, New Jersey 08540.

As a state university, the University of Massachusetts at Boston is able to offer only limited financial aid to foreign students.* Therefore, foreign students should make certain that they can meet all expenses before applying for admission.

HIGH SCHOOL PREPARATION

The subjects of preparatory study recommended for admission call for the satisfactory completion of a four-year high school course or its equivalent and are stated in terms of units. A unit is the equivalent of at least four recitations a week for a school year. High school graduation alone is not sufficient. The applicant's record must indicate capacity for handling the quality of scholastic work which the University has established as its standard of achievement. Sixteen units of secondary school work must be offered, selected according to the following recommendations:

College Preparatory Mathematics	3**
English	4
Foreign Language (2 years of 1 language)	2
U.S. History	1
Laboratory Science	1

The remaining units are elective and may be selected from the following subject matter:

a. Mathematics
b. Science
c. Foreign Language
d. History and Social Studies
e. Free electives (not more than four units)

* Six tuition waivers are available annually for academically superior students.
** Preferably two years of Algebra and one of Plane Geometry.

Free elective subjects are those not included in groups a-d, as for example: music, art, drawing, typewriting, aeronautics, agriculture, home economics, etc. Such free electives are allowed in order that the student who wishes may have some opportunity to elect other high school offerings, while at the same time covering the fundamental requirements for college work.

Students planning to major in the physical sciences and mathematics should, if possible, offer two years of algebra, one of plane geometry, and one-half year of trigonometry. Preparation in analytical or solid geometry, chemistry, physics, and introductory calculus is also strongly recommended.

Candidates of exceptional ability and promise may be considered for admission even though some of the prescribed courses are not included in their high school records. Candidates who are deficient in one or more subjects required for admission to the University must present records which are otherwise strong.

Some of the programs offered at the University will serve students through nontraditional programs and courses, and in these programs the experiences and backgrounds of the applicant will be evaluated in addition to, or instead of, the traditional academic preparation.

EQUIVALENCY DIPLOMA

In some cases the Massachusetts High School Equivalency Diploma may be substituted for the usual high school program. It is suggested that persons with an equivalency diploma arrange for a personal interview with a member of the admissions staff to discuss their goals and possible plans for meeting these goals.

ACKNOWLEDGEMENT AND NOTIFICATION

In most cases applicants will be notified by letter during April of the action taken on their applications for September and during December for January. Applicants who present strong academic records, enthusiastic school recommendations, and satisfactory College Board scores will receive earlier notification. This early notification should reassure the well-qualified applicant regarding college entrance and enable the student who has selected the University as his choice of college to settle his plans. Applicants accepted at an early date, however, are under no pressure to make a final decision in regard to their choice of college before the Candidate's Reply Date of May 4. In this way the burden of multiple applications on high school guidance counselors and college admissions officers may be lessened.

ADVANCED PLACEMENT

Students whose scores on Advanced Placement examinations meet standards determined by the University shall be regarded as meeting the equivalent University requirements. The College Entrance Examination Board Advanced Placement examinations or special examinations given by the University will determine advanced placement.

TRANSFER STUDENTS

A limited number of transfers from approved colleges may be admitted. Since applicants for transfer exceed the number that can be accepted, they are placed on a competitive basis. Evaluations will be based upon high school and college records and on the College Board Scholastic Aptitude Tests, which are required of all transfers. Any student who has been previously enrolled in a college is considered a transfer and must file a transfer application form. Applicants for transfer should write to the Admissions Office for a transfer application.

Any course taken at an accredited institution which is comparable in substance to a course offered at the University of Massachusetts at Boston, and in which the grade is C or better, will transfer and be applied, wherever possible, to the graduation requirements.

High school and all college transcripts plus results of Scholastic Aptitude Tests must be sent to the Admissions Office. Transfer application forms signed by the registrar of the last college attended must be submitted by November 1 for the spring semester and by April 1 for the fall semester.

All transfer students who are candidates for a Bachelor's Degree must take at least 45 semester credits in residence as well as fulfill all University requirements for graduation.

Community College Transfers

As a part of the Massachusetts system of higher education, the University recognizes its kinship with the regional Community Colleges and therefore guarantees that the student who has completed the Community College transfer program, who is fully qualified, and has the recommendation and required cumulative average of the Community College, will be accepted for transfer into the four-year program. Appropriate courses given at the Community College will be fully accepted for transfer credit and applied to core curriculum requirements where possible.

PART-TIME STUDENTS

The University of Massachusetts at Boston admits a number of part-time students in each semester. Part-time students may be either degree-seeking or non-matriculated. Because of the often nontraditional backgrounds and experiences of part-time students, a personal interview may become an important part of the evaluation and is thus required of all applicants for part-time study.

Special Admissions

The Special Admissions Office seeks to attract students from minority group backgrounds and those who for financial reasons might not consider applying to college at all. Most of the students are older and have held jobs for several years. In order to apply, a student must be from a low income background. All

students accepted by the Special Admissions Office are full-time degree candidates under the same obligations as all other students who come to the University.

Each student who applies through Special Admissions must submit, along with his application, two informative letters of recommendation from those familiar with his work, either on a job, in school, or in connection with a project he has pursued in the community; and a high school transcript. Students who have not completed high school are encouraged to consider applying, provided they have had an equivalent work experience or have read widely. After completion of the application, an interview should be arranged. The purpose of the interview is to give the counselor some idea of the applicant's interests, his hopes for the future, and his past experiences, in an effort to help both the counselor and the student decide whether or not the application to the University makes sense.

In the Spring, open meetings are held for prospective students to discuss Special Admissions and the University in general. Those students accepted for the fall semester are required to participate in a summer writing-skills program.

Further questions can be answered directly by the Special Admissions Office. All applications should be addressed to Mr. Livaughn Chapman, Director, Special Admissions, University of Massachusetts at Boston, Boston, Massachusetts 02125. Students should apply *no later* than May 15 to assure September consideration.

College Preparatory Program

The College Preparatory Program provides an opportunity for low-income high school students with inadequate academic backgrounds to prepare themselves for admission to the University. Ordinarily students enter during their sophomore or junior year of high school. Financial eligibility is set by the guidelines of Upward Bound, which provides most of the funds for the program. In general, students are accepted who show strong motivation and academic promise but have performed unevenly or have been enrolled in business or trade curricula in high school. Upon completion of their work in the program, students are accepted for admission to the University of Massachusetts at Boston.

The program offers twice-weekly evening courses in standard college preparatory subjects and provides tutors in courses taken in the student's high school. During the senior year, qualified students may enroll for credit in a freshman level University course with tutorial support. In the summers following the sophomore and junior years, students attend a six-week residential summer school outside Boston. During the summer following graduation from high school, students attend a summer session at the University in which they are enrolled in freshman courses with tutorial support.

Application forms and further information may be obtained from the Director, College Preparatory Program.

Classification of Students

I. DEGREE STUDENTS

Full-Time Students: All students carrying 3 courses or 12 or more credits are accepted as degree candidates and assigned to a graduating class.

Non-Classified Degree Students: Students who are admitted to degree status on the same basis as full-time students, but with the expectation of only part-time pursuit of the degree are considered Non-Classified Students. They are given a classification of "NC". For their initial enrollment they are classified as Freshmen or Transfers by the Admissions Office. They are assigned to an adviser for appropriate counseling and pre-registration advising.

II. NON-DEGREE STUDENTS

Special Students: A transient student accepted for courses on a non-continuing basis is assigned to this category. Class designation is "SP".

Tuition, Fees and Expenses

TUITION

As a state institution, the University of Massachusetts at Boston offers a low rate of tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the Board of Trustees.

A student must present evidence satisfactory to the Treasurer of the University that his domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. He must also have established a *bona fide* residence in the Commonwealth for a period of not less than one continuous year prior to the date of acceptance at the University, and certify his intention to continue to maintain such a residence.

The domicile of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation, the student, in addition to the requirements of these regulations respecting residence, shall present satisfactory proof respecting emancipation. Minors under guardianship shall be required to present, in addition to the certification of the domicile of the guardian, satisfactory documentary evidence of the appointment of the guardian. No student shall be considered to have gained residence solely by reason of his attendance in the University, nor shall a student lose residential preference during his continuous attendance at the University. The residence of a wife shall follow

that of a husband. The prescribed form of application for classification as to residence status must be executed by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University. Discretion to adjust individual cases within the spirit of these rules is lodged with the President of the University.

EXPENSES

Normally expenses vary from approximately $500 to $600 per year. The following estimate of a year's expenses includes only those items which are strictly college-related. Tuition for residents of Massachusetts is $300* per year and for others $1100.

Tuition	$300*
Student Activities Fee	30*
Health Services Fee	28
Student Medical/Surgical Insurance (12 months' coverage, optional)	30
Books, stationery, laboratory and other supplies (estimate)	200
* Subject to change.	$588

No provision is made for room and board expenses as the University of Massachusetts at Boston is non-residential.

INITIAL PAYMENT FOR FRESHMEN

The initial payment for first semester expenses required of freshmen and transfer students prior to fall registration, and other expenses reasonably expected, are indicated below:

	Residents of Massachusetts	*All Others*
Tuition	$150*	$550*
Less Credit for Matriculation Fee (Non-Refundable)	(15)	(15)
Net Tuition	135	535
Student Activities Fee	15	15
Health Services Fee	14	14
Student Medical/Surgical Insurance 12 months' coverage (optional)	30	30
Orientation Fee (paid upon acceptance) (Non-Refundable)	15	15
Total of first semester Student Fee Bill	$209	$609
Books, stationery, laboratory and other supplies (estimate)	100	100
Total	$309	$709

* Subject to change.

The figures for books, stationery, etc., are approximate; they vary depending upon courses chosen and individual needs. Students should be prepared to pay cash for books and incidental supplies. Certain departments make special charges for necessary laboratory supplies. A bill will be rendered to the parent of each student prior to the beginning of the semester.

STUDENT ACTIVITIES FEE

Used to support programs and activities beneficial to students, such as the recognized student organizations and the University Cultural Events Committee.

STUDENT HEALTH FEE

Used to support the University Health Services and its programs.

MEDICAL/SURGICAL INSURANCE

An optional plan providing hospital, medical, and surgical care on a twelve-month basis for injuries or illness during the school year, holidays and summer vacation. Students who register for the Fall semester have only one opportunity to enter this program each year, at the time of payment of the Fall semester bill. It is also offered on the Spring semester bill for new Spring registrants only. Dependents of married students are not covered under this plan. Coverage for dependents is available at additional cost. Inquire at the University Health Services.

PAYMENT DUE DATES

In accordance with University policy all charges for tuition and fees are due and payable approximately 21 days prior to the date of registration of each semester. Bills will be rendered in advance with due date shown and should be returned with the proper payment to the Bursar's Office, University of Massachusetts at Boston, Boston, Massachusetts 02125. Students may not register until all University charges are paid or otherwise accounted for.

SCHOLARSHIP PAYMENTS

It is the responsibility of all scholarship holders to see that the University is adequately notified prior to the time fee bills are prepared. Known scholarships are shown on the fee bills. If such items are not shown, deductions may not be made from the bill until satisfactory evidence has been presented to the Treasurer of the University by the donor.

LATE PAYMENT

Any student who does not make payment of his semester charges by the date specified may be required to pay a late payment fee of $5.

TUITION AND FEE REFUNDS

A student who leaves the University for any reason, except as specified below, before a semester is completed will be granted a *pro rata* refund of tuition and

fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given a full refund of tuition and fees. The $15 admission (matriculation) payment and the $15 orientation payment required of new students are not refundable. A student called into military service before completion of a semester will be given a *pro rata* refund of tuition and fees provided that he receives no academic credit for the work of that semester. If academic credit is given, there will be no refund. A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

REFUND SCHEDULE

Regular term

a. Within the first two weeks from the beginning of semester or term (Registration Day) 80%
b. During the third week 60%
c. During the fourth week 40%
d. During the fifth week 20%
e. After the fifth week ..... no refund

Refunds are based upon the withdrawal date established by the Registrar.

Veterans

Any veteran whose service is credited to the Commonwealth of Massachusetts (i.e., entered the service in Massachusetts), and who has served 180 days active duty since February 1955, is eligible to attend the University tuition free. Instructions relative to the procedure to obtain this tuition waiver are available at the Registrar's Office. This tuition waiver covers a period of four years but must be renewed each year. Summer school attendance must have a renewal of the tuition waiver but is not charged as a renewal if the courses taken in summer school are required for a degree.

Information concerning veterans status and payments under Federal and State laws is available at the Registrar's Office.

Certificates of eligibility for schooling are issued by the Veterans Administration upon application by the veteran. Upon receipt of the certificate of eligibility, the veteran should deliver it to the Registrar's Office for processing.

Responsibility for any change in status rests with the veteran. Any change in a veteran's status while attending the University in relation to semester hour credits, marriage, dependents or withdrawal should be reported immediately to the Registrar's Office.

VETERAN'S EDUCATIONAL TRAINING PROGRAM

Veterans who feel that they need to improve their skills before entering the University on a full-time basis may apply for admission to the VET Program.

Funded by the U.S. Office of Education, this program offers classes and counseling which help the veteran make a smooth transition between military life or long absence from formal schooling to the life of a student. Courses are offered in English composition, mathematics, literature and social sciences on a non-credit basis. However, students in the program may substitute up to two credit courses in the University for two non-credit courses. In addition, they may receive vocational, educational and personal counseling.

Many VET Students participate in the program and apply for admission to the University without the traditional requirements for admission. The State Department of Education recognizes students in the program as eligible for GI Benefits.

Financial Aid

Financial aid at the University of Massachusetts at Boston is awarded to those students who cannot provide the full cost of their college education through their own and their families' reasonable efforts. The term "financial aid" is used to include scholarships, grants, long-term loans and part-time employment.

Applications for financial aid should be filed at the same time as the application for admission. The filing of an application for financial aid will have no influence on the decision for admission.

All awards are made on an academic year basis only. A student must apply each year for any type of aid for the following year.

MASSACHUSETTS STATE SCHOLARSHIPS

The Board of Higher Education awards scholarships to students who attend the University of Massachusetts at Boston. *All students who apply for aid to the University should also apply for a Massachusetts State Scholarship.* Applications are available at secondary school guidance offices or at the Board of Higher Education Scholarship Office, 182 Tremont Street, Boston 02111. The application deadline is December 15, 1973, and Parents' Confidential Statements should be filed with College Scholarship Service by December 1, 1973.

UNIVERSITY SCHOLARSHIPS

University Scholarships are available for residents of Massachusetts. Only those students in the top 10–25 percent of their class with above average performance on the College Entrance Examination and a financial need will be considered for scholarships.

I.B.T.W. SCHOLARSHIPS

I.B.T.W., Local #1 Scholarships are tuition scholarships for sons and daughters of former members of Local #1 of the International Brotherhood of Telephone Workers. Half of the awards will be made to freshman applicants. Further information and special applications should be requested from the Financial Aid Office.

(At time of publication the future of the following federal programs is uncertain. For current information contact the Financial Aid Office.)

EDUCATION OPPORTUNITY GRANTS

Education Opportunity Grants are gift awards given to academically promising students in accordance with special requirements set by the Higher Education Act of 1965. These grants are designed especially for students of low income families.

LOANS

The major sources for loans are the National Direct Student Loan Fund and Federally-supported State Guaranteed Loan Programs.

a. National Direct Student Loans are available through Federal funds received by the University. Federal legislation permits students needing money to borrow up to $1,000 per year for five years. The actual amount of the loan is determined by the student's needs and by the amount of Federal funds made available to the University. No interest is charged on loans until repayment begins. The repayment period starts nine months after the student ends his studies, and may be extended over a 10-year period at an interest charge of 3 percent on the unpaid balance. Repayment of capital and interest may be deferred up to a total of three years while a borrower is serving in the Armed Forces, with the Peace Corps, or as a Volunteer in Service to America (VISTA). Also, no payments are required so long as the student remains at least a half-time student at the undergraduate level. There are provisions for cancelling all or part of this loan if the student enters the teaching profession.

b. Students may apply for loans under the Guaranteed Loan Program in their home states. This program, established by the Higher Education Act of 1965, varies from state to state. Generally, undergraduate students may borrow up to $1,500 per academic year with a total maximum of $7,500, while a graduate student may borrow up to $1,500 per academic year; the total sum of $7,500 for one student's undergraduate and graduate study may not be exceeded. Commercial banks, mutual savings banks, savings and loan association, credit unions and other financial institutions subject to Federal or State supervision may be lenders under this program. A student should make application directly to one of these participating institutions, preferably to one located in the city or town of his permanent residence. The University is asked to certify the enrollment and good academic standing of the student, the reasonableness of his college expenses, and the amount of financial aid available from sources other than his family. These loans are considered a part of the financial aid package.

As of March 1, 1973, the student must submit an application supplement if he wishes to apply for a subsidized loan, i.e., no interest payments until after he graduates. This supplement provides for the University to

recommend to the bank the amount of the loan. In general, this recommended amount will be the subsidized loan amount. Nine months after the student graduates or leaves school, he begins repayment of the loan along with 7% interest. Payment may be deferred for graduate studies, Armed Forces or Peace Corps/Vista. Repayment is arranged with the bank from one to ten years.

PART-TIME EMPLOYMENT

Part-time employment is available mainly through the College Work-Study Program, part of which is supported by the Federal Work-Study Program, and will be given as part of the financial aid package. This will require eight to 15 hours of work per week for students who need financial aid. Students are paid weekly for the hours they have worked.

APPLICATION PROCEDURE

a. Pre-Freshman applicants should submit to the Financial Aid Office the Financial Aid Application included with the Admission application. In addition, applicants should obtain from their school's guidance office a copy of the Parents' Confidential Statement prepared by the College Scholarship Service. That statement should be mailed directly to the Service at the time the student applies for admission, but no later than March 1. The University of Massachusetts at Boston should be listed under Item 13.

b. Transfer and upper-class students should obtain applications and Parents' Confidential Statements from the Financial Aid Office. Applications are due by April 1.

Transfer students who received financial aid from the school from which they are transferring, should request the Financial Aid Office at that school to send a record of their awards to the University Financial Aid Office.

AWARDS

The amount of awards is determined by degree of need and may range from $100 to full cost of attending school. A fuller explanation of determination of need is available in the Financial Aid Office.

Announcement of awards will be made by means of an award letter as soon as possible following the applicant's acceptance by the University. Further communication with the Financial Aid Office is unnecessary, as each applicant will receive an answer as soon as a decision has been made.

University Health Services

The medical care provided by the University Health Services is structured primarily for the well-being of the student population at the University of Massachusetts at Boston. The program is student-oriented, and the services offered are those which have real meaning for the student. The services exist

to help minimize loss of student time and energy from educational pursuits for reasons of health. Two registered nurses are on duty from 8:30 a.m. to 5 p.m., and both clinical and laboratory facilities are offered. Physicians and psychiatrists are available on an appointment basis, and special consultants are arranged when necessary.

The physical examination and medical history of each student is reviewed by a physician before registration. The University Health Service is aware, therefore, of any pre-existing medical problems which either require medical care or might necessitate a modification of the student's academic or athletic program. All medical records are held in the strictest confidence by the University Health Services.

The Health Services are supported by the Health Service Trust Fund, constituted by the fee which each student is required to pay. Students are urged to enroll in the University of Massachusetts at Boston J. C. Paige Student Hospitalization Insurance Plan. This insurance plan entitles the student to extensive but not total hospital services, in-patient physician's care, out-patient surgical care, accident insurance, referral to specialty consultants, X-ray and laboratory diagnosis, etc. A full description is available at the University Health Services office.

Housing

The University of Massachusetts at Boston is a commuting institution. As such, living arrangements are the concern and responsibility of the students and their parents, although the University will offer guidance on housing.

Office of Student Affairs

Student Affairs includes, either completely or in cooperation with other offices, the following areas:

Career planning
Communication with parents
Counseling
Cultural events programs
Discipline
Financial aid
Foreign students
Handicapped students
Intramural athletics
Orientation program
Placement
Recognized student organizations, and
Student activities

Students have a variety of outlets for using and developing their talents through such activities as:

Anthropology Club
Armenian Club
Art Club
Biology Club
Bowling Club
Chemistry Club

Chess Club
Asian-American Cultural Club
Columbia Point Workshop
College Young Democrats
Dionysius Guild (Drama Club)
Economics Society
Film Club
Food Co-op
German Club
Hellenic Culture Club
Hispanic Culture Club
Italian Club
International Students
Le Cercle Voltaire
Martial Arts Society
Motorcycle Club
Music Club
Club Ohavai
Philosophy Club
Photography Club
Physics Club
Playwright Club
Poetry Workshop
Pre-Law Society
Pre-Medical and Pre-Dental
Psychology Club
Public Interest Research Group
Puerto Rican Club
Rifle and Pistol Club
Ski Club
Slavic Club
Social Relations Coalition
Sociology Club
Spartacist League
Student Mobilization Committee
Ujima Society
Vietnam Veterans Against the War
Women's Abortion Action Committee
Women's Self Defense Club
Young Socialist Club
Karate Club

Advising and Study Counseling

The staff of the College Dean's Office is available to students to provide them with information on the curriculum, general requirements, program planning and graduate study opportunities. Tutorial and study skills assistance is available to students through this office. Small classes in basic writing techniques and in reading skills are established each semester. Group tutorials are available in the core courses such as mathematics, languages and natural sciences. Students and faculty members should contact the Dean's Office for further information on both types of programs.

All freshmen are advised by freshman advisers in their colleges; upperclassmen are advised by faculty members in their major departments.

Information on Graduate study, educational opportunities at other U.S. universities and in foreign countries may be obtained at the Central Advising Office. Specific information and counseling for foreign students at UMass-Boston is available at the Central Advising Office.

Vocational Counseling and Placement

The services of the Vocational Counseling and Placement Office of the University are available to all registered students and alumni.

The principal services provided by this office are:

Vocational counseling—individual and group
Off-campus part-time employment
Full-time graduate placement
Occupational and career information library
Assistance in preparing for job interviews
Fall and spring career seminars
Preparation of résumés and references

All students, regardless of year in school, are encouraged to register with the Vocational Counseling and Placement Office and to share with members of the staff emerging concerns and questions relevant to their future plans.

Academic Regulations

Grades shall be reported according to the following letter system. No other interpretation of this letter system shall be authorized.

A — Excellent
B — Good
C — Fair
D — Passing
F — Failure
Inc — Incomplete
P — Passing (pass/fail option)

The grade of Incomplete shall be reported only when a portion of the assigned or required class work, or the final examination, has not been completed because of the student's serious illness, extreme personal circumstances, or for scholarly reasons at the request of the instructor. If the student's record is such that he would fail the course regardless of the result of the missing work, he shall fail. A student can obtain credit for an Incomplete only by finishing the work of the course within the first two weeks of the following semester. The grade of Incomplete is converted to a failure if the course requirements have not been satisfied by that time. Exceptions to the two-week deadline may be requested from the appropriate agency in cases of protracted illness, critical personal problems, or for scholarly reasons at the request of the instructor. The initiative for removal of the Incomplete grade rests with the student.

An Incomplete on a final grade report is not calculated in arriving at a temporary quality point average. When the Incomplete is later converted to a grade, the quality points are changed and the student is notified.

Once a grade is submitted, it cannot be changed except on approval of the Department Chairman.

PASS/FAIL OPTION

A student may elect one course each semester to a maximum of eight on a pass/fail basis provided he presents a P/F Option card to the Registrar's Office

at the mid-term. The grade of pass will be included in the graduation credits but not in the quality points or cumulative average. A P/F once submitted, cannot be withdrawn or changed to a grade. A student must be carrying 3 courses or 12 or more credits during the semester in which he elects the P/F.

QUALITY POINTS

Quality points are assigned to course grades as follows: A, 4; B, 3; C, 2; D, 1; F, 0. The quality points for each grade are multiplied by the number of credits for the course, and the totals for all courses are added to arrive at the number of cumulative quality points. The number of cumulative quality points is divided by the number of cumulative credits carried to arrive at the cumulative quality point average. A P is not averaged in the cumulative average.

RETENTION AND GOOD STANDING

Cumulative Index Required For Retention

Semester	*Cumulative Average Retention*
1	0.0
2	1.3
3	1.5
4	1.6
5	1.7
6	1.8
7	1.9
8	2.0

Note: Students who elect a five-year program are expected to maintain a 2.0 average for the last three semesters.

Academic Dismissal

A student whose cumulative average falls below the requirement for retention will be academically dismissed.

Scholastic Probation

A student will be placed on scholastic probation if his semester average is below 1.5 after any of the first three semesters or below 2.0 after any of the subsequent semesters.

Any student who is at the probation level shall be warned by a statement on the bottom of his copy of the grade report. This warning is to indicate that continued below-standard performance will result in failure to graduate or in academic dismissal.

Probation precludes membership in University and College governance bodies and committees, and also proscribes holding office in student organizations.

Probation Appeals

The Committee on Standards and Scholarship shall be charged with modifying, extending, or limiting the restrictions on a student during a period of scholastic probation, and determining the limit of its duration. The Committee shall report all such modifications to the University Assembly.

Readmitted Students

A readmitted student must attain the cumulative average required for the class to which he has been assigned at the time of readmission.

Transfer Students

The former cumulative average of a transfer student does not carry over to this University; he begins a new cumulative average upon admission. A transfer student is not dismissed after the first semester because of his cumulative average. However, for all subsequent semesters, the student must attain the cumulative average necessary for the class to which he was assigned.

Failed Courses

A failed course in a subject required for the degree must be repeated. If the failed course is not required, a substitution may be made upon the approval of the student's adviser. If the original failed course is repeated and passed, it remains on the student's record but will not be computed in the cumulative average.

A course once passed may not be repeated for a higher grade.

COURSE CHANGES—FIRST TEN ACADEMIC DAYS

1. Add Period — the student is allowed 10 academic days from the beginning of the semester to add, drop, or substitute a course WITHOUT NOTATION on his record.
2. Add/Drop Procedure — If a student has good reason to drop one course and add another, he may accomplish this in the following order:
   a. Secure an Add/Drop card from the Registrar's Office.
   b. Have the instructor of the course to be added certify that space is available in the desired section.
   c. Secure release from the instructor of the course to be dropped.
   d. Secure the Adviser's signature.
   e. Submit the completed Add/Drop card to the Registrar's Office.
3. Withdrawal — If the student simply wishes to withdraw from a course (within the first ten days) he may do so with his instructor's approval, using the following procedure:
   a. Obtain an Add/Drop card from the Registrar's Office.
   b. Obtain the necessary signatures and return the card to the Registrar's Office.

COURSE CHANGES — AFTER 10TH ACADEMIC DAY

1. From the 11th academic day to a specified date before the beginning of the examination period, a student may drop a course subject to minimum load regulations (3 courses or 12 credit hours for matriculated student). The notation of withdrawal on the student's record will be the grade of "W" which is not computed in the grade point average.
2. Procedure — (11th day to a specified date before examination period). To be properly withdrawn from a course the student must accomplish the following:
   a. Secure a Course Withdrawal card.
   b. Schedule a conference with his adviser and the instructor of the course and secure their signatures.

WITHDRAWAL FROM THE UNIVERSITY

1. If a student withdraws prior to a specified date before the first final examination, a "W" for each course will be recorded in his permanent record file. The courses in which he was enrolled will be recorded along with his withdrawal date.

   The effective date of withdrawal is that on which all proper forms are completed, signed, and returned to the Registrar.
2. Withdrawal Procedure — To withdraw from the University, the student must do the following:
   a. Consult with a member of the College Dean's Advising Staff, who will provide and sign the necessary form.
   b. Receive clearance from all departments of the University where he may have accrued charges: Library, Laboratories, Health Services, Treasurer's Office, Student Affairs Office, Bookstore. This will clear the student's records so that he may obtain appropriate refunds and/or transcripts.
   c. Return the form to the Registrar.
3. If any charges are outstanding, the student's permanent records will be "frozen" and no transcripts can be issued. Failure to complete a Withdrawal form will result in the recording of the grade of F in all courses at the conclusion of the semester.
4. Any student withdrawing during the fall semester after the *November 1 readmission deadline* will not be able to return for the spring semester.

CHANGE OF MAJOR

Any student who has stated a major and wishes to change it should consult first with a member of the College Dean's Advising Office staff. Upon approval of the change, the departments involved and the Registrar's Office will be notified, and the student will be assigned to a new adviser by the new department.

ATTENDANCE

Attendance at all scheduled classes is expected. No administrative control of attendance is exercised except as hereinafter provided. In cases of illness,

students are to explain their absences directly to their instructors. Grades of students who meet requirements of the instructor in making up work shall not be reduced for absence because of illness.

All absences due to illnesses should be reported to University Health Services. Although students are expected to deal directly with faculty members, the Health Services will verify dates of absences if requested by faculty members.

CONDUCT

A high standard of conduct, based on self-respect and consideration for the rights of others, is expected of all students. The disciplinary system of the University is based upon a published Code of Student Conduct, and is administered by a committee of faculty and students. Hearings are conducted so as to ensure due process and guarantee fair and impartial consideration. It should be understood that the University, acting through its Chancellor or any administrative officer designated by him, in emergency situations, distinctly reserves the right to suspend a student. A student so suspended by administrative action is entitled to a speedy consideration and disposition of his case by the University Committee on Student Discipline.

COURSE LOAD

The normal course load for Freshmen and Sophomores is four courses for 16 credit hours and for Juniors and Seniors, five courses for 15 credit hours. A student with a cumulative grade average of 3.0 or 3.5 in the previous semester, may take an extra course with the permission of his adviser.

A student majoring in a Science who must take laboratory courses of more than 4 credits may assume a load of 18 credits. This is intended especially for Juniors and Seniors who may find it necessary to take three 3-credit courses, a required 4-credit core curriculum course, and a 5-credit laboratory course (or a similar variation) in one semester.

Students may elect to plan a four-year (eight semester) or five-year (10 semester) program.

SUMMER COURSES OUTSIDE THE UNIVERSITY

In order to receive credit for summer course work outside the University, a student must receive prior authorization from the department concerned for each course to be taken. A Course Authorization form can be obtained from the Registrar's Office; the original to be returned to the Registrar, one copy to be retained by the Department, and one copy to be retained by the student. In general, a grade of B or higher is required for transfer credit. Permission to accept a grade lower than B may be obtained only from the Department to which the credit is being transferred. It is the student's responsibility to see that a transcript is sent to the Registrar upon completion of the program.

DEPARTMENTAL HONORS PROGRAMS

To graduate with Departmental Honors, a student must have either: (1) successfully completed some special honors work, such as a thesis or seminar; or (2) gained a 3.5 grade average in his major field, the awarding of honors not to be automatic, however, but to depend on the recommendation of an honors committee in his department.

The student must, in addition, have a 3.0 overall grade average. (Note that this governs *graduation* with honors, not admission to honors work, which is left to the discretion of the departmental honors committee.)

Not more than 6 credits may be received for special honors work.

If a student entered in an honors course completes the work satisfactorily but not on an honors level, he shall receive credit for the course toward graduation.

GRADUATION REQUIREMENTS

In order to graduate, a student must acquire a total of 124 credits. Students who qualify for advanced placement in languages or other 4-credit freshman-sophomore courses may graduate with as few as 120 credits. All students must accumulate a minimum of 45 Residency credits at the University.

A student must meet the requirements of a major department.

A student must complete either the *A.* or the *B.* pattern of courses below.

A. Core Requirement

1. One year of training in writing to be taken in the Freshman year.
2. Courses in foreign language as follows: Students who demonstrate proficiency in a foreign language at the intermediate level shall be exempt from a language requirement. Students who meet the entrance requirements regarding language or who otherwise demonstrate elementary proficiency in a foreign language shall take one year of a foreign language at the intermediate level *or* one year of a foreign literature in translation.
3. Three terms of course work in the social sciences, of which at least one must be taken in History and one in another discipline.
4. Three terms of course work in the natural sciences or in mathematics, of which at least two terms must be taken in the same discipline, and at least one in a natural science.

B. As an alternative to *A.* a student may choose to design his or her own core curriculum, in consultation with a faculty adviser or with an advising committee. Questions concerning this program should be referred to the College Dean's Office.

FINAL EXAMINATIONS

When the examination schedule is published, any student who finds himself scheduled for two examinations at the same time or for three examinations in one day should report the situation directly to the Registrar's Office.

PRIZES AND AWARDS

Brian Rattigan Prize

A cash award made annually for outstanding creative achievement. Established by his friends and classmates in memory of Brian Rattigan, a poet and member of the first graduating class of the University of Massachusetts at Boston, who drowned during the summer before his Senior year. Selection of the recipient is made by a special committee of faculty and students.

John W. Ryan 1966 Faculty Convocation Award

Awarded each year at the Honors Reception to the Junior who attained the highest average at the completion of the second year at the University. Established in 1966 partly in order to commemorate the convocation of the faculty and partly in order to recognize academic excellence in the student body.

Luis Emilio Soto Prize

Awarded each Spring at the Commencement Exercises to the Senior majoring in Spanish who best reflects the humanistic qualities and the spirit of Professor Soto.

Inaugurated in May 1970, and named for Professor Luis Emilio Soto (1902–1970), who, in his short stay at the University of Massachusetts at Boston, wholly won the hearts of his students and colleagues by his devotion to them and to their work.

The Colleges of the University

Colleges I and II are based on the traditional liberal arts and constitute a major part of the University of Massachusetts at Boston. Each college provides students with both traditional and experimental ways of studying the subjects and disciplines which are important to the human experience. All Colleges encourage their students to acquire those skills and interests which will make learning a life-long process, and each college is developing programs and emphases which distinguishes it from the other colleges of the University.

The College of Public and Community Service, a new college also based on the traditional liberal arts, is planning a curriculum which combines the critical spirit of a liberal arts college with the engaged activity that must characterize a college addressing urban problems.

COLLEGE I

College I is committed to a pattern of education that begins in the student's exploration of a range of different ways of thinking and knowing. Students take a variety of courses combining experience of the matter of the course with training in the basic skills appropriate to academic inquiry concerning that subject. In addition, College I is framing a series of new interdepartmental freshman courses designed to serve as introductions to college study. These courses are team-taught by members of different departments, they carry double the academic credit of normal courses, and they are focused on topics of broad significance and basic human concern. Two such courses offered in the Fall of 1973 are courses in "Law and Justice" and in "The Phenomenon of Language." Further courses are being planned.

The College also provides an "Option B" program under which students may present for approval by a faculty adviser a program of courses which the student wishes to adopt in place of the college's core curriculum. The college also is planning to implement a program under which a small group of freshmen, with the help of a faculty team, design and carry out their own program of study for the academic year.

The purpose of the exploratory phase of education in College I is to allow the student to acquaint himself with the complexity and range of academic inquiry and discourse, to establish the intellectual basis on which he can organize and correct his educational experience, and to develop some of the basic and more specialized skills helpful to the pursuit of his educational goals. This exploratory process is followed by a more concentrated major program through which the student seeks to develop further understanding and competence in the nature and use of at least one intellectual discipline to the degree of relative comprehensiveness and self-initiative or intellectual independence. College I provides majors in seventeen academic departments and, in addition, is planning several interdisciplinary concentrations within the

next several years. Students interested in majoring in Italian, Music and Philosophy should note that these majors are offered only in College I.

The purpose of education in College I is not to train students for specific vocational possibilities but to encourage and help them to develop an intellectual independence and self-reliance based on experience in a range of intellectual styles and methods and on concentration in one of these academic areas. Thus, it is directed at the development of intellectual flexibility and of resourcefulness in the solution of intellectual problems, and it rests upon a tension between its requirements of academic breadth and of a departmental major and the important role of the individual student as the central agent of his own education.

COLLEGE II

College II is developing programs within a framework of traditional liberal arts involving the disciplines of the humanities, the sciences, and the social sciences, which allow students to combine the benefits of departmental specialization with those of interdisciplinary study. By exploring new modes of inquiry within and outside the historical traditions of Western culture, College II offers options of synthesis and innovation permitting discovery of new ways to improve the quality of our lives, both as individuals and as a community.

College II already has established significant areas of academic interest not available in other colleges of the University. Such distinctive programs of study, however, complement rather than replace the more conventional major programs offered by each of the academic departments in the college, thereby providing a broader conjunction of opportunities for students.

The Urban Studies Concentration provides opportunities for the investigation of urban issues and problems from the perspective of various disciplines—sociology, history, economics, and art. An interdisciplinary study of Western and non-Western religions, with courses in the humanities and social sciences, is offered by the Religious Studies Program. Students enrolled in the Individual Major Program design their own pattern of course selections, in consultation with faculty advisers, drawing upon the resources of two or more academic departments in the College. And, in addition to such interdisciplinary programs, College II houses the only programs in the Visual Arts, Theatre Arts, Classics, and Russian available at the University.

College II has already developed a number of distinctive social traditions as well. The Student Activities Committee promotes extracurricular life in the College by sponsoring a series of lectures, films, and seminars on student-oriented subjects, guest speakers, an annual College II boat cruise of Boston Harbor, as well as musical events, art exhibitions, departmental academic and social receptions, and various formal and informal conferences. And the College II Constitution provides for a student-faculty Senate responsible for establishing and maintaining the means and standards through which students may earn the Bachelor of Arts degree in College II, and for coordinating Col-

lege efforts within the context of general goals relevant to the University-at-large.

COLLEGE OF PUBLIC AND COMMUNITY SERVICE

In September of 1973, The College of Public and Community Service, the third college at UMass-Boston, opened with an initial enrollment of 300 students. Enrollment for the second year will increase substantially. Advocating innovative approaches to higher education, the College has been guided by six general principles throughout its planning and development. Briefly stated, they are:

- To combine a basic liberal arts education with training in areas of specific relevance to public and community service broadly defined.
- To organize the undergraduate college around problem areas rather than academic disciplines.
- To use as faculty those persons who have been trained in the academic community as well as persons of demonstrated competence holding positions of responsibility in public and community agencies who may or may not have an academic degree.
- To broaden the student body to include those who are currently employed in public agencies, persons who have been out of high school for some period of time and want to return to college, and those persons who have not completed high school but are prepared for college.
- To emphasize the use of internships, supervisors, field work and projects in community based activities as a regular part of the curriculum.
- To measure student progress through the frequent certification of skills and knowledge, rather than through the accumulation of course credits. This "certificate system" will allow for flexibility, high curricular standards, and the certification of skills acquired through work experience.

The curriculum founded on the liberal arts and organized around this "certificate system," will focus on skills and knowledge and will be of particular relevance to students preparing to enter a community or public service profession. The curriculum will describe the skills and knowledge appropriate to attain a degree, but it does not prescribe narrow paths through which these competencies may be attained. These competencies are organized into a number of broad categories:

1. Essential Skills—to insure that students acquire the basic skills necessary for effective communication, comprehension, and analysis.
2. General Skills—to develop the student's skill to approach problems through the interpretative techniques of the liberal arts, as well as to apply skills in interpersonal relations, group processes, and organizational participation. This portion of the curriculum will encompass several broad themes: the individual and society, the intercultural

dimensions of urban life, and the management and transformation of institutions.

3. Professional Skills—to equip students with the professional skills necessary to enter into a public or community service career or to engage in community advocacy in public service careers. In the first year the professional areas in which we will have programs are: human growth and development, housing and urban development, and legal services. A number of additional professional areas are proposed for future years, including environmental services, communications, transportation and allied health (excluding nursing).
4. Independent Interest—to encourage students to master some body of knowledge unrelated to their vocational objectives.
5. Problem Solving Skills—to allow students to apply their skills and knowledge to real, complex problems.

Special Programs

Afro-American Studies Concentration

This special program, derived from the University's commitment to offer courses in both Western and non-Western studies, is specifically designed for students interested in the historical experience, cultural accomplishments, and significant presence of the Black man in Africa and the New World. Successful completion of the Concentration is formally acknowledged on students' official records.

Students must major in a department and are trained in its discipline while electing courses which emphasize Afro-American subject matter. Faculty advisers, and members of the Afro-American Studies Concentration Committee, assist students in choosing these courses.

Option A:

A minimum of six courses from the Approved List. At least three of these courses must be taken outside the major department.

Option B:

Honors Program. A Junior/Senior year honors program for highly qualified students who present to the Afro-American Studies Concentration Committee a satisfactory proposal for in-depth study of an appropriate subject or problem. Requires two semesters of an interdisciplinary Junior seminar, the election of additional courses as appropriate and the writing of an honors thesis during the Senior year which is acceptable to the Committee.

Course Offerings

AFRO-AMERICAN STUDIES HONORS SEMINAR

An interdisciplinary seminar for students admitted to Option B (Honors), and to a limited number of other highly qualified students participating in the Option A program.

Prerequisite: 3.0 overall averages and permission of the Afro-American Studies Concentration Committee.

AFRO-AMERICAN STUDIES SENIOR HONORS THESIS

Study in depth of a topic chosen by the student in consultation with an honors adviser, and a paper written with the approval and under the direction of an honors adviser, normally related to work done in the Honors Seminar. Honors awarded on the basis of performance in the Honors Seminar, evaluation of the paper by the Afro-American Studies Concentration Committee, and 3.0 overall average.

Prerequisite: Afro-American Studies, and permission of the Afro-American Studies Concentration Committee.

Additional Approved Course Offerings

Students may petition the Afro-American Studies Concentration Committee for permission to include other relevant courses in their Concentration program. In addition a list of Inter-Institutional Black Studies courses is available from the Registrar. These courses will also be credited toward the Concentration.

Introduction to Anthropology
People and Cultures of Africa
The Art of Africa
Urban Problems
Economic Problems and Prospects of Black America
Black Presence in American Literature
Black Literature in America
Selected Topics in English
The Black Soul and the Theatre
Black French Literature
Introduction to African Civilization I, II
Problems in African Civilization
The Age of Jackson and Lincoln
Civil War and Reconstruction
Black History in America
History of Africa
Seminar in American History
African Literature
Jazz

Non-Jazz Black Music in America
Afro-American Experience
Metropolitan Politics
Urban Problems
Problems in African Civilization
Politics of Africa
Urban Community
Social Change and Modernization
Racial and Ethnic Relations

Institute for Learning and Teaching

The Institute for Learning and Teaching, established by the University Senate in April, 1971, provides direct, on-site educational services to experienced teachers and others who work with children in the Boston metropolitan area. In addition, it offers in conjunction with academic departments selected programs for undergraduates who are contemplating careers in child-serving professions, and encourages cooperation among Boston area institutions concerned with teacher training.

In cooperation with the Boston School Department, the Institute is helping prepare teachers who have been reassigned to newly-constructed open-space schools. A second program focuses on training for parochial school teachers in several schools in East Boston. A third is directed at helping the staff of the Bilingual Education Department in Boston address the educational problems of the Spanish-speaking. A fourth focuses on working with high school staffs regarding the underlying problems of secondary school unrest.

The Institute also sponsors a number of short-term programs through its Alternative Training Service for professionals who work with children in the metropolitan area.

The Institute is willing and eager to work with interested academic departments and individuals on programs concerning questions of learning and teaching at the University.

In these projects, an Institute staff member develops a close working relationship with a designated group of professionals; and as the members of the group identify their training needs, appropriate resources are mustered to meet these needs. These resources—adjunct professors, master teachers, and curriculum materials—are the faculty of the Institute. It has no standing faculty per se.

On the undergraduate level the Institute has joined with the Sociology Department to offer a concentration of study and field work called "Sociology and Urban Social Service." (A more detailed description of this program appears under the heading "Urban Social Service" in this section.) By September, 1973, the Institute will have expanded its undergraduate offerings to include other cooperative programs.

The Institute encourages those interested in learning more about its activities to visit its offices.

Pre-Medical Program

A student interested in a medical, dental or veterinary career may select any of the majors offered at the University of Massachusetts at Boston on the basis of interest, ability and suitability.

Students who demonstrate interest in and ability for a medical career should register with the Pre-Medical Program in the Advising office. A faculty Pre-Medical Committee acts as adviser to the program and updates the information available through the Advising Office. The Committee also interviews applicants to dental, medical and veterinary schools, and oversees the evaluation of each applicant's record. Students should, as early as possible, seek out information on graduate admission requirements from libraries and the Advising Office.

Religious Studies Concentration

Designed for students who wish to pursue an interdisciplinary study of religion,

this concentration is connected with a departmental major, the training in which will provide the student with strength in one particular discipline. The balance of the concentration will be elected from courses in other departments and disciplines.

The Interdepartmental Committee on the Study of Religion assists and advises students interested in designing a program of study in the field of religion. A student in his fourth, fifth or sixth semester whose interests lie in this field is invited to discuss his concerns with any member of the Interdepartmental Committee with a view toward designing a coherent and feasible program of study. The student and his faculty adviser will submit this program to the Interdepartmental Committee for review and approval. Successful completion of the concentration is formally acknowledged on students' official records.

Course Offerings

PATTERNS OF RELIGIOUS MEANING AND ACTION

An introductory and survey course in the study of religion. Comparative and interdisciplinary approach. Beginning with primitive and archaic religion (including myth and ritual), the course will concentrate on two or three of the world-historical religions (e.g., Islamism, Buddhism, Judaism, Christianity—and including mysticism and millenarianism) and on contemporary religious phenomena.

HINDU RELIGION

The patterns of religious meaning and action in Indian Hindu culture as expressed in myth, literature and art. Equal attention to traditional material such as the Upanishads and the Bhagavad Gita, and to recent figures and movements such as Tagore and Gandhi.

BUDDHIST RELIGION

The various forms of Buddhism, its background in archaic Indian religion, the different types of Buddhist teaching; mysticism and practices in India, Ceylon, S.E. Asia, China, and Japan (i.e. Theravada, Mahayan, Madhyamika, Yogacharin, Zen and Pure Land Buddhism).

INTRODUCTION TO BIBLICAL LITERATURE: OLD TESTAMENT

Reading of representative texts for the Old Testament and introduction of the characteristic problems in interpreting those texts.

INTRODUCTION TO BIBLICAL LITERATURE: NEW TESTAMENT

Reading of representative texts for the New Testament and introduction to the characteristic problems in interpreting those texts.

VARIETIES OF MYSTICISM

Critical and comparative study of specific mystics and mystical movements from the Hindu, Muslim, Jewish, and Christian traditions.

Prerequisite: One religious studies course or permission of instructor.

COURSES IN, OR CLOSELY RELATED TO, THE STUDY OF RELIGION

The Medieval Period
Medieval Poetry
English Poetry of the Early 17th Century
Milton
Blake
Catholic Literature from 1800-1930
Early Middle Ages
Later Middle Ages
Age of the Renaissance and Reformation
Jewish History: Antiquity to the Late Middle Ages
Jewish History: From the Spanish Expulsion to Modern Statehood
The Middle East, 622-1517
Problems in African Civilization
Mythology and Literature
Visionary and Prophetic Modes in Literature
Dante and the Duecento
Ancient and Medieval Philosophy
Philosophy of Religion
Existentialism
Plato
Sociology of Religion
Sociology of Social Movements

Women's Studies Concentration

A Women's Studies Concentration is a new program. A Concentration is in addition to a regular major; it will be recorded on student's permanent record

and transcript. Many courses will meet the requirements not only of the Concentration but of majors and of some distribution requirements: Classics, French and German help meet the language requirement; anthropology, economics and history meet the social science requirements and count toward majors in their departments; the English courses and Humanities count toward the English major. For further information about the courses call the instructors. Men are welcome—most classes are 1/4 to 1/3 men.

Courses To Be Offered in September of 1973 Include:

Women in Greek and Roman Literature
Women's Work
The Feminine Presence in French Literature
Men and Women in German Culture
Women in Industrialist Capitalist Society
Images of Women in Literature

Sociology and Urban Social Service

The Sociology and Urban Social Service Concentration is designed for dedicated students who wish, beginning in their freshman year, to major in sociology as preparation for a child-serving career in an urban setting. Students in this program take specially created sections of the sociology course offerings which coordinate their course work with field placement activity. Such students are expected to intern in a variety of social service agencies such as schools, hospitals, child guidance centers, recreational centers and other community agencies.

Entering freshmen interested in applying for the social service concentration should write to the Chairman of the Sociology Department.

Teacher Certification Program

Students seeking careers in education may avail themselves of the services of the Teacher Certification Program. The staff provides information and counseling to all students interested in preparing to teach. In addition, the program enables highly qualified students to satisfy Massachusetts requirements for certification. Since UMass-Boston offers no major in Education, a teaching candidate pursues the University's normal degree and major sequences. At the same time, by judicious choice of electives from among those offered by several departments, he may acquire credits in courses approved for certification. The program culminates in the senior year when, under the direction of the faculty of his major department, the student enters practice teaching and participates concurrently in a curriculum-and-methods seminar.

Requirements for Certification

The Commonwealth of Massachusetts issues teaching certificates to American citizens who hold the bachelor's degree and who comply with certain additional requirements. Briefly summarized, those requirements are, for elementary teaching, 18 credits in approved courses; for secondary teaching, 12 credits in approved courses, plus concentration in a subject taught in the secondary school. Approved courses must include at least two of the following four areas: Psychology of Education, Philosophy of Education, Curriculum, Methods of Instruction. Supervised teaching experience is also necessary for both the elementary and secondary certificate. Students admitted to the senior year program (see below) automatically include "Methods of Instruction" in the Practice Teaching semester and receive 9 approved education credits toward Massachusetts certification. Students admitted to the Elementary Education Program also take Issues in Elementary School Curriculum for which they receive 3 credits. Students also elect appropriate courses in the other three subject areas.

Admission to the Teacher Certification Program

With the exception of the senior curricu-

lum-and-methods seminar and concurrent practice teaching, all courses leading to certification are open to every student. Only a limited number of students can be accepted for the senior year program. Admission to the program is granted by the Teacher Certification Program Committee after a review of all applications. Admission is based on departmental approval, evaluation of academic performance and recommendation of the Coordinator of the Teacher Certification Program.

Application Procedure

Because preparation for teaching makes demands beyond those ordinarily required to earn a degree, the prospective candidate must begin to plan early. He should register with the Teacher Certification Program before the end of his sophomore year, and should seek assistance in planning his future program from the TCP Coordinator and from a member of his major department. He may want to consider attending at least one Summer Session in order to relieve the pressures of the senior year, when practice teaching will claim a large share of his time and energy.

Those who wish to enroll in the curriculum-and-methods/practice teaching sequence must apply for admission early in January of the junior year. Application forms and information are available in the Teacher Certification Program Office.

Courses Approved for Certification

The following courses may be counted toward fulfillment of Massachusetts certification requirements. *Starred courses are especially recommended.

For Elementary or Secondary Certification:

*Philosophy of Education
*Educational Psychology
*Developmental Psychology
*Theories and Fundamental Issues of Learning
*Sociology of Education

For Secondary English Certification only:

Advanced Composition
Principles and Methods of Literary Criticism
History of the English Language

For Secondary Social Studies Certification only:

Seminar in European History
Seminar in American History
American Social History from Civil War to Present

The electives below are open only to seniors who have completed two or more certification courses and who have been admitted to the Teacher Certification Program. All include full days of practice teaching, five days a week, for a period of 10 weeks, under the supervision of experienced teachers and University faculty. Because practice teaching is both time consuming and physically demanding, students are advised to carry no more than one additional course during that semester. Elementary student teachers may take no other courses during the full-time practice teaching semester.

Each of the courses listed below is a 9-credit block. Each department determines the amount of credit (if any) granted toward the major. Students are advised to consult their major department concerning distribution of credit and scheduling of practice teaching.

Methods and Practice Teaching of Art in Secondary Schools
Methods and Practice Teaching of Biology in Secondary Schools
Methods and Practice Teaching of Latin in Secondary Schools
Methods and Practice Teaching of English in Secondary Schools
Methods and Practice Teaching of French in Secondary Schools
Methods and Practice Teaching of German in Secondary Schools
Methods and Practice Teaching of Italian in Secondary Schools
Methods and Practice Teaching of Mathematics in Secondary Schools
Methods and Practice Teaching of Music in Secondary Schools

Methods and Practice Teaching of Physical Science in Secondary Schools
Methods and Practice Teaching of Russian in Secondary Schools
Methods and Practice Teaching of Social Sciences in Secondary Schools
Methods and Practice Teaching of Spanish in Secondary Schools
Issues in Elementary School Curriculum
Methods and Practice Teaching in Elementary Education

Students in departments not listed should consult with their departments to determine if such courses are to be offered.

Urban Affairs Concentration

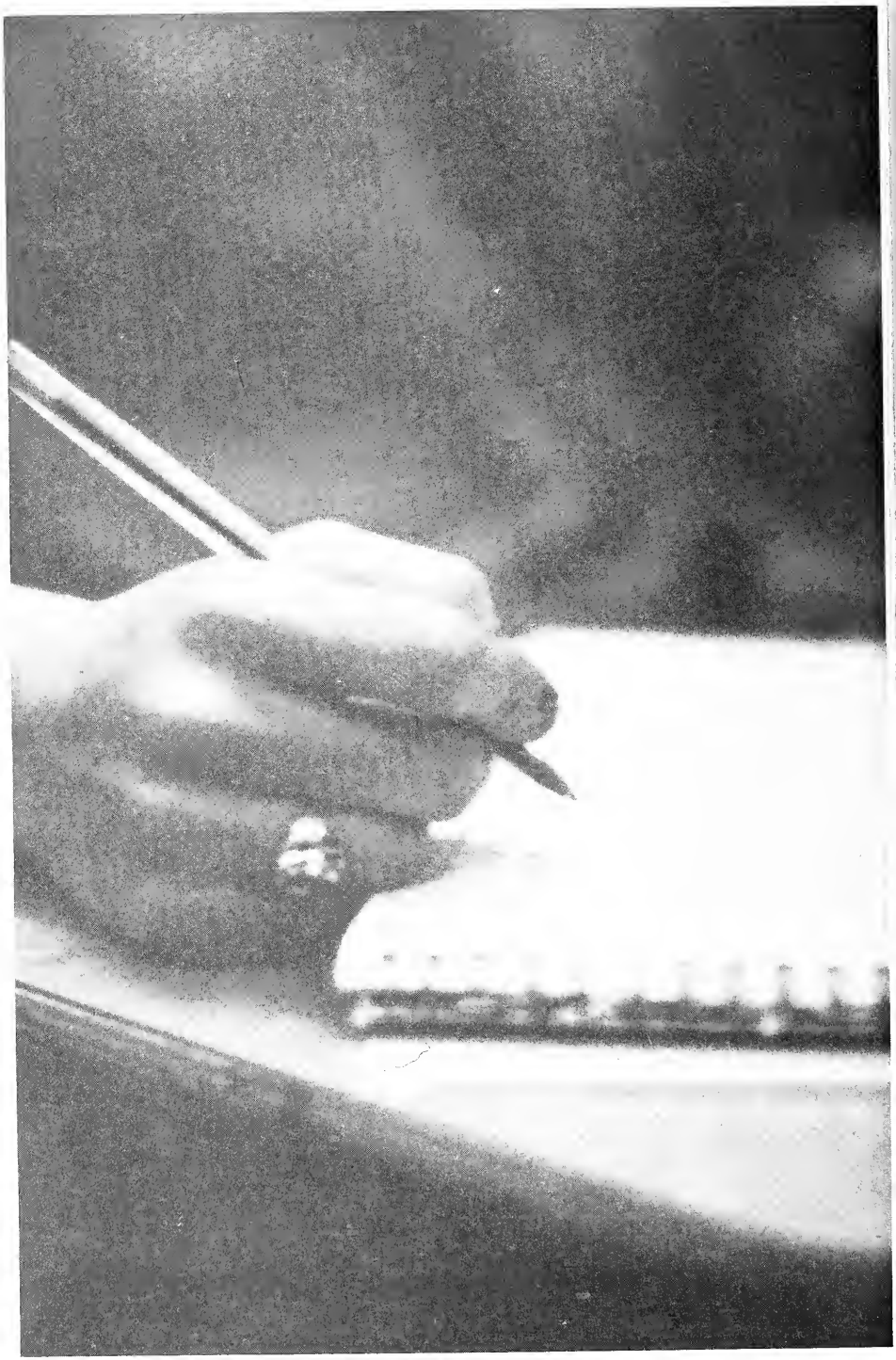
The Urban Affairs Concentration offers College II students an opportunity to investigate urban issues and problems from the point of view of several different disciplines. Understanding important issues such as how cities emerged and developed, how they are shaped by an array of forces, and the causes and consequences of urban problems necessarily require that we adapt a comprehensive approach. Therefore in addition to a major, a student who wishes to have a concentration in Urban Affairs takes certain courses in economics, history, politics, sociology, and psychology. More information on this concentration and a listing of the approved courses is available from any of the following faculty advisers for the concentration: Profs. Torto (Economics); Paul Gagnon (History); Diane Paul (Politics); Harry Brill (Sociology); Harry Finkelstein (Sociology).

University Year for Action

University Year for ACTION is a university-based, federally-funded program of public and community service.

A student volunteer spends three full semesters in the UYA program and earns a total of thirty credits. Nine of these credits are awarded for full-time field work in community service in the greater Boston area.

UYA volunteers meet together for two-and-one-half hours a week for an Urban Studies Seminar. Under the direction of UYA staff this seminar provides a general analytic framework for the volunteers' field work both through presentations by UYA staff and speakers knowledgeable in specific areas of urban economics, politics and community and public service, and through discussions by the volunteers of their own comparative field experiences. Three credits per semester are earned by each volunteer for an independent study project in a major discipline under the guidance of a UMB faculty member.



Course Listings

This is a major listing of the courses being offered in the Departments for the 1973-1974 Academic Year. Additional courses are in the process of approval and revisions are constantly in the process of evaluation. Descriptions of courses are available in the publication *Course Listings 1973–1974,* which are available through the Registrar's Office. Graduation requirements for majors are also listed in this publication.

ANTHROPOLOGY

Introduction to Anthropology
Archeological Method and Theory
Archeological Method and Theory Laboratory
Peasant Society
Urban Anthropology
Primate Evolution: The Study of Human Origins
Primate Behavior
Mesoamerican Prehistory and Ethnohistory
Old World Prehistory
New World Prehistory
Prehistoric Agriculture
Field Research in Anthropology
Elements of Social Organization
Comparative Ethnology
Psychological Anthropology
Medical Anthropology
Economic Anthropology
Cultural Ecology
Political Anthropology
The Anthropology of Religion
Peoples and Cultures of Meso-America
Indians of North America
Peoples and Cultures of Africa
Peoples and Cultures of Europe
Peoples and Cultures of the Middle East
Kinship and Social Structure
African Religions
Methods of Cross-Cultural Research
Anthropological Theory
Directed Study
Special Topics Seminar
Tutorials in Anthropology

ART

Introduction to the Language of Art
Introduction to the History of Art
Visual Fundamentals
Basic Design
Introductory Drawing
Introduction to Film
The Art of Greece
The Art of Rome
Introduction to Italian Renaissance Painting
Italian Renaissance Painting: The Golden Age
Italian Sculpture, 1300–1600
Northern Art from Pucelle to Duerer
Art of the Baroque
19th Century Art
20th Century Art
American Painting and Sculpture
Contemporary Art
Modern Architecture
Aspects of Buddhist Art
Far Eastern Painting
Chinese Painting
Indian Art and Its Influence

The Art of Africa
Origins and Development of Western Architecture
Value Judgments in Art
Visual Experiments
Three Dimensional Design
Workshop in Drawing
Workshop in Painting
Workshop in Film Making
Classical Painting
Mannerism in the Visual Arts, 1520–1600
Masters of Baroque Painting
Bernini, Borromini and Pietro DaCortona
Sources of 20th Century Painting
Modern Sculpture

ART

European Painting and Sculpture, 1925–1940
American and European Influences in American Art
Senior Workshop in Painting
The Classical Tradition in Western Art
Sculpture: Form and Meaning
Portraiture
French Art, 1500–1800
Special Problems
Seminar in Visual Studies
Methods and Practice Teaching of Art in Secondary Schools

BIOLOGY

General Biology I
General Biology II
Human Biology
Biology of Organisms
Biology of Organisms Lecture
Biology of Populations I
Biology of Populations II
Biology of Populations Lecture
Biology of Cells
Biology of Cells Lecture
Independent Study
Special Topics
Field Biology on Nantucket (Summer)
Advanced Field Biology on Nantucket (Summer)
Methods and Practice Teaching of Biology in Secondary Schools

CHEMISTRY

Chemical Science
Chemical Principles I
Chemical Principles II
Organic Chemistry
Organic Chemistry for Biology Majors
Chemical Problem Solving
Physical and Analytical Chemistry
Physical Chemistry, Structure
Inorganic Chemistry
Topics in Physical Chemistry
Organic Qualitative Analysis
Introductory Biochemistry
Topics in Organic Chemistry
Analytical Instrumentation
Advanced Laboratory in Chemistry
Senior Thesis in Chemistry
Related Course
  Physical Science Methods and Practice Teaching of Physical Science in Secondary Schools
Master's Degree Program
  Chemical Dynamics I
  Chemical Dynamics II
  Chemical Structure I
  Chemical Structure II

Chemical Synthesis I
Chemical Synthesis II
Master's Thesis
Seminar

CLASSICS

CLASSICS IN TRANSLATION

Greek and Roman Civilizations
Greek and Roman Epic Poetry
Greek and Roman Religion and Mythology
Greek and Roman Tragedy
Greek and Roman Comedy
Women in Greek and Roman Literature: Reflections of a Divided Society
Literary Criticism in Antiquity
Independent Study
Honors Thesis

GREEK

Elementary Greek
Beginning Modern Greek
Intermediate Modern Greek
Intermediate Greek
Advanced Greek Reading and Composition
Introduction to Greek Literature
Greek Literature: Attic Orators
Greek Literature: Greek Historians

LATIN

Elementary Latin
Intermediate Latin
Latin Composition
Latin Literature: Epic Poetry (Virgil)
Latin Literature: Ovid's Metamorphoses; Tacitus
Latin Literature: Horace and Readings in the Roman Theatre
Latin Literature: Lucretius and Cicero
Latin Literature: Roman Satire
Methods and Practice Teaching of Latin in Secondary Schools

ECONOMICS

Economic Literacy
Accounting Principles and Applications
Statistical Methods
Economics Theory I: Macroeconomics
Economic Theory II: Microeconomics
Urban Economics
Research in Urban Problems
The Economics of Transportation
Perspectives on Housing in the U.S.
International Economics
Economic Development
The African Economy
Asian Economic Development
Economic Problems and Prospects for Black America
Income Distribution
Economics of Social and Human Resources
The Economics of Education
Pollution and the Quality of Life
Comparative Economic Systems
Economic Interest Groups and the American Political Process
The Economics of Health Care
Marxist Analysis and Radical Critiques of Modern Economic Theory
Economics of Labor and Collective Bargaining
Women's Work

The Economics of the Public Sector: Problems in Public Finance
The Economics of State and Local Governments
The Economics of Money
Industrial Organization
Mathematical Economics
Econometrics
Private Markets and Political Power
The Multinational Corporation and the Less Developed Countries
Independent Studies
Seminar
Seminar on Environmental Control
Seminar on Monetary and Fiscal Policy
Honors Thesis

ENGLISH

Writing, Thinking, and Selected Readings
English Composition
English as a Second Language
Freshman English
Group I: Introductions to Literary Studies: Recommended for Sophomores
- Origins of the Modern Period
- Twentieth-Century Masterpieces
- Introduction to Shakespeare
- Practical Criticism
- Introduction to British Literature
- Introduction to Literature in America
- Forms of English Poetry to 1700
- Forms of English and American Poetry Since 1700
- Forms of English Prose Fiction
- Forms of American Prose
- Forms of English Drama to 1700
- Forms of English and American Drama Since 1700
- Black Literature in America

Group II: Literary Genres
- Medieval Poetry
- Renaissance Poetry
- Elizabethan and Stuart Drama
- English Poetry of the Early Seventeenth Century
- Seventeenth Century Prose
- Eighteenth Century Fiction
- Nineteenth Century English Prose Fiction
- Industrialism in 19th Century Literature
- Victorian Poetry
- Autobiography in America
- American Non-Fictional Prose
- Modern American Poetry
- Modern British Poetry
- Modern American Fiction
- Modern Drama
- Mid-Twentieth Century Drama
- Post World War II Comic Fiction
- Contemporary Women Poets
- Satire
- Narrative in the Novel and Film
- Black Women Writers

Group III: Literature in Its Cultural Context
- A Critical Decade In American Literature
- The American Hero
- The Medieval Period
- The Renaissance
- The Neo-Classical Period
- The Romantic Period
- The Victorian Age
- American Romanticism

The Rise of American Realism
The Modern Period
Colonial American Literature
Industrialism in 19th Century Literature

Group IV: Regional and Ethnic Literature
Early Celtic Literature in Translation
The Black Presence in American Literature
Irish Literature
Humanities 249 African Literature

Group V: Major Authors
Chaucer
Shakespeare's Plays: A Survey I
Shakespeare's Plays: A Survey II
Milton
Blake
Yeats
Henry James
Faulkner
Fitzgerald and Hemingway

Group VI: Language, Literary Criticism, and Other Topics
History of the English Language
History of Prose Style
Old English Language and Literature
The Adolescent in Literature
Principles and Methods of Literary Criticism
Selected Topics in English and American Literature
Related courses
Mythology and Literature
Visionary and Prophetic Modes in Literature
The Image of Women in Literature

Group VII: Writing
Creative Writing
Advanced Composition
Creative Writing Workshop

Group VIII: Specially Directed Study
Independent Study
Senior Seminars
Honors Work I
Honors Work II
English Course for Teacher Certification:
Methods and Practice Teaching of English in Secondary Schools

FRENCH

Elementary French
Basic Oral French
Intermediate French
Intensive French
Twentieth Century French Novel
Contemporary French Theatre
Political Trends in the Creative Arts in 20th Century France
French Existential Literature
Masterpieces of French Literature
The French Cinema
Nature and Structure of French Comedy
Politics in the Creative Arts in France from the Revolution to 1900
The Feminine Presence in French Literature
Translation and Stylistics
Textual Analysis
Phonetics and Diction
Survey of French Literature

Survey of French Conversation
Advanced French Conversation
The Great Poets of the Modern French Song
French Writers As Witnesses of Their Times
Politics in French Literature
The Nineteenth Century
Modern French Novel in Translation: 1900–1935
Modern French Novel in Translation: 1935 Until the Present
The Black Soul and The Theatre
French Historians and Their Writings on France
History of The French Language
French Literature in the Middle Ages
Advanced Translation
The Age of Rabelais
The Age of Montaigne
The Theatre of the Seventeenth Century
Philosophers, Moralists, Letter-Writers of the Seventeenth Century
Novelists and Poets of the Seventeenth Century
Eighteenth Century Theatre and Novels
Eighteenth Century Philosophers
French Romanticism: Preromanticism and Poets
French Romanticism: Theatre and Novels
Symbolist Poetry
Contemporary Poetry
The Novel from 1850–1900
Women Writers in French Literature
Twentieth Century Novel from 1900–1935
Twentieth Century Novel from 1935 to the Present
Twentieth Century Theatre to 1939
Twentieth Century Theatre from 1939 to the Present
Black French Literature
French Civilization
Independent Study
Seminar: The "Fantastic" and Supernatural In Nineteenth Century Literature
Seminar: Twentieth Century Avant-Garde Writers
Seminar: Existentialism
Seminar: Catholic Literature From 1800 to 1930
Seminar: The Form of The Novel From the Seventeenth Century to the Present
Seminar: The Prophets of The Apocalypse
Seminar: The Act of Writing, Theory and Practice
Seminar on a Major French Author
French Seminar: Fact and Fiction in the French Realist Novel
Honors Thesis in French
Method and Practice Teaching of French in Secondary Schools
Humanities: Proust, Joyce, and Mann

GERMAN

Elementary German
Elementary German for Reading and Culture
Intensive German
Intermediate German for Reading I & II
Audio-Lingual Intermediate German
Accelerated Intermediate German

Writing Workshop
German Theatre
German Civilization from Luther to Goethe
German Civilization from Romanticism to WWI
Goethe and His Age
Faust: Origin, Legend and The Literary Tradition
Aspects of Modern German Literature
The Crisis of Moral Relativism in Modern German Literature
Nietzsche and the German Arts
Germany In the 20th Century: Weimar and Nazi Culture
Brecht and the Modern Theater
Hesse, Mann and the Romantic Imagination
East Versus West in Contemporary German Literature
Modern Austrian Literature
Protest and Revolt In German Literature
Images of Men and Women in German Literature
Composition and Conversation
Introduction to German Literature
Advanced Conversation and Composition
Goethe and Pre-Romanticism
German Romanticism
German Drama from Lessing to the Present
The German Novelle
German Lyric Poetry
Naturalism, Neo-Romanticism and Expressionism
German Literature After World War I
Brecht
German Post-War Prose From East and West
Independent Study
Lessing and His Time
Senior Honors Seminar in German
Methods and Practice Teaching of German in Secondary Schools

HISTORY

Elementary Historical Writing
Ideas and Morality in the West, 500 B.C. to 1700 A.D.

CIVILIZATIONS

World Civilizations I
World Civilizations II
Western Civilization
Modern World History I
Modern World History II
East Asian Civilization
Introduction to African Civilization I
Introduction to African Civilization II

MAJOR HISTORICAL FORCES

Science Technology and the Modern World
Revolutions in Modern History I
Revolutions in Modern History II
Problems In Modern European History, 1789 to the Present

ADVANCED HISTORY

Introduction To Classical Archeology
Greek History
Roman History
Early Middle Ages
Later Middle Ages

Age of the Renaissance and Reformation

Eighteenth Century Europe: Europe In The Age of Enlightenment

Europe In The Nineteenth Century I

Europe In The Nineteenth Century II

Europe In The Twentieth Century

Tudor-Stuart England

England In The Age Of Revolution

Early Modern France: Renaissance to Revolution

France: 1815 to the Present

Russian History

German History to 1815

German History Since 1815

The History of Italy: From the Renaissance to 1870

History of Italy, 1870 to Present

Irish History, 1688–1923

Spain and Portugal Since 1469

English History, 1485–1800

The Balkans Since 1750

Central Europe, 1815 to the Present

Jewish History: Antiquity to the Late Middle Ages

Jewish History: From the Spanish Expulsion to Modern Statehood

The Middle East, 622–1517

The Middle East, 1517 to the Present

Problems in African Civilization

History of East Africa

History of Modern Japan

History of Contemporary East Asia

Modern Vietnam

American History

American Colonial History: The Earliest Settlements to 1763

Age of the American Revolution, 1763–1789

The Age of Jackson and Lincoln

Civil War and Reconstruction History

The United States in the Twentieth Century, 1900–1937

The United States in the Twentieth Century, 1937–1969

Colonial Latin America

Latin America: Independence to the Present

Topics in American Religious History

Diplomatic History of Europe: 1815–1914

Diplomatic History of Europe: 1914 to the Present

Economic History of Western Europe to 1750

Economic History of Western Europe, 1750 to the Present

History of European Ideas I

History of European Ideas II

History of American Foreign Policy, 1763–1900

History of American Foreign Policy, The Twentieth Century

History of Boston

American Social History to the Civil War

American Social History from the Civil War to the Present

History of American Thought

The American University: Past and Present

Black History In America

History of Working People in America
Medieval Law
The Medieval Mind
The Social and Economic Transformation of Europe
Science and Technology In The Industrial Revolution In Britain
Artisans and Peasants in Early Modern Europe
The British Empire 1700–1900
Britain in the Twentieth Century
The French Revolution
Contemporary Currents of Protest In The Soviet Union
History of the Russian Intelligentsia: Eighteenth Century to the Present
The Russian Revolution–1917
History and the Social Sciences
Vienna–1900
Hitler: A Man and His Times
Marx and Freud: Studies in Modern Intellectual History
History of European Socialism
Women in Industrial Capitalist Society
History of Feminism
Hitler and Stalin: Comparative Dictatorships
Modernization, Nationalism, and Revolution in the Middle East I
Modernization, Nationalism, and Revolution in the Middle East II
History of Africa from 632 to 1870
History of Africa from 1870 to the Present
Special Problems
Seminar in European History
Seminar in American History
Seminar in Latin American History

HUMANITIES

Masterpieces of Western Literature
Readings in European Fiction
African Literature
Romanticism in Its European Context
Visionary and Prophetic Modes in Literature
The Image of Women in Literature
Arts of Love in Medieval Literature

INTERDISCIPLINARY

Science for Survival

ITALIAN

Elementary Italian
Intermediate Italian
The Contemporary Italian Novel
The Theater of Italy
Masterpieces of Italian Literature
Political Thought in Italian Literature
Dante's Comedy
Italian Composition and Conversation
Literary Theories and Bibliography
Introduction to Italian Culture Through Literature
Dante and the Duecento
Lectura Dantis
Petraca and Boccaccio
The Age of Humanism in Italy
The Italian Renaissance
The Renaissance Epic
Italian Literature Of the 17th and 18th Centuries
Neo-Classicism and Romanticism
The Modern Novel
The Modern Italian Novel
Modern Italian Poetry
Reading and Research

Letteratura Dialettale Italiana
Honors Thesis in Italian
Method and Practice Teaching of Italian in Secondary Schools

MATHEMATICS

Liberal Arts Mathematics
Introduction to Computer Concepts
Basic Math and College Algebra
Liberal Arts Math II
Elementary Probability Theory
Elementary Statistics
College Algebra and Trigonometry
Survey of Calculus
Introduction to Mathematical Computer Programming
Calculus I
Calculus II
Analytic Geometry and Determinants
Unified Calculus I and II
History of Math I
History of Math II
Differential Equations and Allied Topics
Fundamentals of Mathematics
Linear Algebra I
Linear Algebra II
Applied Mathematics Analysis I
Applied Mathematics Analysis II
Advanced Calculus I
Advanced Calculus II
Abstract Algebra I
Abstract Algebra II
Numerical Analysis
Theory of Computation
Probability and Statistics I
Probability and Statistics II
An Introduction to Real Analysis
An Introduction to Complex Analysis
Theory of Numbers
Topics in Geometry
Differential Geometry
Mathematical Logic I
Mathematical Logic II
Topology
Reading In Mathematics
Methods and Practice Teaching of Mathematics in Secondary Schools

Master's Degree Program

Introduction to Modern Algebra
Theory Of Functions of a Complex Variable
Topology I
Topology II
Differentiable Manifolds I and II
Stochastic Processes I
Stochastic Processes II
Partial Differential Equations I
Partial Differential Equations II

MUSIC

Chorus
Introduction To Music
First Year Theory
Ear Training and Sight Singing I
Elements of Music I
Introduction to Musical Research I
Second Year Theory and Composition
Ear Training and Sight Singing II
Elements of Music II
Development of Chamber Music
Italian Opera
19th Century American Music
20th Century American Music
History and Development of Jazz in America
The History of Non-Jazz Black Music

19th Century Music
Music in the 20th Century
Music of the Classical Period
The Musical Works of Beethoven
Orchestration I
Introductory Composition
Intermediate Composition
Music of the High Baroque
Orchestration II
Advanced Composition
Music in the Renaissance
Seminar in American Music
Methods and Practice Teaching of Music in Secondary Schools

PHILOSOPHY

Introduction to Philosophy
Projects on Contemporary Issues
Philosophy and Literature from the Enlightenment to the Present
Introduction to Logic
Philosophy of Education
Ancient Philosophy
Modern Philosophy
Contemporary Philosophy
History of Ethics
Philosophy of Society
Moral Relativity
Ethical Theory
Philosophy of Art
Philosophy of Religion
Existentialism
Philosophy of Mind
19th Century Russian Thought
Problems of Metaphysics
Materialist Theories of Mind
Social and Political Philosophy
Determinism Freedom and Social Theory
Equality: Sex and Class
Philosophy of Law
The Emotions: Affection, Compassion, and Love
Philosophy of History
Philosophy of Action
Empiricism
Major Currents of 19th Century Thought
Theory of Knowledge
Philosophy of Anthropology
Plato
Aristotle
The Critical Philosophy of Immanuel Kant
Philosophy and Psychoanalytic Psychology
Individual Independent Study
Group Independent Study
Internship in Philosophy

PHYSICAL SCIENCE

Methods and Practice Teaching of Physical Science in Secondary Schools

PHYSICS

College Physics
Fundamentals of Physics I
Fundamentals of Physics II
Introduction to Astronomy
Concepts of Modern Physics
Nuclear Energy
Introductory Physics Laboratory
Physics Laboratory
Introduction to Contemporary Physics
Physical Laboratory
Mechanics
Theory of Electricity and Magnetism I

Theory of Electricity and Magnetism II
Statistical Physics
Electronics
Basic Electronics with Lab
Selected Topics in Electronics
Intermediate Laboratory
Atomic Physics and Introduction to Quantum Mechanics
Nuclear and Particle Physics
Introduction to Solid State Physics
Readings In Physics
Advanced Laboratory
Research In Physics

POLITICS

Government and Politics of the United States
Political Ideas of the 20th Century
Utopianism
Comparative Politics
International Relations
The Afro-American Experience; The Politics of Protest
Strategy of Political Changes
Political Parties
The Legislative Process
Public Administration
American Constitutional Law and Theory
Civil Liberties in the United States
The Federal System
State and Local Politics
Metropolitan Politics
Problems of Urban Politics
Suburban Politics
The Politics of National Development
European Political Development
Government and Politics of Britain
Government and Politics of the Soviet Union
Government and Politics of India
Political Crises in South Asia
China in the Modern World
Government and Politics of Africa
Third World Experience in the West
World Politics and World Order
International Organizations
American Foreign Policy
Soviet Union Policy
Ancient and Medieval Political Thought
Modern Political Thought
Socialism in the Modern World
History of Chinese Political Thought
American Political Thought
Independent Study
Seminar
Special Problems in the Field of Politics
Special Problems

PSYCHOLOGY

General Introductory Psychology
Personality
Human Motives and Emotions
Cross Cultural Study of Personality
Psychopathology
Psychoanalysis and the Study of Man
Social Psychology
Environmental Psychology
Community Psychology
Psychology of Language
Developmental Psychology
Educational Psychology
Learning
Perception
Physiological Psychology

Comparative Psychology
Statistics
Psychological Testing
Experimental Psychology
History of Psychology
Death, Dying, and Lethal Behavior
Normality and Psychopathology in Childhood
Freud's Case Histories
Nature of Prejudice
Educational Segregation and Desegregation
Psychology of Human Aging
The Family and the Child: A Psychological View
Psychobiology of Development
Systems of Psychology
Thinking
Problems in Psychology
Advanced Developmental Psychology: Special Topics
Topics in Psychology: Psychology of Women
Topics in Psychology: Psychology and the Afro-American Experience
Topics in Psychology: Group Dynamics
Topics in Psychology: Social Psychology and Mental Health
Topics in Psychology: Attitude Surveys
Topics in Psychology: Psychology and Film
Topics in Psychology: Psychology of Adolescence
Advanced Seminar in Psychology: Social Psychology
Advanced Seminar in Psychology: Psychosomatics
Issues for Psychology
Advanced Seminar in Psychology
Senior Honors

RUSSIAN

Elementary Russian
Intermediate Russian
Introduction to Russian Literature
The Sound Patterns of Russian
Structure of the Russian Language
Russian Stylistics
Specialized Reading
19th Century Russian Poetry
Pushkin
20th Century Russian Poetry
Selected Readings in Russian Literature
Methods and Practice Teaching of Russian in Secondary Schools

RUSSIAN LITERATURE IN TRANSLATION

Dostoevsky
Tolstoy
Russian Literature in Translation
Russian Culture and Civilization
Bulgakov, Pasternak, and Solzhenitsyn
Chekhov
Soviet Literature
Russian Drama

ARMENIAN

Elementary Armenian

SOCIOLOGY

Introduction to Sociology
Human Service Organizations
The Urban Community
Asian and Asian-American Influence on America
Community Organizations

Politics and Sociology of Ecology
Social Statification
Elements of Sociological Theory
Family
Asian Institutions
Social Deviance and Control
Theory of Social Change
Collective Behavior
Society and the Individual
Communications and Opinion
Racial and Ethnic Relations
The Black Family
Sociology of the Future
Sociology of Education
Sociology of Religion
Political Sociology
Elements of Social Statistics
Methods of Sociological Research
Comparative Social Structures
Criminology
Population and Ecology
Social Psychology of Sex Roles: Men and Women in Society
Medical Sociology
Community Organization
Minorities and Housing
The Sociology and Psychology of Complex Organizations
Minority Role Behavior
Contemporary Sociological Theory
Field Work Methods
Nonexperimental Methods in Sociology
Juvenile Delinquency
Corrections
Practicum in Correction
Police in Society
Research Studies in the Sociology of Alcoholism
Sociology of Law
Social Psychiatry
Modernization
Conflict in Society
Sociology of Social Movements
Ideology and Social Control in Southern Africa and Latin America
Socialization
Directed Study in Sociology
Special Topics Seminar

SPANISH

Elementary Spanish
Intermediate Spanish
Audio-Lingual Intermediate Spanish
The Hispanic Character as Portrayed in Literature
Advanced Spanish Conversation
Advanced Spanish Composition
Spanish Composition
Introduction to Spanish Culture
Introduction to Spanish-American Culture
Hispanic Masterpieces in Translation
Modern Spanish-American Literature in Translation
Advanced Spanish Grammar
Language Arts
Literary Arts
Survey of Spanish Literature
Spanish Poetry from Its Origins to 1900
Poetry of the Golden Age
Golden Age Novel
Golden Age Theatre
Cervantes
Methods In Research
Women in Spanish Literature
Spanish Romanticism

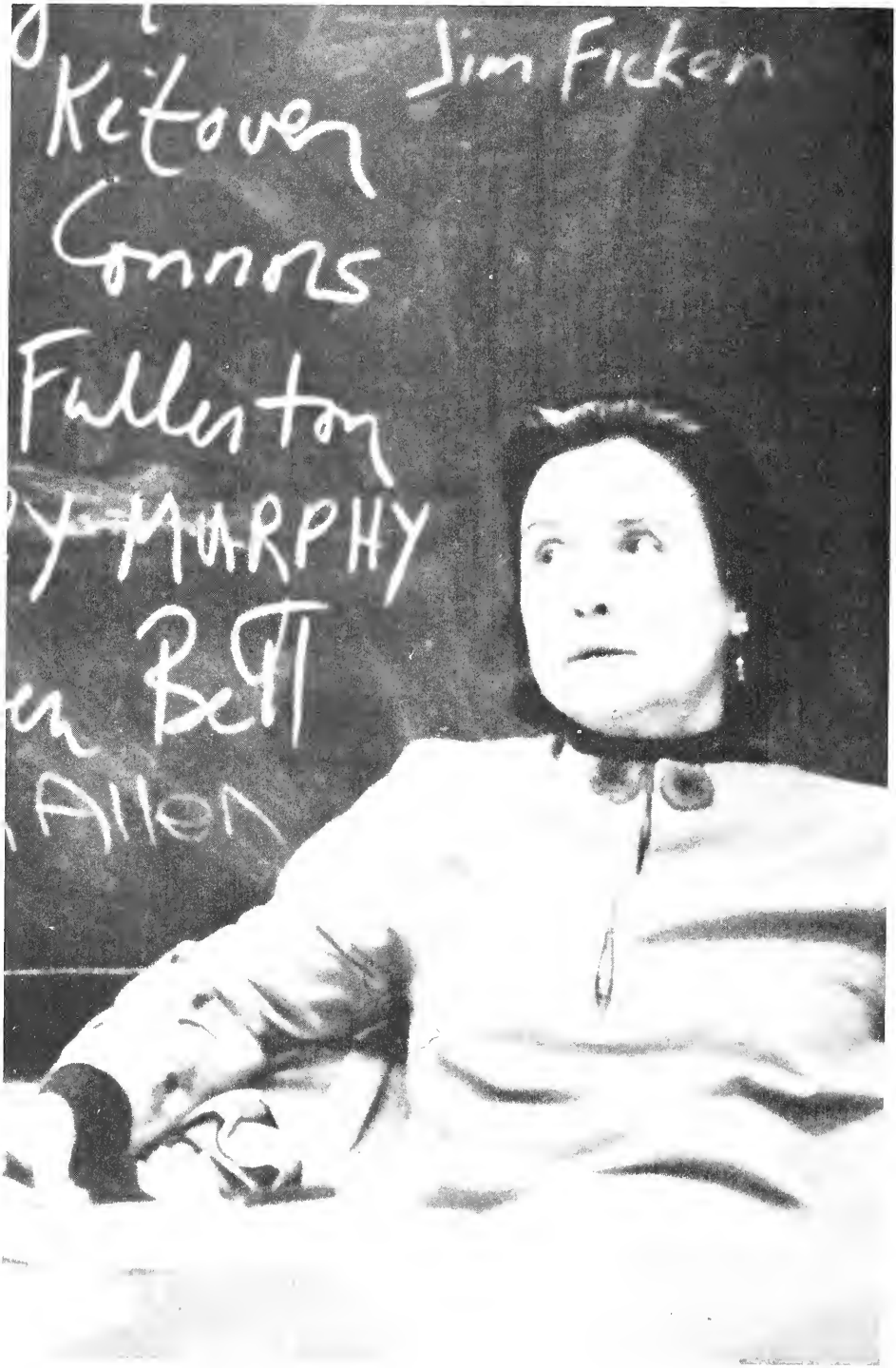
Spanish Realism
Galdos
Ruben Dario
Don Quijote
The Generation of 1898
Twentieth Century Spanish Poetry
Twentieth Century Spanish Fiction
Twentieth Century Spanish Theatre
Spanish Literature Before 1500
Survey of Spanish-American Literature
Spanish-American Colonial Literature
Nineteenth Century Spanish-American Literature
Spanish-American Essay
Modern Spanish-American Novel
Modern Spanish-American Fiction
Contemporary Spanish-American Poetry
Modernism
Twentieth Century Spanish Essay
Independent Study
Studies in Spanish Literature
Studies in Spanish-American Literature
Special Themes in Spanish-American Literature
Senior Seminar
Methods and Practice Teaching of Spanish in Secondary Schools

SPECIAL HISPANIC STUDIES

Introduction to Spanish-America
Spanish Composition and Stylistics
Bilingual Education
The Caribbean
Hispanic Culture in the United States
Antillean Intellectual History and Thought

THEATRE ARTS

Traditions of Western Drama
The Styles and Techniques of Comedy
The Styles and Techniques of Tragedy
Stagecraft I
Speech and Movement
Theatre of Social Protest
American Theatre Before O'Neill
The American Theatre Since Eugene O'Neill
Mid-Twentieth Century Drama
Black Theatre in America
Workshop in Classical Drama
Workshop in Modern Drama
Workshop in Nineteenth Century Drama
New Theatre Strategies
Introduction to Directing I, II
Introduction to Acting I, II
Playwriting I, II
Design I, II
Seminar in the Scenic Imagination
Seminar in Contemporary American Playwrights
Selected Topics: The Craft of the Black Playwright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Connors
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MURPHY
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1973-1974
Medical School Catalogue

University of Massachusetts at Worcester

1973-1974 Catalogue of the Medical School

University of Massachusetts at Worcester

Contents

Foreword

THE OPENING OF THE SCHOOL year 1973–74 finds us in our own Medical Science Building, with good prospects of the hospital opening within a year and a half. The student body, comprising four classes, numbers 104, and the faculty is over 200 strong. The plans to bring the School to a full complement of 400 students by the fall of 1978 are moving forward successfully. They include adding faculty by increments each year until we reach the number necessary to carry out our commitments in teaching and patient care. The School continues to be overwhelmed with applicants, with the result that we must turn away many who are qualified for admission. For this reason, we admit Massachusetts residents only. Despite the fact that the students admitted all come from the same state, they represent a wide range of backgrounds, educationally and otherwise. The 40 students matriculating in September, 1973, come from 21 different colleges. The faculty is also considerably diversified in background and education.

We have now formed an affiliation with the Wesson Women's Hospital in Springfield, which has 136 beds, 96 bassinets, and over 5,000 obstetrical deliveries a year. The students go there for a six-week clinical clerkship in gynecology and obstetrics during their third year. In addition, there will be a new training program for residents in obstetrics and gynecology at the Memorial Hospital in Worcester which will be helpful in developing a clinical clerkship at that hospital. This past academic year was the School's first clinical one. Once again we would like to express our gratitude to the voluntary and part-time faculty who have done so much to make the clinical teaching a success.

LAMAR SOUTTER, M.D.
Dean

1973-74 Academic Calendar

Tuesday, Sept. 4	*Registration for fourth-year students and first day of fall clerkships*
Monday, Sept. 10	*Registration for first- and second-year students and first day of classes*
Monday, Sept. 17	*Registration for third-year students and first day of classes*
Monday, Oct. 8	*Holiday*
Monday, Oct. 22	*Holiday*
Wednesday, Nov. 21	*Thanksgiving recess begins after last class*
Monday, Nov. 26	*Thanksgiving recess ends, 8:00 A.M.*
Wednesday, Dec. 19	*Christmas recess begins after last class*
Wednesday, Jan. 2	*Christmas recess ends, 8:00 A.M.*
Monday, Jan. 28	*Registration and payment of fees for second semester*
Monday, Feb. 18	*Holiday*
Friday, March 15	*Spring recess for first- and second-year students begins after last class*
Saturday, March 23	*Spring recess begins for third-year students after last class*
Monday, March 25	*Spring recess for first- and second-year students ends, 8:00 A.M.*
Monday, April 1	*Spring recess for third-year students ends, 8:00 A.M.*
Monday, April 15	*Holiday*
Monday–Friday, May 13–17	*Review and examinations (first-year class)*
Saturday, May 25	*Graduation exercises*
Monday, May 27	*Holiday*
Friday, May 31	*Last day of second-year classes*
Friday, June 14	*Last day of first-year classes*
Saturday, June 22	*Last day of third-year classes*

General Information

The University System

The University of Massachusetts is the state university of the Commonwealth, founded in 1863 under provisions of the Morrill Land Grant Act passed by the United States Congress one year earlier.

The University is a member of the great community of Land Grant colleges and state universities serving the nation as principal resources of higher education. Incorporated as the Massachusetts Agricultural College in April, 1863, the institution was opened to a handful of students in 1867. Rooted in the liberal arts tradition (its early presidents were graduates of such colleges as Dartmouth, Williams, Amherst, and Harvard), it has grown steadily from the four teachers and four wooden buildings available for its opening session. Reflecting the broadening interests of its students, the General Court of the Commonwealth of Massachusetts in 1931 authorized a second name, Massachusetts State College. Sixteen years later, in 1947, the institution became the University of Massachusetts.

The Amherst campus of the University consists of approximately 1,100 acres of land and 150 buildings, and enrollment there is approximately 23,000. A second campus was opened in 1965 in Boston, where enrollment is approximately 6,000. The Medical School at Worcester is the third campus of the University and the tenth division to offer programs of study leading to advanced degrees.

The Medical School

The Medical School was authorized by an act of the Massachusetts Legislature in 1962. In 1965 the decision was made to locate the School in Worcester. Subsequently, 126 acres of land on the eastern edge of the city, overlooking Lake Quinsigamond, were obtained for the School. In addition to providing a splendid site for the construction of new buildings, the property included an existing building containing some 48,000 square feet of floor space. This structure, known as the Shaw Building, was the home of the School until the 1973-74 academic year.

Limited space in the Shaw Building necessitated admitting only a small number of students to the first three classes. Sixteen students were admitted to the first class in September, 1970, and this hardy group will become the first graduates of the School at the conclusion of the current academic year. Classes of 24 students each were admitted in 1971 and 1972, while the current first-year class numbers 40.

As this catalogue goes to press, plans have been made for the gradual transfer of all personnel and equipment to the partially completed Basic and Clinical Sciences Building during the late summer and early fall of 1973. This large new building provides the superb physical facilities required to implement an academic program of highest quality that is the ultimate goal of those who planned the School and the faculty who have been recruited to develop the teaching program. With the availability of space in this building it is now possible to mount an intensive program to recruit the additional faculty needed to provide the breadth and depth of expertise required in a modern medical curriculum.

Already the School finds itself in a position to compete favorably with other schools for some of the ablest applicants from Massachusetts. Analysis of the academic qualifications of entering students has shown that the grade point averages and scores on the Medical College Admissions Test of the students are, on the average, at the national mean for entering medical students. It is gratifying that the present student body comes from more than 40 undergraduate colleges and universities, coast to coast.

New Facilities

STUDENTS ARE TO USE the new Basic and Clinical Sciences Building for the first time beginning in the fall of 1973. This large, new, granite-faced building contains the Library, teaching and research laboratories and amphitheaters. Under construction for three years, this 10-story structure is the first of the new buildings, which are to house the Medical Center, to be opened for student use.

Being completed at about the same time is the new power plant. Constructed of black, anodized aluminum panels and solar gray glass and served by a 220-foot stack, this complex plant will supply the heat, steam and air conditioning to be used by the entire Medical Center.

Construction of the teaching hospital started one year ago and will be completed in about two years. It is now planned that the hospital will open some time during the spring of 1975.

The entire complex is planned and organized to function as a single, integrated health sciences facility with the main buildings inter-connected at every level. The Basic and Clinical Sciences Building is designed as an open-ended rectangle with basic sciences, clinical sciences and student laboratories, each occupying a separate wing. The library section of the building occupies the center court formed by the other three wings. At each level, departmental offices and laboratories in the clinical science wing will correspond, as nearly as possible, to the clinical service located on that floor of the hospital building.

The School is planned for classes of 100 medical students each, with additional provision for graduate students who are candidates for M.S. or Ph.D. degrees in the basic medical sciences. The teaching hospital includes facilities to be used by other allied health professions, as well as for medical education.

Features of the Basic and Clinical Sciences Building of particular interest to students include: three amphitheaters one above the other, each with 175 seats and full audio-visual support; entry to each amphitheater is from two floors, enabling hospitalized patients to participate in clinical conferences; student locker rooms, lounges and a book store located in one area of the first floor convenient to the Library; the abundant opportunity for individual study in the numerous carrels of the Library; excellent facilities for small group conferences; and audio-visual facilities that permit the production of educational materials as well as the monitoring of educational programs.

Affiliated Hospitals

Hospitals throughout the Commonwealth have indicated interest in establishing formal relationships with the Medical School. Affiliation agreements have been signed in Worcester with St. Vincent Hospital (600 beds), Worcester City Hospital (448 beds), Worcester Memorial Hospital (379 beds), and Hahnemann Hospital (220 beds), and in Springfield, with the Wesson Women's Hospital (136 beds). The latter hospital admits only obstetrical and gynecological patients and its staff provides instruction in these fields to third-year students. The Worcester State Hospital (1,009 beds) participates actively in the teaching of psychiatry during the third and fourth years of the curriculum. The affiliation agreements are sufficiently flexible to permit various degrees of affiliation between the clinical departments of the School and the corresponding services of the hospitals. In this way, the academic needs of students are met without compromising the primary commitment of the hospitals to patient care and without disturbing the relationship between physicians and their private patients. Appointments to the Medical School faculty of those members of various hospital staffs who are interested in teaching are made upon recommendation of the departmental chairman and approval by the faculty and Trustees of the University.

In addition to hospitals having formal affiliation with the School, some 14 others have contributed in a significant way to the implementation of the course in pathology during the second year. A few hospitals and medical groups offer opportunities for elective work to students in the School. As the student body expands in size and the need for additional opportunities for clinical experience increases, the School will continue to explore the possibility of meaningful affiliation with additional hospitals.

THE LIBRARY WAS DESIGNED to provide the Medical School and the associated biomedical community with convenient access to the world's scientific literature. For this purpose, a substantial collection was compiled from the former library of the Pittsburgh Academy of Medicine, a European medical library, gifts from individuals and estates and direct acquisitions. In addition, the Worcester Medical Library has intershelved its holdings with those of the Medical School and is represented on the School's Library Committee by two of its members.

The Library's new facilities include the capacity for about 100,000 volumes and seating provisions for 566 persons, a figure which includes 262 carrels. About 2,000 subscriptions are being received and virtually all worthwhile English-language books on medically-related topics are purchased as they are published. Non-print formats such as film, slides, audio tapes, video tapes and records are acquired when desirable and appropriate equipment for using these materials is available in certain areas. The Library was recently designated a Government Depository Library which means that it receives free at the time of issue all Government Printing Office publications on desired subjects.

Library policy permits the circulation of most books to qualified borrowers, and a photocopy machine is available for the reproduction of desired information. Reserve shelves contain volumes that should not be circulated but need to be kept accessible. Reference services are available and a Medline teletype terminal provides on-line access to the National Library of Medicine's computerized index of medical literature.

The Library is a member of the Worcester Area Cooperating Libraries, through which each library's resources are made accessible to the other members. Included within this group are several major colleges and research institutions such as Clark University, Holy Cross College, Worcester Polytechnic Institute and the Worcester Foundation for Experimental Biology. For items not available locally, the Library can utilize the New England Regional Medical Library Service and request material from the extensive collection of the Francis A. Countway Library of Medicine in Boston and from the National Library of Medicine in Bethesda, Maryland.

Requirements for Admission

Selection for admission is based upon careful appraisal of the applicant's overall potential for a career in medicine. Factors considered include motivation, maturity and character as well as academic preparation. A minimum of three years of study at the college level is required and a baccalaureate degree is recommended.

The student planning a career in medicine should realize that an education of considerable breadth is required. In seeking to acquire in college a science background that is adequate preparation for medical school, the student should not forfeit the opportunity to become acquainted with the history, art, religion and literature that constitute the cultural heritage. On the other hand, the student majoring in the humanities should take enough courses in the physical and biological sciences to establish an ability to deal successfully with this aspect of the study of medicine. There is no single program of college study that can be recommended as the best, or preferred, preparation for medical school; therefore, the course of study followed by each student should reflect individual interests and abilities. Applicants are encouraged to undertake advanced study in some field of special interest, including independent study, if this is possible.

Described below are specific course requirements in four subject areas. It should be kept in mind that they represent the minimal acceptable preparation in each of these fields of study. Keeping the number of required courses small permits students greater latitude in the selection of undergraduate majors and enables those not selecting a science major to qualify for admission. A minimum of required courses is also in keeping with the educational philosophy of the School, as expressed in the description of the curriculum.

Biology—A one-year basic course in general biology or zoology is required. Students interested in additional courses should consider genetics, embryology, cell physiology and comparative anatomy.

Chemistry—One year each of inorganic and organic chemistry is required, including laboratory experience. Students interested in advanced courses should consider biochemistry and physical chemistry.

Physics—A one-year course in general physics is required. A student receiving advanced placement credit for a course taken in secondary school may wish to take an additional college-level course.

English—At least one year of college-level study of English is required. Much of the art of medicine involves competence in communication. The ability to read rapidly and with good comprehension is essential in dealing with the large volume of medical scientific literature; proficiency in writing

clearly and concisely is highly desirable. Therefore, the applicant will be expected to have an adequate command of the English language.

Additional Recommended Courses—Because a knowledge of mathematics becomes increasingly important in the study of science, a course in calculus is recommended. The study of psychology, sociology and social anthropology will provide useful background for understanding human behavior in response to illness. An understanding of statistical methods is helpful in evaluating scientific data and some knowledge of economics is pertinent to study of the socio-economic aspects of medical care.

The prospective medical student is urged to consult the publication of the Association of American Medical Colleges entitled "Medical School Admission Requirements" which contains much helpful information concerning medical schools and preparation for the study of medicine. Copies of the book may be purchased from the Association at One Dupont Circle, N.W., Washington, D.C. 20036.

Applications

Application forms for admission to the University of Massachusetts Medical School may be obtained by writing to the School's Office of Admissions, 55 Lake Ave. North, Worcester, Massachusetts 01605. Applications are accepted between July 1 and December 15 of the year prior to admission. Late applications will not be accepted. No application fee is required.

All applicants are required to take the Medical College Admissions Test. Arrangements for taking the Medical College Admissions Test (MCAT), requesting test reports, and all other correspondence and requests for information concerning the administration, processing and scoring of the MCAT should be directed to:

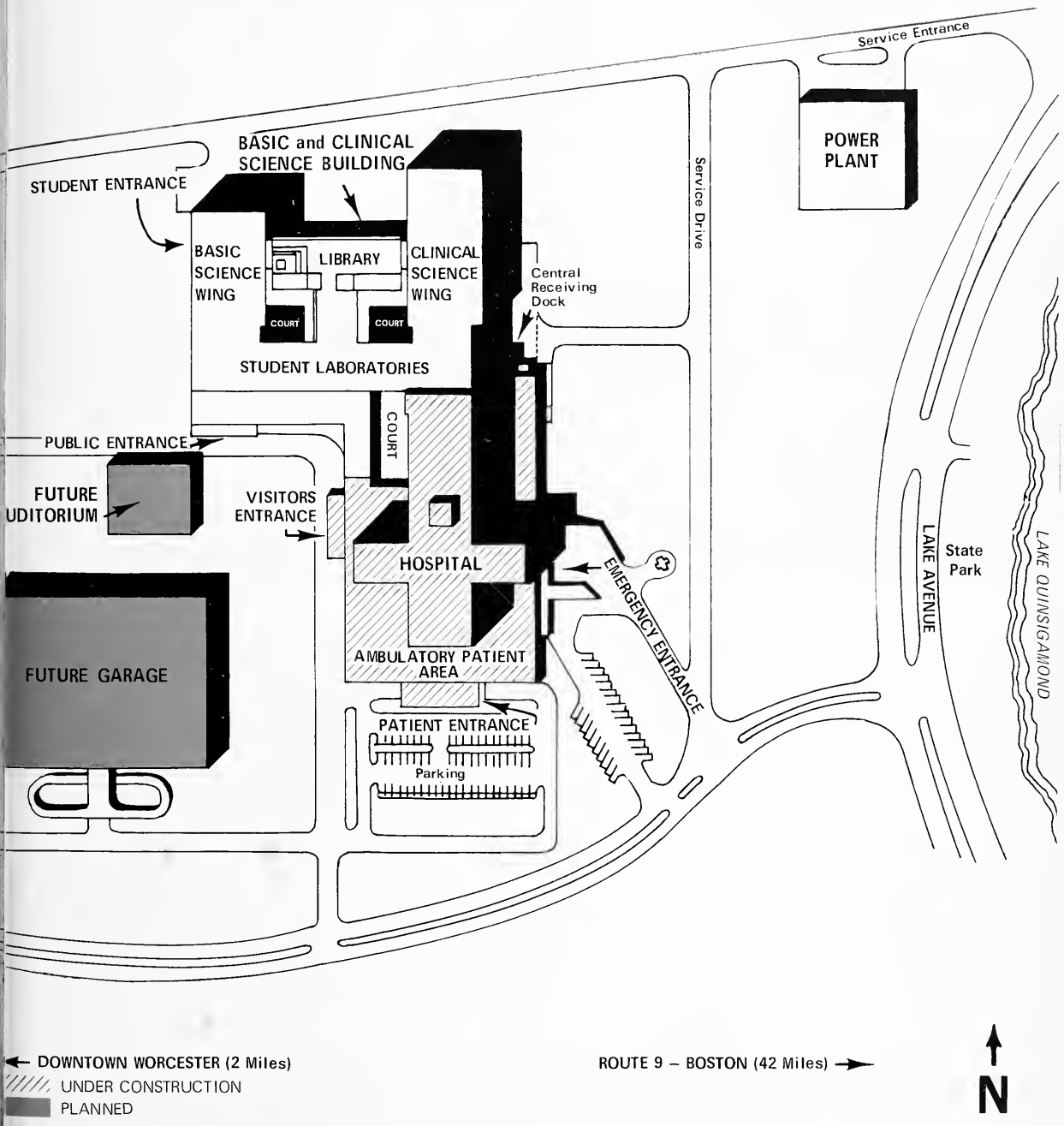
Medical College Admissions Test, The American College Testing Program, P.O. Box 451, Iowa City, Iowa 52240, Phone: (319) 351-4470.

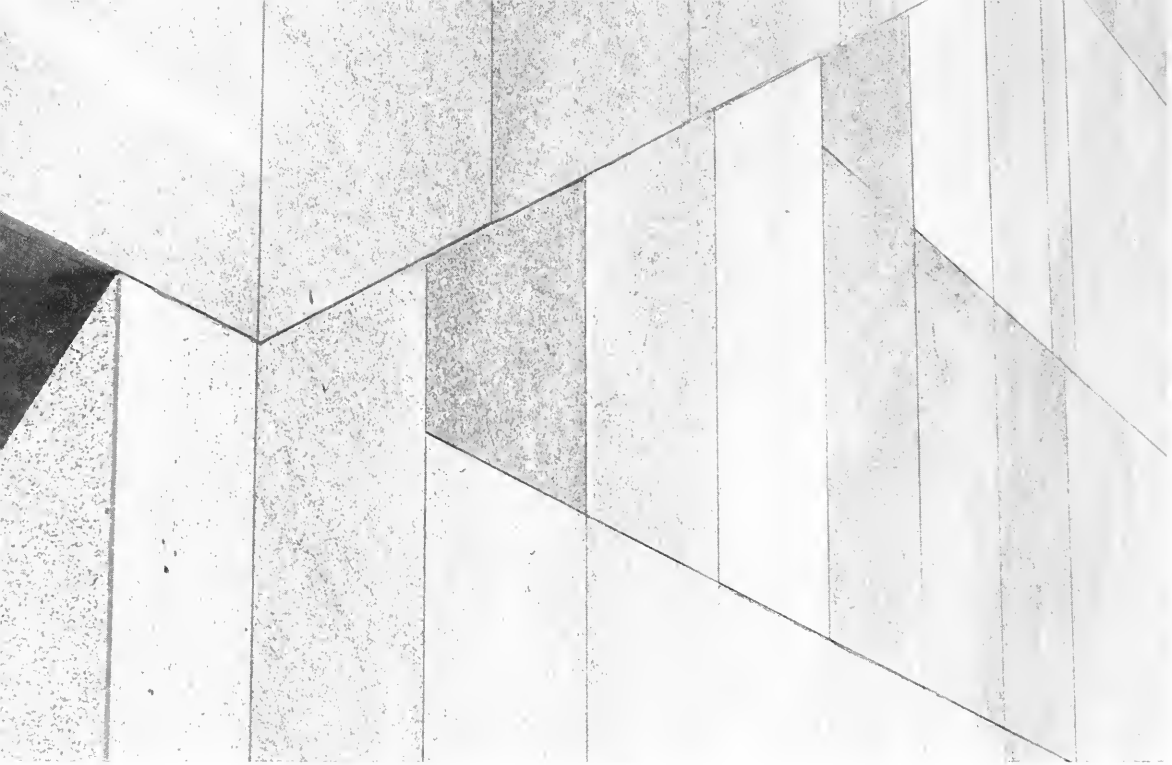
Admission Policy and Acceptance Procedures

The Admissions Committee will review all completed applications with supporting documents. Applications will be considered complete when all of the following have been received:

(a) The completed application form.

(b) Certified transcripts of applicant's grades from each college or university attended. Applicants should request the Registrar's Office to send


Service Entrance
POWER PLANT
BASIC and CLINICAL SCIENCE BUILDING
STUDENT ENTRANCE
Service Drive
BASIC SCIENCE WING
LIBRARY
CLINICAL SCIENCE WING
COURT
COURT
Central Receiving Dock
STUDENT LABORATORIES
COURT
PUBLIC ENTRANCE
FUTURE UDITORIUM
VISITORS ENTRANCE
HOSPITAL
EMERGENCY ENTRANCE
AMBULATORY PATIENT AREA
FUTURE GARAGE
PATIENT ENTRANCE
Parking
LAKE AVENUE
State Park
LAKE QUINSIGAMOND
DOWNTOWN WORCESTER (2 Miles)
UNDER CONSTRUCTION
PLANNED
ROUTE 9 – BOSTON (42 Miles)
N



transcripts directly to the Medical School. Copies of transcripts sent by applicants cannot be accepted. As additional course work is completed, transcripts should be sent as long as application is still active.

(c) Letter of recommendation. A letter of evaluation that is the official recommendation of the school's Premedical Advisory Committee will suffice. If such a letter, or form, is not provided by the applicant's school, the names and addresses of two instructors to whom the School may write for recommendations must be supplied.

(d) MCAT scores.

(e) A Certificate of Domicile and Residence, properly authenticated by the Clerk of the town or city in which the applicant resides. It is the current policy of the Committee on Admissions to consider only those applicants who are certified as legal residents of the Commonwealth of Massachusetts and citizens of the United States. The policy governing eligibility for in-state tuition is printed on the back of the Certificate of Domicile and Residence provided with the application blank.

Receipt of the application form will be acknowledged promptly. Periodically thereafter, all applicants whose applications are not complete (see above) will be informed as to which documents have not been received. All required documents should be submitted as early as possible.

Completed applications will be reviewed by the Committee on Admissions and personal interviews scheduled if the Committee believes these will be helpful. Interviews will be held at Worcester.

The School has agreed to participate with other schools of the Association of American Medical Colleges in employing a series of uniform acceptance dates from December, 1973, through March, 1974. Thereafter the Committee on Admissions will employ a "rolling" admissions policy. Applicants selected for admission will be so notified and will normally be expected to accept or reject a place in the class within two weeks. In exceptional circumstances, applicants may be granted an additional two weeks to make a decision.

When all places in the class entering in September have been filled, remaining applicants will be so notified. However, a list of alternates will be prepared and should any of the enrolled students withdraw prior to the opening of school, replacements will be selected from the list of alternates. Applicants selected as alternates will be informed of this and requested to indicate whether or not they wish to have their names remain on the list.

No deposit is required of those applicants who are offered and accept a place in the entering class. However, anyone who accepts a place and later decides to withdraw will be expected to inform the Office of Admissions immediately in order that another applicant may be accepted.

The application, supporting documents and all correspondence should be mailed to: Committee on Admissions, University of Massachusetts Medical School, 55 Lake Ave. North, Worcester, Massachusetts 01605.

Evaluation of Applicants

The Committee on Admissions is composed of faculty members representing several different scientific disciplines from the basic and clinical sciences. It is the responsibility of the Committee to recommend applicants to the Dean for acceptance. Every application for admission and all information provided by, or on behalf of, the applicant is carefully evaluated by the Committee as it endeavors to select those who possess exceptional personal qualifications as well as the intellectual ability and academic preparation necessary for the successful study of medicine. There is no discrimination against any applicant because of race, religious belief, sex, or political affiliation.

Letters of recommendation are required and those from Premedical Advisory Committees, or their equivalent, are preferred. When these are not available, the applicant must provide the Committee with the names and addresses of two or more college instructors who are willing to give the Committee a personal evaluation of the applicant.

The decision to interview certain applicants rests with the Committee on Admissions and the Dean. It is not possible for the Committee to interview all applicants. Those invited for interview are those deemed by the Committee as not only qualified for admission but also likely to be competitive for a place in the class. The interview offers an opportunity for exchange of information between Committee and applicant, and allows the latter to see the School, sense the atmosphere for learning, and to meet and talk with students. For these reasons, all interviews are held at the Medical School except in the instance of students in schools out of state who find the cost or inconvenience of coming to Worcester to be burdensome. For such students, other arrangements will be made upon request.

Each year since the School opened, the task of selecting a class has become increasingly difficult. The number of applicants has increased steadily from approximately 300 for the first class to an anticipated 1,000 for the class that will enter in September, 1974. Although the size of the entering class has also been enlarged, the number of seemingly well-qualified applicants has increased at a much faster rate resulting in intense competition for the available places in the class. Potential applicants whose cumulative grade point averages are below 3.0 and whose scores on the Medical College Admissions Test are below the 80th percentile may find that these are significant handicaps in competition for admission.

Transfers and Advanced Standings

To date, it has been possible to accept transfer students, with advanced standing only, to fill the few vacancies that have occurred as the result of withdrawal from school of previously enrolled students. Although it is anticipated that this policy will continue in effect, the matter will receive annual review by the faculty. Therefore, students interested in the possibility of transferring to this school should direct their inquiries to the Office of Admissions. Information regarding current policy on transfers and, when appropriate, application forms and instructions for applying will be sent to all potential applicants. It should be noted that the same residency requirements must be met as for students entering the first year.

Students wishing to receive advanced standing on the basis of study undertaken in a foreign medical school (other than Canadian schools) must register with the COTRANS Office of the Association of American Medical Colleges. That office will arrange for qualified applicants to take the basic science examinations of the National Board of Medical Examiners. Scores on these examinations will be taken into consideration in evaluating all such applicants for transfer with advanced standing.

Candidates for transfer from U.S. schools must have met the conditions of admission of the first-year class at the University of Massachusetts Medical School and must present evidence of honorable dismissal from the school they are attending. They may, at the discretion of the faculty, be required to take examinations in any of the courses taken at another school.

Expenses and Fees

THE MAJOR EXPENSES not listed below are those for meals, rooms and customary living expenses. In the absence of University-operated living and dining facilities, the cost of room and board can vary from student to student. It probably is wise to allow $750 to $900 for meals and $600 to $900 for individual accommodations, per academic year. The cost of apartments for married students is somewhat greater.

Fees and other expenses that can be anticipated are:

Application Fee	(None)
Acceptance Deposit	(None)
*Tuition—Massachusetts Residents**	$600
*Microscope Charge***	$35
Books, Instruments and Supplies including Laboratory Coats (estimated)†	$250
Student Health Fee††	$70

*In order to register as a Massachusetts resident, a student must have on file in the Office of Admissions a Certificate of Residence properly authenticated by his Town or City Clerk. Only Massachusetts residents will be accepted for 1974-75.

**A microscope for each student is provided by the School. A charge is made for upkeep and repair of these instruments. Students wishing to purchase their own microscopes may do so, but should consult the Department of Anatomy regarding approved models.

†Average expense for first three years; expenses of the fourth year should be somewhat less.

††Optional medical-surgical insurance is available. The cost of the individual is $37.50 per year; family coverage is an additional $36.75 per quarter.

Financial Assistance

THE FACULTY AND ADMINISTRATIVE OFFICERS of the School are well aware that a substantial number of students each year will find the expense of obtaining a medical education burdensome. Even during the short time the School has been open, there has been a significant increase in the general cost of living. Unfortunately, at the same time, it has become increasingly uncertain as to what sources of financial aid will be available to the School, and in what amounts. The principal problem is the uncertain future of the financial aid programs administered by the United States Department of Health, Education and Welfare, which have annually been the source of approximately 60 percent of all such funds administered by the School itself.

Possible new sources of funds are constantly being explored by the School and every effort is made to obtain money for scholarships and loans. However, applicants who anticipate needing financial assistance are urged to seek out private sources of assistance that may be available to them as individuals. In some communities fraternal orders, civic groups, churches, medical societies and other organizations offer assistance to students.

Procedure

Applicants anticipating need of financial assistance should give some indication, on page 2 of the application form, of the approximate extent of aid needed and, if invited for interview, should discuss the matter frankly with someone in the Office of Admissions. This does not diminish the individual's chances of being accepted and does enable administrative officers to anticipate more accurately the total needs of students.

All persons applying for financial aid from the Medical School must also apply to the Massachusetts Board of Higher Education for a scholarship. Application forms and instructions may be obtained at the Financial Aid Office of most colleges in Massachusetts, or by writing to the Scholarship Office, Commonwealth of Massachusetts, Board of Higher Education, 182 Tremont Street, Boston, Massachusetts 02111. Attention is called to the April 1 deadline for filing applications with the Board of Higher Education and the fact that the applicant need not be accepted into medical school before applying.

All applicants who apply for financial aid will be asked to prepare confidential financial statements submitted to an outside agency for analysis and used in support of the application for aid. All applications for financial assistance will be evaluated by the Financial Aid Committee and awards are made on the basis of relative financial need. Although the Committee will act on applications as soon as possible each year, it may be late summer before the Committee has adequate information as to the monies available for distribution.

Formal application for financial assistance from the School is not filed until after the applicant has received a letter of acceptance from the Dean. This letter requests the applicant who is accepting a place in the class to indicate whether he or she wishes to apply for financial aid. Forms and instructions for this purpose are then mailed to the student. Since the Financial Aid Committee makes recommendations regarding both scholarships and loans, only one application form is necessary. In general, students with the greatest financial need will receive a combination of scholarship and loan assistance, while those with lesser need will receive loans only.

Scholarships

THE FOLLOWING LIST indicates the sources of scholarship money available through the School:

ROY J. WARD, M.D., MEMORIAL SCHOLARSHIPS—These several scholarships are awarded annually by the Central Massachusetts Lung Association. They are made possible by voluntary contributions to the Association's Christmas Seal campaign. Students from Franklin and Worcester Counties and from several adjacent towns in Middlesex County are eligible to receive these awards.

WOMEN'S AUXILIARY OF THE WORCESTER DISTRICT MEDICAL SOCIETY—Funds for this scholarship are contributed by members of the Auxiliary. It is awarded annually and although the Auxiliary has placed no restrictions on eligibility, it has been customary to award the scholarship to a woman.

WORCESTER DISTRICT MEDICAL SOCIETY—One or more scholarships awarded annually from funds contributed voluntarily by the physicians in southern Worcester County. In selecting the recipients of these scholarships, preference is given to residents of Worcester County.

AMERICAN MEDICAL ASSOCIATION, EDUCATION AND RESEARCH FUND—Each year the School receives a variable sum of money from this Fund. The amount reflects nationwide contributions by physicians and, in particular, those

contributions given specifically for this medical school. Use of this money is not restricted by the donors, however, the Dean and faculty have elected to allocate the entire amount to scholarships. At present, the money received from this source is second in amount only to that received from the U.S. Government for scholarships.

Health Professions Scholarship Program—This program, administered by the U.S. Department of Health, Education and Welfare, provides the School with a variable amount of money on an annual basis. In amount, it has been the largest single scholarship grant received by the School. Unfortunately, the 1973-74 academic year may be the last year of the program.

The Robert W. Johnson Foundation Grant—Money from this Grant may be used only to assist students who are either women, members of certain specified minority groups, or from "rural" areas of the country. Received as a one-time grant in 1972, the money must be awarded to recipients by the end of the 1975-76 academic year. The grantors have permitted the School to use the money for scholarships, loans or a combination thereof.

Loans

Health Professions Student Loan Fund—The School has participated with the Department of Health, Education and Welfare in establishing a Health Professions Student Loan Fund. Interest is not charged until three years after graduation and then is assessed at the federal interest rate current at the time the loan was made. Repayment of the loans is made over a ten-year period beginning three years after graduation from medical school.

Massachusetts Medical Society Loan Fund—Through the Directors of the Charitable and Educational Fund, the Society annually sets aside a sum of money to be available as loans to students at this School. After review of all applications for financial assistance, the Financial Aid Committee refers some students to the Treasurer of the Society who handles the details for obtaining a loan. Loans bear an interest rate of 1%, not compounded, for five years. The terms provide the option to extend the period of the loan an additional five years upon request of the student and agreement of the Directors of the Fund.

Student Facilities

The design of the Basic and Clinical Sciences Building places most of the student areas together on the first floor at the north end of the basic science wing. Two large rooms serve as student lounge and recreation areas. Immediately adjacent are the student store, locker rooms and the mail room which will provide locked mail boxes for each student. Temporarily, while

the student body is small and the hospital building incomplete, one of the large rooms in this area will double as a lounge and food service area.

The entrance to the Library is on the first floor, a short distance from both the student area and from the main entrance of the building. Student laboratories are located in the east-west wing of the building above the first floor. The Library, student laboratories and other student areas will be open at night for those students who wish to study and work in the building.

The community offers numerous opportunities for outdoor recreation. Facilities for boating, fishing and swimming are available at Regatta Point, immediately across the street. Quinsigamond State Park, containing tennis courts, athletic fields and a state-operated indoor ice-skating rink is just a short distance south of the School. Mount Wachusett with its skiing facilities is about 30 minutes away by automobile. Golf courses open to the public are located nearby.

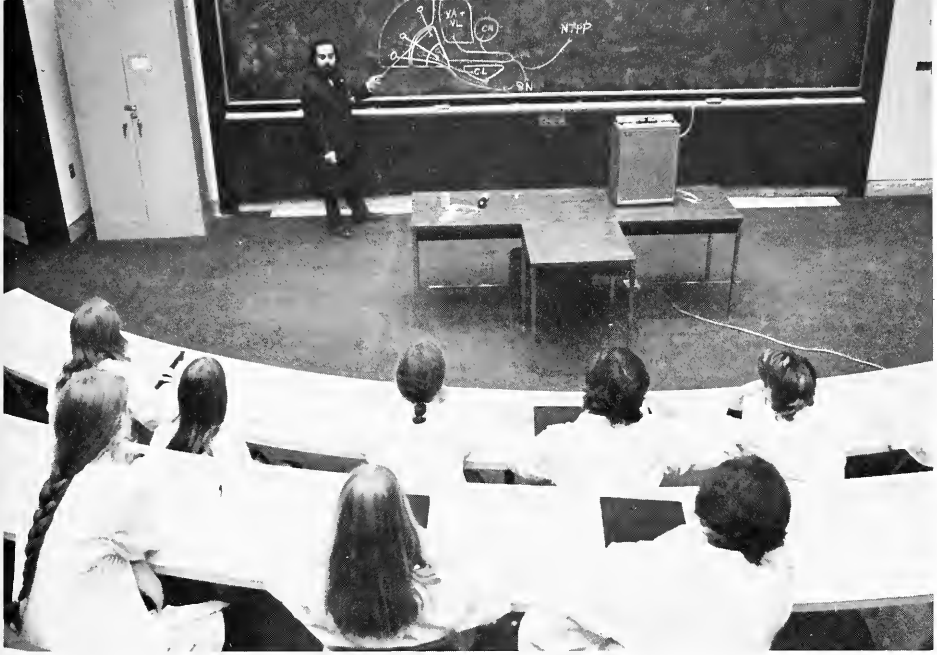
Housing and Transportation

The School has limited facilities for housing single students and these have been assigned to upperclassmen. The staff, assisted by professional consultants, has canvassed the nearby residential areas to determine what accommodations may be available for rent. This information is made available to all students, who are then expected to make their own arrangements with landlords, and with each other, if they wish to share apartments.

Bus transportation to the campus is possible on several different routes. From some locations, however, students may find it desirable to commute by private automobile. Those who wish to park at the School are required to obtain a parking permit from the Physical Plant office. (Parking permits for entering students desiring them will be issued at the time of Registration.)

Food Service

The design of the Medical Center places all food service facilities in the hospital building. Until that building opens, early in 1975, temporary arrangements for food service will be provided in the Basic and Clinical Sciences Building. These will accommodate all personnel in the Center. Vending machines will make a variety of foods available at all hours; however, anyone wishing to bring lunch from home may do so. There are several restaurants in the general vicinity of the School, although some of these are best reached by automobile in inclement weather.



Student Health

A Student Health Service has been established to meet the ambulatory health care needs of all students. The administrative staff of Worcester Memorial Hospital has cooperated most generously with the School in arranging for the Health Service to be based in the ambulatory care area of that hospital. Physicians on the faculty of the School staff the Service and a roster of additional specialists is available to provide consultations. Prior to the opening of school each year, students are informed of the details of the plan for health supervision.

In addition, a Student Health Insurance Plan available through the University of Massachusetts at Amherst offers students a low cost, hospital, surgical and medical program to supplement the ambulatory care provided by the Student Health Service. The Plan provides twelve-month protection against the cost of injury or illness during university holidays, summer vacations and other times when the student is away from the Medical School. An additional premium is charged those married students who elect to obtain coverage for members of their immediate families through the Plan.

Unfortunately, at present the School is unable to provide for the ambulatory health care needs of students' families. The possibility of developing a more comprehensive service, to meet the entire health care needs of students and their families, is being explored but implementation of any such plan will not be possible before the University Hospital is in operation.

The Curriculum

The years of study in medical school are looked upon as the middle period in a continuum of formal education that begins with entry into college and extends through the years of graduate study and specialty training. During these early years, the student must cultivate those attitudes and habits that will enable him, as a physician, to keep his knowledge current throughout his career. In an era of rapidly expanding information relevant to the sciences basic to medicine, the burden of keeping informed falls squarely upon the individual physician and his success at this depends upon mastering the process of sustained self-education. It is sobering to realize that appropriate methods of diagnosis and treatment are, to a substantial degree, replaced by more effective methods in every decade.

Because of the need to acquire the tools of self-education, a significant portion of the curriculum for each student at the University of Massachusetts Medical School will be planned and implemented by the student. The faculty will offer guidance in making these plans and supervision will be provided to whatever extent necessary. At the same time it is recognized that there is a body of information that is fundamental to an understanding of health and disease and is applicable to almost all areas of medical practice. Some courses will, therefore, be required of all students. Thus, the curriculum is designed to provide a sound basis for proceeding into any of the many careers open to physicians and each student will be offered the opportunity to select particular areas of medical science for study in depth. Periods of elective time for this purpose are provided in the schedule.

It is considered essential that the plan of study also contain free, unscheduled time which each student is expected to utilize to his own benefit. Laboratories and the Library will be available during this time, as will nearby facilities for recreation.

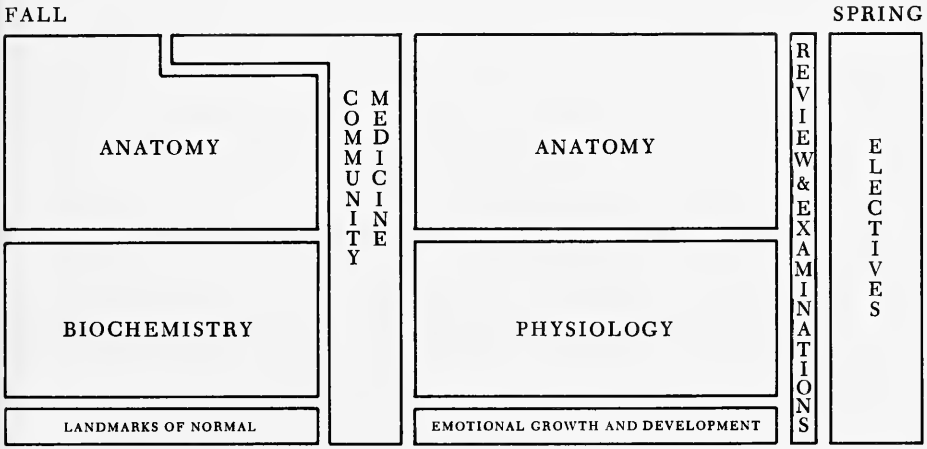
Registration and Orientation

For entering students the first activity on the opening day of school is registration at which time such details as the assignments of lockers and mail boxes and the issuing of parking permits are attended to, as well as the matter of actually enrolling as a medical student. Following registration, the class is formally welcomed by the Dean and there is an opportunity to meet certain members of the faculty and to discuss the educational philosophy on which the curriculum rests and the goals toward which it is oriented. The small size of the institution during these early years has made possible the development of a sense of mutual respect and understanding between

students and faculty that has become a hallmark of the School. Hopefully, for all students, this will continue to be something that begins the first day of school and grows through the years.

Plan of Study *(All Departments)*

First Year

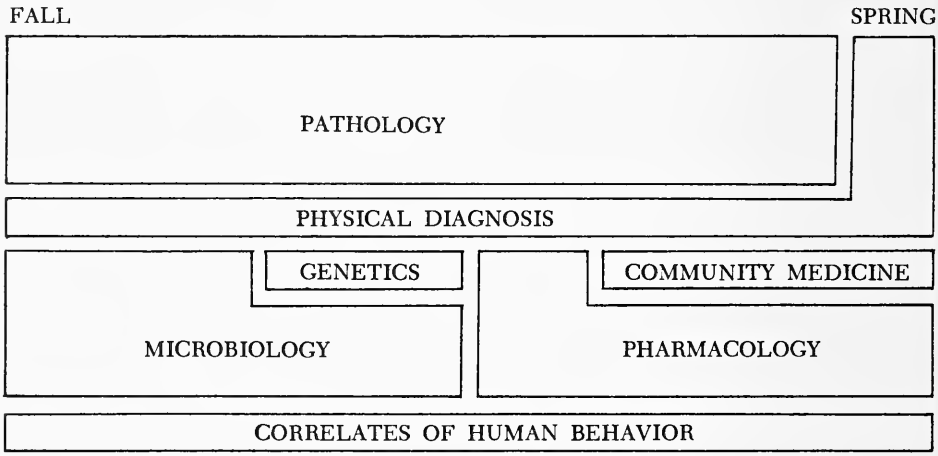


The bulk of the first year is devoted to the study of normal structure and function of cells, tissues and organs. Two days a week for the first 14 weeks are devoted to anatomy, and two to biochemistry. A series of lectures and discussions dealing with fundamental aspects of personality development is begun by the staff in psychiatry. During the last six weeks of this block of time the Department of Community Medicine considers various aspects of the delivery of health care. These latter sessions serve as background for, and introduction to, a three-week field project in Community Medicine immediately following the Christmas recess. For the next 15 weeks anatomy is presented in conjunction with physiology; during this block of time one-half day per week is devoted to an interdisciplinary consideration of topics related to clinical problems. The participating faculty are from both basic and clinical sciences but the topics selected correlate closely with the material being studied in physiology.

Following a week of review and examination, the final four weeks of the spring term are reserved for special projects. This time has been made available to provide each student with an opportunity to pursue a concentrated study in depth of some topic within his area of particular interest. In the spirit of preparing students to continue their own education after their years of formal training, this important portion of the first-year program is

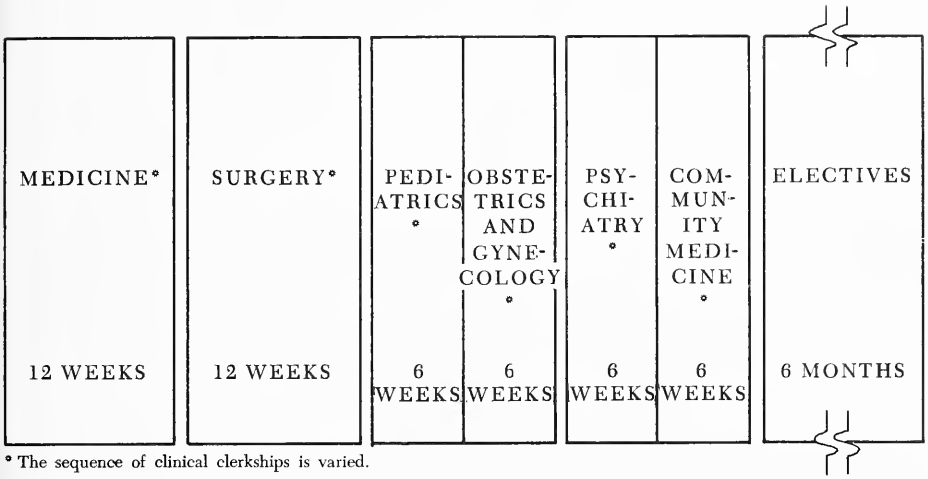
designed to allow the individual student to come to grips with a particular problem and—with the guidance of a faculty member—to devote his full energies toward its resolution. The time may be devoted to library projects, laboratory projects, or field projects in Community Medicine. Regardless of the nature of the subject of this endeavor, each student will gain first-hand experience in the acquisition and evaluation of data. It is anticipated that some funds will be available to provide stipends for a few students who may wish to continue their projects through the summer months.

Second Year



During the second year emphasis is placed on physical abnormalities, pathological processes and the development of diseased states. An attempt is made to correlate the subject matter in the courses being taught simultaneously. Psychiatry and physical diagnosis are assigned time each week throughout the year. The course in physical diagnosis introduces the student to clinical medicine. Emphasis is on the doctor-patient relationship and on acquiring skill in obtaining the medical history and performing the physical examination. Teaching is done at the several hospitals in Worcester, much of it at the bedside. During the spring, epidemiology of disease is taken up by the Department of Community Medicine.

Third and Fourth Years

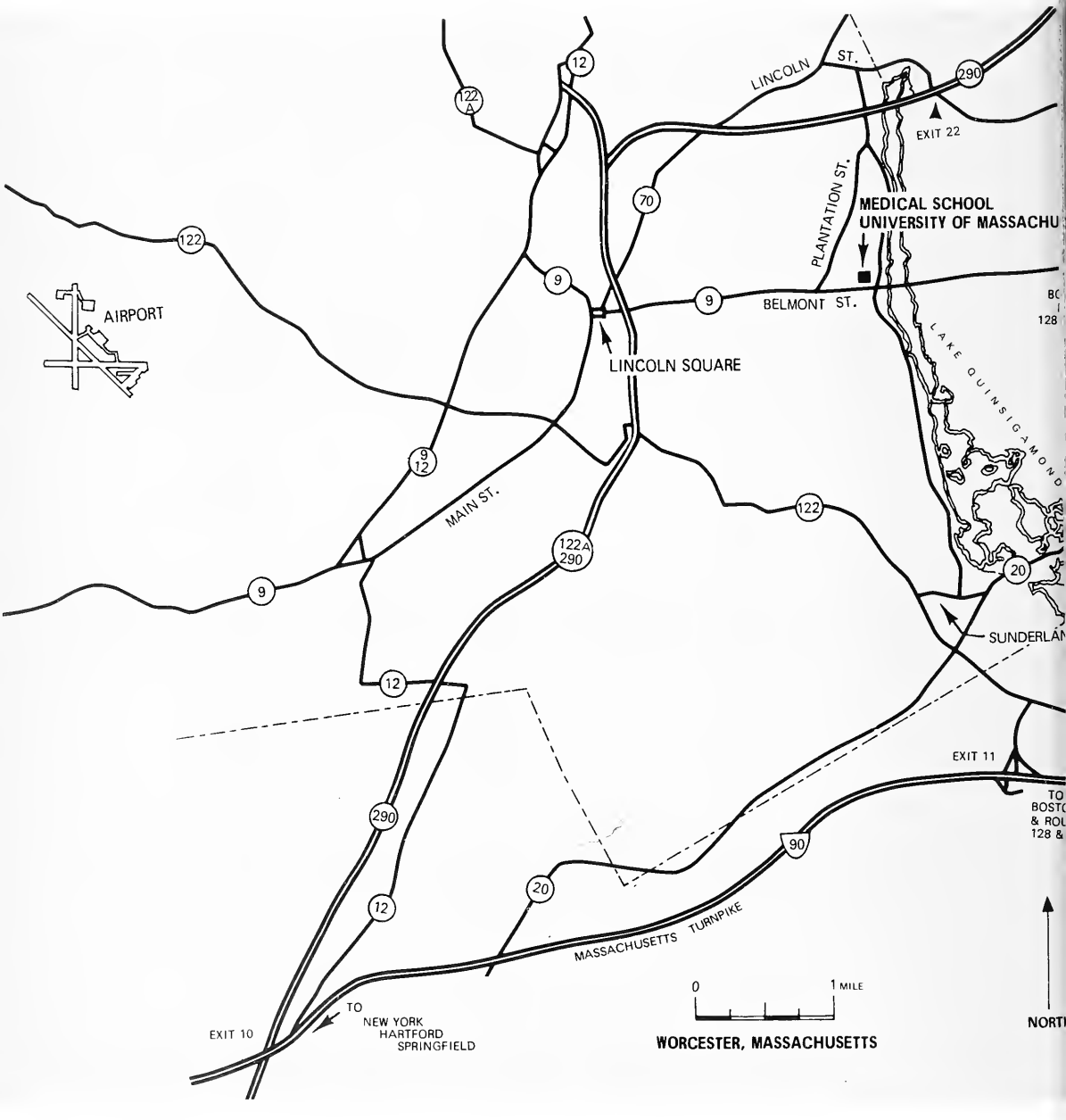


* The sequence of clinical clerkships is varied.

THE LAST TWO YEARS of the curriculum are planned as a unit beginning with a series of clinical clerkships and includes a series of basic science and/or clinical electives. In the third year the class is divided into small groups of approximately four students. Each group is assigned to a clinical service at an affiliated hospital where it participates in the day-to-day care of patients as part of a team whose other members include interns, residents and attending physicians. Instruction in such fields as radiology, anesthesiology and the sub-specialties of medicine and surgery takes place in conjunction with other in-hospital activities. The total clinical experience in most fields includes the care of both hospitalized and ambulatory patients. The continuing program in Community Medicine includes the opportunity to work with practicing physicians in various communities and students come to know the role of the family physician and his relationship to other specialists. Such assignments offer each student the opportunity to make an initial appraisal of the health needs of society and to decide how he can best contribute to meeting those needs.

During the final six months of the curriculum, each student is expected to select for intensive study a field that holds special interest for him. With the guidance and counseling of members of the faculty, he plans a balanced program of study, combining work in both basic science and clinical departments, as appropriate to his particular field of interest. The possibilities for elective work include an extended clinical experience in hospital and clinic, work in a clinical or basic science laboratory, library research, preceptorial association with a physician in private practice, work with a Department of Health or community health agency, or study at another

medical center. It is the intent of the faculty to allow each student considerable latitude in planning his elective activities, but in each instance it is necessary to obtain faculty approval for the program of study proposed. Those responsible for the supervision of each student submit reports on the nature and quality of the work performed.



Grading System

THE FACULTY BELIEVES that some system of periodic evaluation is essential to enable students to identify their deficiencies and misconceptions and to permit instructors to evaluate their teaching efforts. Through frequent and intimate contact with students, the faculty will seek to identify early any difficulty a student may be having in understanding a topic and will advise him regarding such problems, for it is the intent of the faculty that all students admitted shall successfully complete their course of study.

The School's philosophy of emphasizing learning as the result of personal initiative is reflected in its pass-fail system of grading. Evaluation is based upon student performance in laboratory, conferences and seminars, classroom discussion and on written examinations. Individual departments may use a variety of mechanisms to evaluate student performance, including grades, and may give this information to individual students, on a confidential basis. However, the report turned in to the Registrar by each department merely indicates a mark of pass or fail for each student, plus a narrative comment about the quality of the student's work. To date, faculty and students have preferred not to include an "honors" grade in the system.

After careful consideration, it has been decided not to require students to take the examinations of the National Board of Medical Examiners, although it is anticipated that most students will elect this method of examination for purposes of subsequent licensure.

Promotion and Graduation

PROMOTION FROM ONE PHASE of the curriculum to the next is determined by the Promotions Board, consisting of instructors from each department involved in the curriculum of a given period of study. The Board will meet promptly after the formal classes of the first and second years have ended. In the event of unsatisfactory work in a course the Board, on recommendation from the department concerned, determines the course of action that a student must follow to complete the work satisfactorily. Students whose performances indicate little promise of success in medicine will be dismissed from school.

The predominantly clinical curriculum of the third and fourth years is treated as a continuum. Evaluation of student performance will be made by each clinical department as students complete the clerkship of that department. If any student's performance in a clinical clerkship, or in one of the electives of the fourth year, is unsatisfactory, this will be reported promptly to the student and to the Dean's office along with the department's recommendation for remedial action. If deemed necessary by the department concerned, or by the Dean's office, a meeting of a Clinical Promotions Board will be called.

During the first year of school, a student may withdraw voluntarily upon written application to the Dean. Application for reinstatement to the first year must be received in writing at least two months prior to the date of readmission and must be approved by the Committee on Admissions. Upperclassmen have the same rights of withdrawal and readmission and the same rules apply except that readmission of an upperclassman will require the approval of the appropriate Promotions Board and of the Dean.

A regularly matriculated medical student, having satisfactorily completed four years of study of not less than thirty-two weeks each, and having fulfilled all other requirements of the University, will be recommended by the Dean to the President and Trustees of the University of Massachusetts for the degree of Doctor of Medicine.

Areas of Study

Department of Anatomy
Department of Biochemistry
Department of Community and Family Medicine
Program in Family Medicine
Department of Medicine
Department of Microbiology
Department of Obstetrics and Gynecology
Department of Pathology
Department of Pediatrics
Department of Pharmacology
Department of Physiology
Department of Psychiatry
Department of Radiology
Division of Surgery
Department of Orthopedics

Department of Anatomy

Professor and Chairman—S. L. Clark, Jr.
Professor—M. K. Wolf
Associate Professor—S. C. Marks
Assistant Professors—S. B. Gagliardi, E. S. Kane, R. H. Singer
Instructors—G. J. Edynak, G. B. Schneider

The Department of Anatomy, dealing with basic medical science, approaches biological problems from the structural point of view, in terms of development and function. A knowledge of structure provides the conceptual framework within which all development and function—normal and abnormal, healthy or diseased—must be understood. Living things consist of highly compartmentalized systems—organs, cells, organelles—in which biochemical events are quite different from those found in homogenates of tissues studied in the test tube. Continuing life is possible only because the elaborate structures of cells and tissues provide compartments in which mutually antagonistic but necessary chemical reactions can be kept separate.

Anatomy, the oldest of the medical sciences, deals with structure from the gross to the submicroscopic; the electron microscope and other anatomical instruments allow the structure of large molecules to be seen, thus bridging the gap between anatomy and biochemistry. Because of his broad-ranging interest in structure, the true anatomist is not satisfied with dissecting a system to understand the nature of its smallest components; he also works to understand how complex systems of cells, organs, individual organisms and even whole societies function. He is willing to accept the difficulties and uncertainties of working with complex systems because he is aware that they function in ways that cannot be predicted wholly from a knowledge of all their independent components.

Students in anatomy are, for a while, anatomists. They study structure as anatomists do: always in terms of development and function, and using the tools of anatomists—hands, eyes, microscopes, electron microscopes and the published work of other students of anatomy. Although the beginning student does not have time to become expert in using the electron microscope, he can examine the raw data—electron micrographs—just as anatomists do, gaining his own anatomical knowledge by first-hand experience. There are opportunities, for those interested, to spend additional time becoming more expert at solving anatomical problems independently. During the later years of the medical curriculum, there is opportunity to return to anatomy to learn the specialized anatomy of one's particular field of interest in medicine.

Department of Biochemistry

Professor and Chairman—R. W. Butcher
Professor—J. P. Flatt
Associate Professors—N. Brown, I. D. K. Halkerston, K. J. Hittelman
Assistant Professors—F. J. Chlapowski, R. B. Clark, T. B. Miller, Jr.
Instructor—L. A. Kelly
Research Professor—M. B. Hoagland
Associate Research Professor—F. Welsch

The Department of Biochemistry deals with specific tools both for understanding normal and disease states and for rationalizing therapeutic intervention in disease. As the role of biochemistry receives greater emphasis, it becomes increasingly important that the physician have a firm understanding of the molecular mechanisms by which cells carry out and control their various functions. An appreciation of these biochemical processes is fundamental to an understanding of contemporary medicine and, perhaps more importantly, to medicine in the future.

The vast amount of detail which presently comprises the discipline of biochemistry precludes comprehensive coverage in a medical biochemistry course. Therefore, stress is placed on the understanding of biochemical theory and principles, and rote memorization is discouraged. The synthesis and transformations of biochemical compounds by cells—with emphasis on structure-function relationships and control mechanisms—are presented in lectures augmented by informal conferences. Problem sets which stress deductive reasoning in the application of biochemical principles are used to illustrate both qualitative and quantitative aspects of biochemistry. The conferences are scheduled meetings held by one or two faculty members and groups of less than 15 students. They provide opportunities for discussion, extension or clarification of lectures and of problem set materials.

Department of Community and Family Medicine

Professor and Chairman—H. S. Fulmer
Professor—A. Yankauer
Associate Professors—R. F. Walton, L. Lipworth
Assistant Professors—W. M. Burke, J. J. Frey, C. W. Hays, T. C. McBride, L. G. Roy
Lecturer—J. H. Warram, Jr.

The Department of Community and Family Medicine, concerned with the identification and solution of community health problems, has broad teaching, research and service responsibilities.

In the education of medical students, a prime objective is the development of a perspective on the responsibility of the future physician for the community, along with the traditional responsibility for individual patients.

To attain such understanding, a certain body of knowledge, together with appropriate skills and attitudes, is of critical importance. The key learning situation is provided in study of the community as "a patient." By actually living and working in communities throughout Massachusetts, the student reviews the existing health status and health services and makes recommendations based on this study. Working directly with faculty, with practicing physicians, with other health workers in the community, and with other students, he learns to identify and quantify the current major health problems, health needs, current changes, and what responsibility he and others might have in guiding such change. He learns about the health needs of the consumers (as individuals and families), and the roles and functions of the providers of medical care. How medical care is and might be organized, financed and delivered is emphasized. In the process, the student learns about the private practice of medicine, the health department and other public agencies, the hospital, nursing home, the voluntary health agencies, experimental health care delivery systems, and the role of all existing and proposed varieties of health manpower. There is an opportunity to work in "team" situations with students in the other health and service professions. By disciplined exposure to health needs, manpower and services, students become specifically informed about the health status of the communities of Massachusetts and generally knowledgeable about medicine outside the university hospital.

In the first year, following a short introductory course, a three-week clerkship in the community is provided, during which the student studies consumers and providers of health services. In the second year the principles

of epidemiology and medical care are taught and discussed in the classroom, utilizing the experiences of the students during their first-year clerkship for some of the subject material. During a six-week field assignment in the clinical years, each student is expected to conduct a health study of an entire community, to apply the scientific approach to the study of a particular disease problem in the community, and to learn about health problems of individuals and families in the context of the community. Electives are offered during the school year and in the summer. In addition, during the fourth year, electives will be available in communities elsewhere in the United States and in the developing countries.

Program in Family Medicine

Associate Professor and Director—R. F. Walton
Assistant Professors—J. J. Frey, L. G. Roy

The program in family medicine provides a learning/training opportunity for medical students interested in continuous, comprehensive health care for all members of a family. Through the experience of family medicine, there is an effort to help students retain their sensitivity to the total needs of the patient and the family, to learn the skills of delivery and research in primary care, and to appreciate the role of the physician-advocate in the health care system.

The educational emphasis within family medicine centers on family dynamics, family/community interaction, development of team responsibility for patient care, as well as the clinical skills inherent in a competent family physician.

Primary training sites for family physicians are the model family practice units, community and referral hospitals, and the community via physicians, health care providers and community health agencies.

The responsibilities of family medicine in the first two years of medical school are found in the courses offered in community medicine. Family medicine also adds a dimension of clinical correlation to the basic skills of community medicine. The third and fourth year programs utilize family physician/preceptors and model family practice units for clinical experience.

Department of Medicine

Professor and Chairman—R. B. Hickler
Professors—S. M. Ayers, J. J. Calabro
Research Professor—E. Rosemberg
Associate Professors—E. Budnitz, M. Farmelant, S. Malkiel, J. A. Merritt, Jr., R. H. Saunders, Jr., O. E. Starobin, E. B. Weiss
Assistant Professors—R. K. Anand, C. A. Birbara, A. C. Brewster, B. R. Brown, W. T. Carleton, F. X. Dufault, L. M. Edelstein, R. B. Endriga, K. Farbman, N. Higano, R. L. Kendall, E. Landau, M. J. Lipson, H. H. MacGilpin, Jr., J. J. Massarelli, R. E. R. Meyer, L. J. Morse, P. E. Pletka, J. M. Seidman, J. B. Singh, L. M. Snyder, G. L. Spanknebel, I. N. Wolfson
Associates—J. Albert, P. Aney, M. Baum, P. E. Berman, R. E. Bessette, V. P. Birbiglia, G. Bowen, H. M. Dean, R. J. Dorris, N. Fortier, P. J. Gardner, D. A. Gilles, W. Halpern, P. F. Molinari, H. E. Rubin, A. D. Ward, W. S. Weir
Instructors—S. L. Garg, P. S. Schwartz, A. Shuster, R. F. Williams

The Department of Medicine contributes to student education during each of the school years. In all years the purpose is to help the student to organize basic information within a clinical context. It is emphasized that the physician combines the intellectual exercise of thinking of disease as a pathophysiological event with a concerned understanding of the impact of illness on a fellow human being.

During the first year, as part of the course in physiology, the clinical faculty gives a series of conferences that frequently involve the presentation of carefully selected patients. These sessions are designed to define the pathophysiology of specific clinical disorders of each of the major organ systems.

The course in medicine during the second year has several components. One-half day per week is set aside for physical diagnosis and the class is divided among the several affiliated hospitals. During the fall term a series of exercises focuses on the various parts of the physical examination. For the remainder of the year, students are assigned in pairs to a clinical instructor who supervises their history taking and physical examination on assigned patients. On alternate weeks, each student reviews in detail his written record of the medical history and physical findings on the patient seen the previous week. During the second half of the year weekly lectures are given to the assembled class by specialists who describe the clinical approach to patients presenting major symptom complexes, such as dyspnea, edema and anemia.

The clinical clerkship in medicine is conducted during 12 consecutive weeks, in the third year. Groups of students are assigned to the medical services at the affiliated hospitals where each works as an integral part of the ward team, participating in all activities of the medical department of the hospital. Each student evaluates two to three new patients per week and is assigned to a preceptor with whom he reviews, discusses and analyzes his clinical work on a regular basis. Each hospital provides at its discretion additional student instruction in specialized areas—*e.g.*, pulmonary laboratory, cardiac catheterization laboratory, electrocardiography, and the emergency room. During the medical clerkship instruction is also provided in three additional areas: radiology (12 hours), neurology (8 hours), and dermatology (4 hours).

The last six months of the fourth year are available for elective courses. Ample opportunity is afforded the student for a concentrated experience in the various laboratory-based clinical sub-specialties in medicine at the several affiliated hospitals, or at other medical centers.

Department of Microbiology

Professor and Chairman—D. J. Tipper
Assistant Professors—K. Farbman, A. Jacobson, T. J. Leighton, R. L. Taber, Jr.
Instructor—G. G. Khachatourians
Lecturer—H. L. Ozer

The Department of Microbiology teaches in the fall of the second year. The course is designed to provide a basic understanding of the physiology of microorganisms (bacteria, fungi, viruses), and of the response of the human organism to these microorganisms. Bacteria are the simplest, and in evolutionary terms, the oldest organisms on earth. Fungi resemble the most ancient of eukaryotic cells, and evolution of differentiated multi-cellular organisms has required the simultaneous development of effective mechanisms for protection against these potential parasites. In turn, these parasites and viruses also have continuously evolved to fit the ecological niche provided by the relatively protected milieu which is the host tissues. Host and parasites co-exist in a state of dynamic equilibrium. A section on the fundamentals of immunology starts the course, together with the virology section, and is followed by the section on bacterial infections.

Responsibility for discussing the genetics and control of gene expression of microorganisms and man is currently shared with the Genetics Department. A short first-year course forms the basis for discussions of gene regulation in many parts of the microbiology course, including viral infection, tumor production and the immune response mechanisms in man, and infectious drug resistance in bacteria.

Progress in the treatment of infectious disease has revolutionized the practice of medicine over the past 30 years and represents a pinnacle of success in the art and science of medicine. However, the interaction of host, pathogens and antibiotics is constantly changing, and optimal treatment is constantly evolving: a battle is continuously fought to maintain possession of that pinnacle. Application of this knowledge requires rapid and accurate diagnosis of disease and a proper knowledge of the basic mechanisms of action of antibiotics and of resistance to these agents. The student must learn how to use the literature, how to use the clinical laboratory properly, and how to evaluate the claims of the pharmaceutical manufacturers regarding new antibiotic agents. A section on antibacterial chemotherapy is followed by the section on fungal disease. The course ends with the parasitology section. Small group discussions and clinical correlation conferences supplement the formal lectures. Laboratory exercises and demonstrations are designed to illustrate diagnostic techniques.

Department of Obstetrics and Gynecology

Professor and Acting Chairman—R. F. Hunter
Associate Professors—D. E. Booker, R. J. Carpenter, Jr., A. R. Jones, S. Lerner, P. W. Ouelette, I. R. Pahl
Assistant Professors—J. B. Bettigole, R. K. Burke, L. C. Clarke, Jr., J. G. Fitzpatrick, T. F. Halpin, K. L. Kenler, P. Silva, K. W. Sinish, J. J. Zadworney
Associates—N. Epstein, J. S. Hollander, E. O. Hubbard, Jr.
Assistants—M. F. M. Ali, J. Baez, P. F. Harris

The Department of Obstetrics and Gynecology provides a variety of educational experiences in order to better prepare the student to deal with those conditions peculiar to women and to understand how the altered physiological state complicates other medical, surgical or mental illnesses.

Rapidly changing social values, new concepts in reproductive biology, a better understanding of the pathogenesis of disease, increasing perfection of technical skills and more sophisticated therapeutic agents and modalities have all had a profound impact on obstetrics and gynecology and are producing significant changes in this specialty. To some extent these changes are reflected in the curricular time devoted to this specialty in medical school. In some medical schools, the study of obstetrics and gynecology has become almost entirely elective and students may miss the opportunity to become familiar with the physiological processes and diseases peculiar to women. The establishment of a new school provides the opportunity for a fresh approach to the teaching of this important specialty.

The major clinical experience is provided through a six-week rotation at either the Memorial Hospital in Worcester, Massachusetts or the Wesson Women's Hospital in Springfield, Massachusetts. At these two hospitals, the student has access to the full range of obstetrical and gynecological problems as well as to out-patient facilities. Each student has the opportunity to participate in prenatal, oncological, family planning, fertility and high-risk pregnancy clinics. The clinical clerkship in obstetrics and gynecology is conducted during six consecutive weeks in the third year. Groups of students are assigned to the medical services at the affiliated hospitals where each works as an integral part of the ward team participating in all activities of the obstetrical and gynecological department of the hospital.

In the obstetrical clinics, the student becomes adept at taking the medical history and carrying out the physical examination of the obstetrical patient. Prenatal care is stressed as a dynamic process for the maintenance of the health of both mother and fetus, and for the early detection and correction of complications. Students have the opportunity to acquire considerable

experience in the conduct of normal and abnormal labor, carry out a suitable number of deliveries and, in addition, observe and assist at some of the more complicated procedures such as fetal monitoring, amniocentesis, intrauterine transfusion, cesarean section, etc.

On the gynecology service students are assigned to both ambulatory and hospitalized patients. Full-time faculty, residents and voluntary staff participate in the supervision and instruction of students in both formal and informal exercises in a variety of clinical settings.

In the fourth year students may elect additional training in specific areas of obstetrics and gynecology. Some of these provide opportunity for the student to function at the level of an intern within the hospital and clinic while others can be designed to permit work with individual private physicians. Included in the elective offerings are opportunities to become thoroughly familiar with technical procedures of special interest to students of obstetrics and gynecology.

Department of Pathology

Professor and Chairman—G. Majno
Professors—G. H. Friedell, R. A. MacDonald
Visiting Professors—P. E. Boyle (Oral pathology), H. E. MacMahon
Associate Professor—L. Pechet
Assistant Professors—E. DeGirolami, L. M. Edelstein, J. M. Gibson, R. S. Harper, L. P. James, Jr., D. T. Purtilo, J. Ruggieri, Jr., E. A. Soto, S. F. Murphy (Neuropathology)
Associates—W. J. Blake, G. B. Robbins
Instructors—R. W. Bain, M. Barbarich, J. B. Jacobs, W. F. MacGillivray
Research Associate—P. F. Molinari
Lecturers—W. A. Bardowil, C. J. DeWan, L. S. Gottlieb, A. T. Hertig, E. P. Richardson, Jr. (Neuropathology), S. L. Robbins, L. M. Snyder

The Department of Pathology course represents the medical student's first formal encounter with the notion of disease. Because the agents of disease are so many and varied (from bacteria and viruses to congenital defects, drugs, weapons, unhappiness and the physician himself) the pathology course must of necessity overlap with almost all other courses offered within the Medical School. It remains unique, however, in its approach—which is primarily to analyze the body's responses to injurious agents, whatever their nature.

Accordingly, the course opens with a brief introduction to general pathology, dealing with the basic manifestations of disease at the level of cells and tissues. This is followed by a longer section on special pathology, which is the study of specific diseases as they affect different organs and systems.

Throughout both sections, pathophysiology, *i.e.*, the relation of diseased structure to diseased function, is emphasized.

Lectures are kept as informal as is compatible with effective teaching. Most lectures are followed by laboratory sessions during which students examine the gross and microscopic changes caused by disease. Seminars and clinico-pathologic conferences are offered at appropriate times. Each student also participates in a few autopsies, including the "work-up" of such autopsies, as an exercise in synthesis. At the end of the course, a brief elective period allows students to pursue selected topics in depth, either at the Medical School or at hospital laboratories.

The course is intended to represent a judicious compromise between the wholly morphologic pathology of the Nineteenth Century, and the more recent integrated courses in which the guiding line of pathology is splintered and lost. The overall aim is to provide students with a sound basis for the study and practice of clinical medicine.

Department of Pediatrics

Professor and Acting Chairman—J. A. Duggan
Associate Professors—J. Brem, H. H. Shuman
Assistant Professors—C. A. Bergman, G. T. Critz, S. K. Dopkeen, A. J. Fitzpatrick, C. R. Guptill, A. Gurwitz, P. P. Karpawich, N. N. Khanna, M. Medalie, J. A. Riordan, C. A. Roy
Instructors—J. M. Cummings, Jr., R. K. Gedachian, D. M. Martin, A. Ramachandra, R. B. Rossi
Associates—J. H. Donovan, Jr., J. W. Harding, J. Izsak, E. Kaplan, D. P. Miller, R. G. Neuhardt, R. Pagano, R. M. Schmidt, J. F. Steele-Perkins

The Pediatric Department objectives are twofold: to offer the student an appreciation of those physical and functional differences which must be considered by the physician regardless of his field of concentration; and to afford the student a meaningful exposure to infants and children in order to assist him in making a career decision.

During the first year and early months of the second year the unique aspects of infancy, childhood and adolescence are correlated with the student's advancing knowledge of basic science through the clinical correlation conference. During these sessions a physician, aware of the content of the basic science course, presents clinical and lecture material designed to illustrate particular physiologic, pharmacologic and biochemical principles as they affect patient care.

During the latter half of the second year, coordinated with the course in physical diagnosis, a structured series of seminars and clinical demonstrations

is presented with emphasis on growth and development, illnesses peculiar to infancy and childhood, and the impact of environmental and social factors on the developing child. Clinical demonstrations are carried out by physicians of the community who are in active pediatric practice. Working with students in teams of two to four, they see patients at hospitals, in out-patient departments and in private offices. Seminar-lectures are presented to groups of eight to ten students.

The clinical clerkships in the third year consist of periods of six weeks during which the student, under supervision, sees patients in the out-patient department, emergency ward, physician's offices, newborn nursery and on the general pediatric ward. During the clerkship, plans are formulated for developing the student's interest in areas in which he wishes to concentrate his fourth-year elective.

Electives are available in Worcester in general pediatrics at the Worcester City Hospital and general pediatrics and neonatology at Saint Vincent Hospital.

Department of Pharmacology

Professor and Acting Chairman—T. B. Miller
Assistant Professors—W. J. Cooke, III, J. D. Feinblatt

The Department of Pharmacology course is usually considered to be a part of the basic science portion of the curriculum but forms a bridge between pre-clinical and clinical studies. Emphasis is given to basic pharmacological principles as they are related to modern therapeutics. After a general introduction, drugs are considered according to a classification by organ system and therapeutic uses. The biochemical and physiological basis of drug actions are considered. Also emphasized are the problems of drug toxicity and side effects. The important sources of information about drugs are discussed and consideration is given to the process by which new drugs are evaluated. Selected laboratory experiences, hospital visits and clinical correlation exercises are offered as illustrations of important topics and principles.

Department of Physiology

Professor and Chairman—H. M. Goodman
Professor—T. B. Miller
Associate Professor—F. S. Fay
Assistant Professors—W. J. Cooke, III, J. D. Feinblatt, P. Grigg, J. J. Singer and J. V. Walsh (leave of absence)

The Department of Physiology offers instruction designed to provide a working knowledge of the fundamental aspects of physiology and to provide a foundation for an understanding of the functional bases of both health and disease in man. Because continuing advancement in modern medicine rests in large measure upon progress in physiology, the student, and later the physician, must be equipped to keep abreast of new developments in the field. The course work therefore seeks to balance broad coverage of the wide range of physiological subspecialties with in-depth analysis of certain topics that are particularly illustrative of basic principles and methods of analysis. In this way, the student acquires both the factual background and the rational approach to the organization and evaluation of information that are the prerequisites for continuing self-education.

Studies in the Department of Physiology begin with intensive consideration of basic aspects of cellular physiology, with emphasis on the functions of biological membranes. Detailed consideration is given to the neurological membrane, its electrical properties, and the integration of neural impulses in the central nervous system. This is followed by an examination of the physiological systems responsible for the regulation of the cellular environment: the cardiovascular, respiratory, renal and gastrointestinal systems. The course concludes with a consideration of the integrative functions of the endocrine system. In addition to formal lectures, throughout the course there are frequent small group conferences, workshops and problem-solving sessions. A few selected laboratory exercises introduce the student to the instruments and techniques available for the study of physiological processes. They also provide graphic illustration of the concepts studied in the lecture hall. The laboratory exercises are supplemented with demonstrations and films.

Department of Psychiatry

Professor and Acting Chairman—E. Mason
Professor—D. J. Myerson
Associate Professors—S. Bloomberg, B. Guterman, L. Lebeaux, M. S. Meyer, J. E. L. Prunier, J. F. Scott, A. Varjabedian, J. Vorenburg

Assistant Professors—G. E. Deering, A. A. Ferrante, C. J. L. Nadeau, V. H. Pentlarge, E. R. Reiner, H. G. Reiss, M. R. Sills, H. L. Wylie
Associates—M. Gil, J. T. Murray, R. J. Parenty, A. Polcino, H. Romero
Instructor—T. W. Lebeaux
Assistant—C. B. S. Patel
Lecturer—R. S. Wolf

The Department of Psychiatry makes an effort to help the student understand the forces that mold modern man in his community. The effects of the internal and external environment on the development of the personality are examined and the interaction between psyche and soma is studied. The thread of development is followed from earliest life to the time of the senium, with emphasis on the periods of change. The effects of emotional and mental malfunction are studied in the laboratories of human behavior, *i.e.*, the community, home, school, job, the medical clinic and the hospital. Prevention and methods of treatment are also presented to the students.

In the first year, seminars are held on the subjects of human sexuality, psychosocial aspects of drug abuse, adolescence and death and dying, as viewed from the psychological, social and medical points of view. The class is divided into small units and these topics are discussed in an atmosphere of open discourse between students and seminar leader.

In the second year, the student is given an opportunity to learn about the theories of personality as viewed by the pioneers, *i.e.*, Freud, Eriksen, Horney, and Sullivan. The new developments in community psychiatry are examined and compared with older, more established treatment methods. In addition, at this point the student observes experienced psychiatrists examine patients. Finally, the pathology of psychiatry is examined as the class studies the neuroses, psychoses, and psychophysiological reactions.

During the third year, students may serve as clinical clerks in the psychiatric units of St. Vincent Hospital, Springfield Medical Center, or Franklin County Community Hospital and also on the wards of the Worcester State Hospital. At this time, they are able to observe the pathological processes that take the patient from his home. The psychoses, neuroses and character disorders are studied. Outpatient work is available in the hospitals and community mental health clinics to acquaint students with the problems of ambulatory mental illness and drug abuse.

During the fourth year, an elective period may be chosen in any community mental health facility that excites the student's interest and where the individual may learn and be of service. These include all of the affiliated hospitals, the Worcester Youth Guidance Center, and the Community Mental Health Centers.

Department of Radiology

Associate Professors—M. L. Janower, E. R. Kilroy
Assistant Professors—S. Balter, W. A. Carey, J. V. Carroll, D. J. Cavan, F. A. White
Associates—J. F. Lingley, J. D. Villiotte
Instructors—K. T. Benedict, P. S-Y. Chen, R. O. Danford, M. A. Weiner

Division of Surgery

Professor and Chairman—H. B. Wheeler
Professors—G. R. Dunlop, J. B. Herrmann, L. Soutter (Thoracic surgery)
Associate Professors—H. M. Constantian (Urology), D. Hight, R. A. Johnson (Neurosurgery), J. J. Manning, F. J. McCready, D. J. Reagan (Otolaryngology), J. F. Sherer, Jr. (Urology), W. T. Small, C. S. Whelan, E. Yasuna (Ophthalmology)
Assistant Professors—E. L. Amaral, R. Beals, R. D. Blute (Urology),

D. P. Brown, F. G. Cataldo, J. P. Chandler, W. H. Chang (Plastic surgery), H. G. Clermont, T. J. Condon (Ophthalmology), J. F. Curran, Jr., R. I. Davidson (Neurosurgery), C. Durham, L. M. Felton, Jr. (Urology), J. F. Furcinitti, J. W. Henderson, E. D. Horne, J. J. Howard, P. J. Howard, Jr. (Urology), S. A. Jaffee (Urology), B. N. Josephs, J. C. McCann, Jr., V. S. Mikoloski (Urology), J. B. Petter (Thoracic surgery), F. A. Pualwan, J. I. Sanders (Thoracic surgery), R. J. Utzschneider, S. D. Weinert (Urology)
Associates—G. R. Schultz (Ophthalmology), R. R. Singer (Ophthalmology)
Instructors—J. G. Cranford, J. J. B. Foley (Anesthesiology), N. H. Gomez (Plastic surgery), J. B. Liland (Otolaryngology), G. A. Meltzer (Ophthalmology)

The Division of Surgery participates in interdisciplinary teaching in the first two years and offers third-year students a 12-week introductory course in surgical care. Undergraduate teaching emphasizes those aspects of surgery which are pertinent to all practicing physicians, and not just those engaged in the practice of surgery. The emphasis is on the pathophysiology of surgical patients, rather than on surgical technique. Most of the students' time is spent in clerkships, which include the major surgical specialties. Emphasis is given to bedside teaching and direct student participation in patient care. An effort is also made to familiarize the student with the spectrum of careers in surgery and to indicate which surgical specialties are most needed at the present time. To assist in this objective, each student is assigned a preceptor in surgery from the voluntary clinical staff of surgeons practicing in the Worcester area. Fourth-year elective courses in surgical fields are also available.

Department of Orthopedics

Professor and Chairman—A. M. Pappas
Assistant Professors—N. M. Beisaw, R. B. Keller

The Department of Orthopedics portion of the curriculum provides an introductory approach to problems of the neuromuscular system. Topics covered include congenital malformations, trauma, infection, metabolic disease and neoplasm. Orthopedics presents the opportunity to integrate aspects of the pre-clinical sciences with pediatrics, medicine and surgery in an interdisciplinary approach to the neuromusculoskeletal system.

The elective program provides the opportunity for students to observe and participate in the practice relationship with orthopedic surgeons. Students attend conferences at the affiliated hospitals and participate in the surgical, office and emergency practice of the preceptor or group of preceptors. The orthopedists who have agreed to serve as preceptors for this program are located in various communities throughout the Commonwealth.

Standing Committees

Committee on Admissions

Dr. Richard H. Saunders, Jr., *Chairman*
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°On Military Leave of Absence.

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1973-1974 General Information

University of Massachusetts at Amherst

The *Undergraduate Catalog* of the University of Massachusetts at Amherst consists of the *Course and Faculty Bulletin* and the *General Information Bulletin*. All students are responsible for observing the rules and regulations thus published, as well as those published in *University Directions*. The University reserves, for itself and its departments, the right to change its announcements or regulations whenever such action is deemed appropriate or necessary.

It is the policy of the University of Massachusetts that any and all acceptance of students for admission be without regard to sex, creed, race, color, or national origin.

APRIL 1973

The University *Undergraduate Catalog* for the 1973-74 academic year is part of the One Hundred and Eighth Annual Report of the University of Massachusetts and as such is Part II of Public Document 31, Section 8, Chapter 75, of the General Laws of Massachusetts.

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For General Information Section

*Academic credit for Military and Air Science courses taught at the University was restored by the Trustees on May 2, 1973, retroactive for the 1972-73 school year. This action was taken while this publication was at the printer, hence credit information contained herein relative to Military and Air Science courses is superseded and should be confirmed with that department.

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A Message from the Chancellor

The University of Massachusetts at Amherst is a publicly supported institution which, in law, equity and tradition, makes us accountable to the citizens of the Commonwealth through the established processes of state government. This public accountability, in turn, places irrefutable and legitimate demands upon the University which profoundly affect the nature and scope of our purpose. Among these is the critical demand for providing an educational program of excellence and diversity to the broadest possible cross section of the people in this state.

At its most fundamental level, and perhaps the level most salient to prospective students, the University represents a rich combination of material resources and human expertise, of increasingly varied programs and diverse people, through which the individual is uniquely at liberty to test himself, to shape and extend his own capacity for knowing and for caring.

As students, your participation in this process, your commitment and tenacity, your questioning and even your impatience are not only welcomed, they are vital to the University's success in the future.

Randolph W. Bromery
Chancellor

Academic Calendar

Adopted by Faculty Senate, May 11, 1972

1973

Registration Day 1, Undergraduate	Tues.	Sep. 4
Registration Day 2, Graduate	Wed.	Sep. 5
Registration Day 3, Undergraduate	Thur.	Sep. 6
First day of classes	Fri.	Sep. 7
Holiday	Mon.	Oct. 8
Holiday	Mon.	Oct. 22
Monday class schedule will be followed	Wed.	Oct. 24
Counselling period begins (classes not suspended)	Mon.	Nov. 12
Counselling period ends	Sat.	Nov. 17
Thursday class schedule will be followed	Tues.	Nov. 20
Thanksgiving recess begins after last class	Wed.	Nov. 21
Classes resume	Mon.	Nov. 26
Last day of classes	Wed.	Dec. 12
Reading Day	Thur.	Dec. 13
Final examinations begin	Fri.	Dec. 14
Last day of final examinations, semester ends	Sat.	Dec. 22

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Registration Day 1, Undergraduate	Mon.	Jan. 28
Registration Day 2, Graduate	Tues.	Jan. 29
Registration Day 3, Undergraduate	Wed.	Jan. 30
First day of classes	Thur.	Jan. 31
Holiday	Mon.	Feb. 18
Monday class schedule will be followed	Thur.	Feb. 21
Spring vacation begins after last class	Sat.	Mar. 23
Classes resume	Mon.	Apr. 1
Holiday	Mon.	Apr. 15
Monday class schedule will be followed	Fri.	Apr. 19
Counselling period begins (classes not suspended)	Mon.	Apr. 22
Counselling period ends	Sat.	Apr. 27
Last day of classes	Fri.	May 17
Reading Day	Sat.	May 18
Final examinations begin	Mon.	May 20
Holiday	Mon.	May 27
Last day of final examinations, semester ends	Wed.	May 29
Commencement	Sat.	June 1

Associated Dates: Rosh Hashanah Sept. 27-28; Yom Kippur Oct. 6; Easter April 14.

The University of Massachusetts is the state university of the Commonwealth, founded under provisions of the 1862 Morrill Land Grant Act. Incorporated as Massachusetts Agricultural College in 1863, the institution became Massachusetts State College in 1931, and the University of Massachusetts in 1947. Rooted in the liberal arts tradition, the institution has grown steadily from the four teachers, four buildings, and handful of students at its opening session in 1867 to the present state university system of three major campuses.

Situated in the Connecticut River Valley, the Amherst campus consists of approximately 1,200 acres of land and 150 buildings, including classroom and laboratory facilities as well as residence halls and other units.

To augment the Commonwealth's university-level facilities, the University of Massachusetts at Boston was opened in September, 1965. The University's Medical School at Worcester, founded in 1962 by an Act of the Legislature, enrolled its first class in 1970.

The total resources of the University are dedicated to giving all qualified students full opportunities to develop their capabilities for service in a growing society.

Admissions

Applications for admission to the University at Amherst may be obtained from the Admissions Office in Amherst. Applications for the Boston campus may be obtained from the Admissions Office in Boston. See the final pages of this Bulletin for addresses.

When to File

High school seniors are advised to file their applications in the fall of the senior year. Unless the applicant has a superior record, an application should not be submitted until the first set of marks is recorded in the fall.

Deadline Dates

Applications must be *received* and *complete* no later than:

In-State—March 1
Out-of-State—February 1
Foreign—February 1.

Tests Required

The Scholastic Aptitude Tests (SATs) may be taken on any of the scheduled dates, although the November testing date is preferred. The March and May dates are too late for seniors, but are appropriate for juniors taking the tests for guidance purposes.

The Amherst campus applicant is required to submit results of the SATs given by the College Entrance Examination Board. Although Achievement tests are not required, the University strongly recommends that each applicant submit results of three Achievement tests, one of which should be English Composition. The other two may be the applicant's choices.

The Boston campus applicant must submit scores of the SATs and three Achievement tests including English Composition.

Postgraduate and out-of-state students are required to submit scores of the SATs and three Achievement tests including English Composition. *Foreign students* must submit results of SATs and TOEFL (Test of English as a Foreign Language).

ALL COLLEGE BOARD TEST REPORTS MUST BE SENT DIRECTLY TO THE UNIVERSITY FROM THE COLLEGE BOARD TESTING CENTER. The applicant should be sure to request that the scores be sent to the campus to which application has been made and to give the correct College Board number for the campus chosen. No action can be taken on an application until official scores have been received by the University.

Preparatory Studies

The applicant's secondary school preparation must indicate the capacity of the student to handle the quality of scholastic work which the University has established as its standard of achievement. A prerequisite for admission is the satisfactory completion of a four-year high school course or its equivalent. A minimum of sixteen units should be offered, distributed according to the following recommendations:

English	4
College Preparatory Mathematics	3*
Foreign Language (two years of one language)	2
U.S. History	1
Laboratory Science	1

*Preferably two years of algebra and one of plane geometry.

The minimum of five other units should be offered in the areas of mathematics, science, foreign language, history and social studies, or free electives (not more than four units).

The student planning to major in physical sciences or mathematics should, if possible, offer two years of algebra, one year of plane geometry, and one-half year of trigonometry. Preparation in analytic or solid geometry, chemistry, physics, and introductory calculus is also strongly recommended.

The student planning to pursue an engineering curriculum should offer two years of algebra, one year of plane geometry, and one-half year each of trigonometry and solid geometry. Chemistry and physics are also advised. Any student deficient in the mathematics requirements should plan to make it up during the summer prior to entrance or should expect to take five years to complete the college course.

Several of the University's schools and colleges do stipulate intermediate language proficiency as a graduation requirement. The student planning to major in such areas will find at least three years of secondary school language preparation advantageous.

The exceptional candidate whose secondary preparation is not within the framework of the above recommendations may be considered for admission. Suitability for admission will be based on other intellectual aptitudes and achievements and readiness for the University curriculum.

Nonresident Candidates

The University of Massachusetts is limited to a 5 percent nonresident quota with thousands applying for the few vacancies available, making admission highly competitive for nonresidents of Massachusetts. See "Residence Status," p. 10.

Transfers

Any student who has been previously enrolled in a college is considered a transfer and must file a transfer application form. The University considers for transfer only those applicants who have completed a minimum of two years of work at another institution.

Priority is given to transfer candidates from Massachusetts who complete a two-year transfer program at any of the Commonwealth's state or city supported community and junior colleges. Remaining transfer vacancies are filled on a competitive basis by candidates seeking transfer from other institutions. Transfer vacancy for the out-of-state resident is extremely limited.

A minimum of 45 semester credits must be taken in residence at the University in order to receive a bachelor's degree.

Applications must be *received* and *complete* prior to April 1 for fall semester consideration, and prior to November 1 for spring semester consideration. It is the student's responsibility to be sure that all transcripts, including the most current, have been forwarded to the admissions office before the stated deadline dates. Decisions are made late in the semester prior to proposed entrance.

Campus Visitations

Amherst: The University recognizes the importance of a firsthand acquaintance with the colleges the applicant may be considering, and hopes that all applicants will find it possible to visit the campus for their own information and satisfaction. *An interview,*

however, is not part of the admission procedure. It is physically impossible for the admissions staff to interview all applicants; therefore, a personal conference will be scheduled only if the candidate or the candidate's guidance counselor has a question which cannot be readily resolved by correspondence.

Group information sessions are conducted on certain scheduled weekdays only. Candidates who wish to come to a group session should contact the admissions office and request the scheduled group session dates. The admissions office is not open on Saturdays.

Guided tours by student guides are available throughout the year. Tour information may be obtained from the University Guide Service at the Campus Center.

Notification of Decisions

In most cases the applicant will be notified by mid-April of the action taken on his application. The applicant who presents a strong academic record, enthusiastic school recommendations, and satisfactory College Board scores will receive earlier notification. This early notification should reassure the well qualified applicant regarding college entrance and enable the student who has selected the University to settle his plans. An applicant accepted at an early date, however, is under no pressure to make a final decision in regard to choice of college before the Candidate's Reply Date. In this way the burden of multiple applications on high school guidance counselors and college admissions officers may be lessened.

Veterans' Applications

A veteran must submit a regular freshman or transfer application, whichever is appropriate, and submit results of Scholastic Aptitude Tests taken within the past two years.

Veterans' Affairs

All University matters involving veterans' affairs should clear through the veterans' coordinator in the Financial Aid Office.

An eligible dependent of a veteran who is entering the University for the first time should present a Certificate of Eligibility at registration. This may be obtained from the nearest Veterans Administration office. Board, room, and fees must be paid in advance whether the student is enrolled under the G.I. Bill or not.

A veteran's dependent who is transferring to the University from another institution or who has done summer work at another institution should present a supplemental Certificate of Eligibility at registration. This may be obtained through the veterans' office at the institution last attended.

Physical Exam

Physical examination by his or her personal physician is required of each entering freshman, re-entering student, and student participating in athletics. Physical report forms for this examination will be mailed to each student with the bill for the first semester and must be completed and returned to the University Health Services ten days before the opening of the semester. Evidence of a *successful* smallpox vaccination and active tetanus immunization is required.

Residence Status

As a state institution the University offers a low rate of tuition to every student entering from the Common-

wealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the Board of Trustees.

A student must present evidence satisfactory to the Treasurer of the University that his domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. This means that he must have established a bona fide residence in the Commonwealth with the intention of continuing to maintain it as such.

The domicile of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation the student, in addition to the requirements of these regulations respecting residence, shall present satisfactory proof of emancipation. A minor under guardianship shall be required to present, in addition to the certification of the domicile of the guardian, satisfactory documentary evidence of the appointment of the guardian. No student shall be considered to have gained residence by reason of his attendance in the University, nor shall a student lose residential preference during his continuous attendance at the University. The residence of a wife shall follow that of the husband.

The prescribed form of application for classification as to residence status must be submitted by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University. Discretion to adjust individual cases within the spirit of these rules is lodged with the Chancellors of the University.

Freshman Orientation

Every student entering as a freshman must attend a two-and-one-half-day orientation program at a specified time during the summer prior to entrance. The program consists of academic placement testing, counseling, and preregistration for courses to be taken during the coming semester and orientation to social and academic opportunities available to undergraduates. Each student is assigned a faculty adviser who will help in the selection of courses and planning of a class schedule. On the final day of each of these periods, a special program is held for parents so that they may learn more about the University.

Each freshman attending the summer orientation program on the Amherst campus will pay a non-refundable fee of $30 to cover the cost of meals, housing, testing, and counseling. Every incoming transfer student must attend a summer preregistration program on the Amherst campus. A $15 nonrefundable fee is required of each transfer to cover the costs of preregistration, counseling, and lodging.

Grading

Enrollment in and graduation from the University involve both quality and quantity of work. The quantity of work is measured by the credits obtained by successful completion of courses. The quality of work is measured by grades.

Each grade is equated with a quality point as noted below. The quality point average required for continued enrollment and for graduation is set by the Faculty Senate. The cumulative average required for graduation is 2.0. Minimum number of credits required for graduation is 120.

Grades are reported according to the following letter system: Grades of A, AB, B, BC, and C are given for satisfactory work; grades of CD, D, and F are given for unsatisfactory performance. A grade of CD or D in a single course indicates little aptitude or application on the part of the student in that particular subject. Grades of CD, D, and F in a number of courses are indicative of work below standard for college work.

A—EXCELLENT—Outstanding accomplishment, showing distinction in intellectual achievement. This grade is not automatically assigned to those students who have received the highest ranks in a class.

AB—INTERMEDIATE—A and B.

B—GOOD—Performance of consistently high quality.

BC—INTERMEDIATE—B and C.

C—ACCEPTABLE—Performance which fulfills essential course requirements in quality and quantity and which meets the accepted standard for graduation from the University.

CD—INTERMEDIATE (below graduation standard)—C and D.

D—PASSING (but not satisfactory)—Performance which falls below the standard for graduation but for which course credit is granted.

F—FAILING—Performance undeserving of course credit.

INC.—INCOMPLETE (subject to conditions).

P—PASS—Indicates passing grade in special Pass/Fail registration. Quality points per semester hour will be assigned as follows:

A, 4.0; AB, 3.5; B, 3.0; BC, 2.5; C, 2.0; CD, 1.5; D, 1.0; F, 0; P (not included in computation of grade averages).

The semester grade point average, as well as the cumulative average, is determined by dividing the total points earned by the total credits carried.

In computing grade point averages the following will not be included:

1. Grades not earned at the University.
2. Courses satisfied by advanced placement.
3. A pass/fail course which has been successfully completed.

Any student whose semester quality point average falls below cumulative requirement is warned of his status by the Registrar and informed of the regulations governing academic termination of enrollment. A student who achieves a high average is placed in one of three honors groups, as follows: First Honors: 3.8 or higher; Second Honors: 3.4 to 3.7 inclusive; and Third Honors: 3.0 to 3.3 inclusive.

Degree Candidates

FULL-TIME STUDENTS
Any student carrying 12 or more credits must be an accepted degree candidate and be assigned to a graduating class.

REDUCED-LOAD STUDENT
A full-time student may obtain exemption from the minimum load requirements set by the Faculty Senate only with the approval of the academic dean and the recommendation of the appropriate one of the following: Health Services, Area Director, Office of Nonresident Student Affairs, or Counseling Center. Such exemption is ordinarily not granted except upon the basis of health or critical personal or academic problems.

A Reduced-Load Student is considered a full-time student in *all* benefits, fees, and obligations. Although a reduced-load student carries less than the minimum load, the appropriate semester and cumulative quality point requirements for retention do apply and the semester counts as one of the maximum of ten toward graduation.

NONCLASSIFIED DEGREE STUDENT
A student who is admitted to degree status on the same basis as a full-time student but with the expectation of only part-time pursuit of the degree is considered a *Nonclassified Student,* and is given a classification of "NC." For initial enrollment an NC student is processed as an incoming freshman or transfer student and is assigned to a major department for appropriate counseling and preregistration advising.

A Nonclassified Student is not entitled to student benefits other than departmental support. To be eligible for continued enrollment, the nonclassified student must maintain a cumulative average equal to the graduation average of the University. The category "Nonclassified" is an original admissions category and is not designed as a category into which a full-time student may revert for purposes of part-time study.

Nondegree Students

SPECIAL STUDENT
A transient student accepted for one or two courses on a *noncontinuing* basis is assigned to this category (Class designation "SP"). No evaluation of transfer credentials or course advising is offered to the student in this category, nor is entitlement to any student benefits. Continuance is not automatic, but at the discretion of the appropriate admissions officer. A minimum of the graduation average of the University is required for an "SP" to continue. The Special Student category is an original admissions category and is not intended as a category into which a full-time student may revert for purposes of part-time study.

Advisory System

Each freshman selects a tentative educational objective and is assigned a faculty adviser within that academic area.

In the second semester of the freshman year, each student is given an opportunity to change to a new department or to remain in his current department. In succeeding semesters, a student may change to another major department by execution of a Major Change Card (available in the Registrar's Office).

It is the function of his adviser to help the student in adjusting himself to the work and life of the University. Academic progress reports issued by the Registrar's Office are sent to the adviser periodically, and the student is expected to report to the adviser from time to time to discuss current academic standing.

The University also forwards reports of academic standing to the parents. Both student and parents are encouraged to consult with the adviser whenever there are problems regarding studies or personal adjustments to college life.

Superior Students

The University regularly provides the superior student with challenging educational programs extending from the freshman through the senior year. These include Advanced Placement and Special Honors Programs.

Many entering students are able to achieve advanced standing and credit for college-level courses successfully completed in their secondary schools as part of the College Entrance Examination Board Advanced Placement Program or an equivalent. The University also administers a number of its own advanced placement tests. A student who demonstrates proficiency in a basic college subject may bypass the beginning course and go on to advanced work in the subject. Also, up to thirty semester hours of credit may be granted a student of high standing who can fulfill some course requirements through independent study.

The College Honors Program provides special guidance and courses for students of superior ability. Students are selected for the program as freshmen or sophomores. The Senior Honors Program recognizes merit and gives highly qualified students time and opportunity for independent study under closer, more personal direction than is ordinarily provided in the University curriculum. Students who complete their work satisfactorily are eligible for graduation with honors.

Policy
Recognizing the educational advantages of both classroom instruction and extracurricular experiences, to which residence-hall living can contribute a great deal, the Board of Trustees of the University has adopted a policy which requires undergraduates to be housed in University residence halls.

Exemptions
Exempt from this policy are married students; students who have reached twenty-one years of age on or before the first official day of classes; members of fraternities and sororities who have been authorized to reside in their respective houses (within approved maximum capacities); and students who commute from the homes of their parents or spouses.

A student living in a University residence who seeks permission to live off campus should submit the request to the appropriate Area Director. All others should submit similar requests to the Housing Office before appearing on campus for registration.

Room Assignments
Residence halls are opened to sophomores, juniors, and seniors on the day before registration. Upperclass students have the opportunity to select rooms in the spring of the preceding year. Rooms are assigned in order of receipt of proper application. Notification of assignment is made in mid-August.

Freshmen are notified three to five days before registration of the date they should arrive on campus to participate in Freshman Week activities. An effort is made to assign roommates to freshmen on the basis of different geographical areas and similar interests.

Housing Plans
The University recognizes the desirability of providing a variety of living arrangements; hence, it offers three basic systems: "Traditional" residence halls, residential colleges, and suite- or apartment-style residence halls. All three plans offer opportunities for intellectual, cultural, and social activities, and all three include some coeducational units, in which the sexes are separated by floors or wings.

The Central and Northeast Residence Areas consist of twenty-one residence halls housing 4,000 students. A "traditional" residence hall is a house with a long-standing tradition of fellowship, unity, and loyalty. The traditional hall, by its very nature, provides opportunity for meaningful friendship in a relaxed atmosphere.

The Orchard Hill Residential College, housing approximately 1,300 students in four coeducational residence halls, represents a planned and conscious attempt to make these residences more private, more quiet, and more academic in tone than most residential units. Each of the units within the college has student personnel and faculty as advisers who provide cultural as well as academic assistance and who coordinate the collegiate aspect of the academic program. *The Southwest Residential College,* which houses 5,500 students in both high-rise and low-rise buildings, operates on the assumption that a "college" within a university may function to provide more effective

 small-group identities and a maximum of contact between the students and members of the faculty.

Special sections of selected courses are designated for residents of both residential colleges. Music and dramatic events, special lectures, and discussions take place in residence halls. Faculty Fellows of the college and students participate equally in the planning of these. Students of the colleges are welcome to participate in as many of these activities as they find to their advantage.

The Sylvan Residence Area offers suite-type dormitories, affording students an opportunity to build close living relationships within small groups by sharing quarters in a suite- or apartment-style arrangement.

Room Furnishings

Most residence hall rooms are provided with beds, mattresses and mattress covers, dressers, desks, desk chairs, closets, and mirrors. In addition, most residence halls have study lounges, kitchenettes, laundry facilities, and vending machines. The residence halls within the residential colleges are provided with draperies and lounge chairs.

Each student is expected to provide pillow, linen, and blankets. A local rental service can supply a weekly change of bed linen and towels; blankets and pillows may also be rented.

Most residence halls are equipped with room telephones. Students who choose to live in these residence halls are charged an additional fee per semester for the basic telephone service.

Residence-Hall Staff

AREA DIRECTORS

Each residence area is administered by an Area Director, to whom all staff personnel in a residence hall report; Area Directors, in turn, report to the Vice-Chancellor for Student Affairs. Area Directors plan and direct all student personnel administrative activities for the residence halls in a given campus residential area; supervise the professional staff and student assistants in the residence halls; advise elected officers and committee chairmen in the residence halls; and provide individual and group advising.

HEADS OF RESIDENCE AND RESIDENCE DIRECTORS

The Heads of Residence and Residence Directors are responsible to the Area Directors. They work jointly with the counselors and Housing Office in the operation of residence halls. They provide leadership and support to the residence hall staff; facilitate the work of elected house government officers and committee chairmen, serving as resource persons and discussing University expectations with them; provide individual and group advisement out of concern for the welfare of students within the residence halls; and carry out administrative responsibilities associated with the operational aspects of residence halls.

COUNSELORS

Counselors receive direct supervision from the Heads of Residence and general supervision from the Area Directors. Their duties include helping to establish a climate in which students will feel free to seek assistance and in which the educational goals of the University are emphasized; counseling individual students in personal, social, and academic matters; working jointly with the Heads of Residence and house government

in providing for the daily operation of the residence halls; interpreting and maintaining regulations with respect to student life on campus; and assisting the Heads of Residence with administrative tasks in the residence halls.

Room Rent

It is Board of Trustees' policy that "charges established . . . shall not be refundable to a student after he has occupied his assigned accommodation except upon certification of the Dean of Students that such student has withdrawn from the University because of involuntary entry into military service or other reason of extreme emergency, the refund in such event to be the balance of the charge paid over that applicable to the period of actual occupancy plus one week." Further information, for which students are held responsible, is contained in University Directions.

Residence halls are constructed, equipped, and maintained, at no cost to the taxpayers, through funding provided by bonds issued by the University of Massachusetts Building Authority. Room rents are fixed so as to provide a fund sufficient to pay building and operating costs, i.e., to amortize the bonds. In order to meet payments on the various residence hall bond issues and to assure the minimum possible room rent, the University must maintain maximum occupancy of residence halls. This requires that a student be held financially responsible for room rent once registering for and occupying a room in a residence hall.

Room Security Deposit

A student who lives in a University residence hall must pay a $100 room security deposit over and above the regular room rent. The deposit shall be paid upon initial entrance to the University and shall be refunded as follows:

a. Upon graduation from the University;
b. Upon voluntary withdrawal from the University, release of assigned housing, or intention not to reregister filed in writing with the Registrar (provided such notice is filed *forty-five days prior to the registration date of the next semester);*
c. Upon involuntary call into military service; or
d. Upon academic dismissal from the University.

A student forfeits the deposit if, having reserved housing, he or she does not occupy it, unless written notice in accordance with regulation on voluntary withdrawal (above) has been given and accepted, or upon dismissal from the University for disciplinary reasons.

Apartments for Married Students

The University owns and operates three groups of apartments for faculty and married graduate and undergraduate students: University Apartments, Lincoln Apartments, and North Village Apartments. As they become available, these apartments are offered to applicants according to a predetermined order of priority and assignment procedure. It is suggested that married students apply for Lincoln Apartments and North Village Apartments as soon as possible. Due to many previously received applications, however, it may be unlikely that an apartment can be assigned by the desired occupancy date. Applications and specific information may be obtained from the Off-Campus Housing Office, Whitmore Administration Building.

Off-Campus Housing

A card file of off-campus house, apartment, and room

rentals is maintained by the Off-Campus Housing Office. Also provided is information about local realtors, garden apartment developments, classified newspaper rentals, and persons seeking roommates. Every effort is made to assist students to obtain off-campus housing; however, a personal visit is usually necessary for the student to review rental listings because of daily changes in the card file and because all off-campus arrangements must be made by the parties involved. Brochures and other information may be obtained from the Off-Campus Housing Office, Whitmore Administration Building.

Insurance

It is not possible for the University to carry insurance which will compensate students or their families for losses suffered on the campus due to such hazards as fire, theft, or water damage. For most families such insurance is highly desirable, either as an extension of present home insurance or as a special contract.

Food Services

The University Food Services cater the food requirements of the University, except those services offered by the Campus Center Complex. Five dining commons serve students on a five-day meal ticket contract. All freshmen, sophomores, and juniors residing in University residence halls are required to purchase the five-day meal ticket. Either a ten-meal or a fifteen-meal ticket, which is valid for either two or three meals per day, Monday through Friday, may be selected. Students over twenty-one years old prior to the start of the semester are exempt from the plan. Students who are members of fraternities or sororities may be permitted to board at their respective fraternities or sororities, upon receiving written permission from their respective student personnel deans. Those not required to board on campus may eat at a dining commons on a cash basis; they may purchase one of the regular meal tickets for ten or fifteen meals per week, or they may purchase a five-day single-meal ticket at a lower rate. Weekend meal tickets are also available. Snack-bar services are available at Worcester Commons and Hampden Dining Commons during regular hours of operation.

Amherst Campus

Expenses are approximately $2,000 per year for the normally economical student. First-year costs are usually greater than those of the other three years, and there are fewer opportunities for earnings. Therefore, a student is advised to have a definite plan for meeting the expenses of the first year before entering. The following estimate of a year's expenses, based chiefly upon last year's costs, includes only those items which are strictly University-related and does not include amounts for clothing, laundry, travel, etc. These costs vary slightly from year to year. Tuition for residents of Massachusetts is $250 per year; for others, $850. The University reserves the right to change any fees without advance notice.

ESTIMATED ANNUAL EXPENSES—AMHERST

Tuition (Residents of Massachusetts)	$ 300.00
Room Rent in University Residence Halls	675.00*
Telephone (Where Available)	40.00
Board at University Dining Halls (Five Day Plan—Approx)	640.00
Athletic Fee	30.00
Physical Education Fee	20.00
Campus Center Fee	60.00
Fine Arts Fee	6.00
Student Activities Tax (Approx)	40.00
Student Health Service Fee	77.00
Student Medical/Surgical Insurance (12 Months' Coverage—Optional)	40.00
Books, Stationery, Laboratory and Other Supplies (Approx)	200.00
	$2,128.00

INITIAL PAYMENT FOR FRESHMEN—AMHERST

Tuition (Residents of Massachusetts)	$ 150.00
Room Rent in University Residence Halls	337.50*
Telephone (Where Available)	20.00
Board at University Dining Halls (Five Day Plan—Approx)	320.00
Athletic Fee	15.00
Physical Education Fee	10.00
Campus Center Fee	30.00
Fine Arts Fee	3.00
Student Activities Tax (Approx)	20.00
Student Health Service Fee	38.50
Student Medical/Surgical Insurance (12 Months' Coverage—Optional)	40.00
Books, Stationery, Laboratory and Other Supplies (Approx)	100.00
	$1,084.00

*There are other annual rates of $615, $680, and $700.

Boston Campus

The direct costs involved in attending the University of Massachusetts at Boston are appreciably lower than those for attending the University of Massachusetts at Amherst. Major difference is the cost for room and board; since the University of Massachusetts at Boston was created as a non-residential college, its students live and board at home or under non-college arrangements. Certain other expenses which are obligatory at the University of Massachusetts at Amherst are not required for the University of Massachusetts at Boston students.

The following schedule of tuition and fees includes only those items which are strictly college-related and does not include amounts for clothing, laundry, travel, etc. Expenditure for books, stationery, and other supplies is estimated to be $200 per year for all full-time students.

SCHEDULE OF TUITION AND FEES—BOSTON

	Full-time	*Part-time*
Tuition (residents of Massachusetts)	$ 300	$ 15/credit hour 150/semester maximum
Tuition (non-residents)	1100	55/credit hour 550/semester maximum
Student Activities Fee	30*	20*
Student Medical/ Surgical Insurance, 12 months' coverage (optional)	30*	30*
Student Health Fee	28	14

* subject to change

The initial payment for first semester expenses, required of freshmen at the time of fall registration, is $194 for students who are legal residents of Massachusetts and $624 for non-resident students.

Explanation of Fees and Payments

IN-STATE TUITION

As a state institution, the University offers the privilege of in-state tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the policy established by the Trustees and detailed under "Residence Status," page 10.

ATHLETIC FEE

Funds received from this charge are used to support comprehensive men's and women's intercollegiate programs as well as intramural programs.

PHYSICAL EDUCATION FEE

Income from this fee is used to support the required physical education program, intramural athletics, and general recreation.

CAMPUS CENTER FEE

Funds received from this charge are used to support the Student Union and the Campus Center and meet the operating costs of their various activities.

FINE ARTS FEE
Funds received from this fee are used to support a varied and comprehensive program of fine arts events for the cultural enrichment and enjoyment of the undergraduate body.

STUDENT ACTIVITY TAX
This tax supports student government and an extensive and varied range of cultural and social activities for students. In addition, payment entitles each student to admission to many campus events and includes a subscription to the daily student newspaper, the annual yearbook, the student handbook, and a student guide to the campus.

HEALTH SERVICES FEE
Funds received from this charge are used to support the medical, psychiatric, and health services provided by the staff of the Health Center.

MEDICAL-SURGICAL INSURANCE
This is an *optional* plan intended to supplement the care received by students at the Health Center. It provides hospital, medical and surgical care on a twelve-month basis for injuries or illness during the school year, holidays, summer vacation, and other times when the student is off campus. Students who register for the fall semester have only one *opportunity* to enter or reject this program each year, at the time of payment of the fall semester bill. It is also offered on the spring semester bill for new spring registrants only. Married students desiring family coverage under the plan now in existence at the University are advised to contact the Student Health Services. All candidates for and members of intercollegiate athletic teams *are required* by the Athletic Department to subscribe to the supplementary insurance plan.

COMMENCEMENT FEE
A commencement fee of $10 is assessed students in September of their senior year, as commencement exercises and events are intended to be self-supporting.

SPECIAL UNDERGRADUATE STUDENTS
The Special Student tuition rate is $15.00 per credit for Massachusetts residents, up to a maximum of $150.00, and $55.00 per credit for nonresidents, up to a maximum of $550.00. Every student must pay a $1 identification card fee yearly, and a student taking three or more courses a semester must pay a Campus Center fee and a health fee.

CREDIT BY SPECIAL EXAMINATION
Any student receiving credit by special examination must pay $5 per credit before the examination may be taken. This fee is nonrefundable.

SCHOLARSHIP PAYMENT
Known scholarships are shown on the fee bills. If such items are not shown, deductions may not be made from the bill until satisfactory evidence has been presented to the Bursar's Office by the recipient.

Payment Due Date
In accordance with University policy, all charges for tuition, fees, board and room rent in University Residence Halls are due and payable prior to the date of registration of each semester. Bills will be rendered in advance with due date shown and payment may best be made by mail. No student may register until all University charges are paid.

Late Payment and Registration

Any student who does not make payment of his semester charges by the date specified may be required to pay a late payment fee of $5.

Refunds

TUITION AND FEE REFUNDS

A student who leaves the University for any reason, except as specified below, before a semester is completed will be granted a pro rata refund of tuition and fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given a full refund of tuition and fees. The $15 matriculation payment required of new students is not refundable.

Refunds are first applied to reimburse scholarship or loan funds (up to the full amount), and any remaining amount is refunded to the student or parent. A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

Refund Schedule

Regular Term

a. Within the first two weeks from the beginning of semester or term (Registration Day)—80%.
b. During the third week—60%.
c. During the fourth week—40%.
d. During the fifth week—20%.
e. After the fifth week—no refund.

Summer Session

a. During the first week—60%.
b. During the second week—20%.
c. After the second week—no refund.

ROOM RENT AND BOARD REFUNDS

A student who has made an advance payment of room rent will be granted a full refund of prepaid room rent if he or she fails to attend any part of the next semester or term or does not reside in a residence hall or other housing. Prepaid board will be refunded on a special per diem basis.

A new policy of Room Rent Refunds was placed in effect by the Board of Trustees beginning with the Spring Semester 1973. According to the new policy, "student room rent refunds shall be refundable according to the following instructions: Any student who occupies his/her assigned accommodations and subsequently leaves the University prior to the end of the first full class week shall automatically be charged a minimum of $100 for his/her room. Any student who leaves the University during the second through fifth weeks shall be charged $100 plus 20% of the remaining balance for each week or part thereof. No refunds will be made after the fifth week of the academic semester. Refunds will be made during the refund period only to students who officially withdraw from the University through the Registrar's Office and according to the Registrar's official withdrawal date. The Dean of Students' Office will be authorized to make exception to the above only for reasons of involuntary entry into military service or for reasons of 'extreme emergency'. Any exception made, however, shall not apply to the $100 minimum charge which shall be levied in all cases automatically."

Student Personnel Services comprise a number of agencies with primary concern for students' nonacademic (out-of-the-classroom) activities—residence halls, health, counseling, student activities, security, admissions, records, nonresident student affairs, career planning, financial aid, and related services.

The Dean of Students directs and supervises the activities of all Student Personnel Services in order that they might serve most effectively to meet the broad educational goals of the University.

The Associate Dean of Students is responsible for the general administration of all residence halls and the activities program of men and women undergraduates. The Associate Dean's Office includes in its staff grouping the Housing Office, Coordinator of Student Activities, Campus Center Manager, the Area Directors, and all Heads of Residence.

The Assistant Dean of Students—Coordinator of Student Activities administers and coordinates all student activities, ranging from individual needs to organized clubs, the Classes, the Campus Center Governing Board, and the Student Senate. The base of operation is the Student Activities Office, which is composed of the Recognized Student Organizations (RSO) financial and accounting service and the Program Office, whose personnel advise and assist in the planning and execution of student projects and programs.

The Office of Nonresident Student Affairs is responsible for administrative liaison with and development of programs for nonresident students—commuters, fraternity residents, and sorority residents. The Greek Area Coordinator and Fraternity Manager are located in these offices.

The Housing Office has responsibility for the supervision of residence hall room assignments and room changes and serves as a central source of information for off-campus housing listings.

The Campus Center Manager administers and coordinates the management policies for the Student Union-Campus Center. The duties include close coordination with the Campus Center Governing Board, serving on various committees concerned with student services, and supervision of the Campus Center staff and services. Major areas of responsibility include the University Store, Campus Center Food Services, Student Union Lobby and Games Area, Campus Center overnight accommodations, Parking Garage, and Print Shop.

The Director of International Programs, located in the Office of the Provost, assists and coordinates international programs, including the study abroad programs of the University of Massachusetts. Students can obtain information from the Office of International Programs on a range of overseas study programs, including those operated by other American colleges and universities and by foreign institutions. This office also has information on low-cost international travel, international student identity cards, financial aid for study abroad, and work opportunities overseas. Students planning to go abroad for work, study, or travel should consult the Director in making these plans. The Director also coordinates Marshall and Rhodes Scholarships.

The Foreign Student Adviser offers assistance to foreign students, faculty, and staff and should be consulted in regard to all matters pertaining to their offi-

cial immigration status while in the United States. In addition, the adviser may be consulted regarding any other problems which a person from another country may encounter while at the University. These questions may include help in finding housing, help with financial matters including the authorization of foreign student loans, relations with American students and the community, and personal problems. He further attempts to help in coordinating community service projects, such as speaking engagements, trips to the United Nations, host families, and International Club activities. The Foreign Student Office is part of the International Programs Office.

The Admissions and Financial Aid Office is responsible for all administrative procedures with respect to undergraduate admissions to the University, including liaison with high school guidance counselors, Community College staff personnel, and other admissions officers for transfer students; it also passes on readmission of returning and re-entering students and admissions standards set in coordination with the Vice-Chancellor for Academic Affairs and academic departments. The admissions deans also serve as advisers to the various academic-year classes.

The Registrar's Office is responsible for registration (enrollment) and matriculation of undergraduate students at the University; administrative procedures relating to course loads, courses of study, withdrawals, grade reports, and transcripts; and maintaining the permanent academic record cards.

The Office of Transfer Affairs is a resource center for all matters pertaining to the transition process of students entering the University from other institutions of higher education. (Nearly one-fourth of all newly entering students are transfers. The major portion of transfer students come from the state-supported Community Colleges.) This Office also coordinates with the Community College system the mechanisms for admission, credit evaluation, financial aid, and orientation, and is concerned with the adjustment process for transfers. It works with the other Student Personnel Services at both the Community College and the University in an attempt to assist the transfer in making a smooth and comfortable adjustment to the University.

The Counseling Center's basic aim is to support the student's efforts to develop into a mature, useful, self-fulfilled member of society. The Center's day-to-day work with the student client involves psychological counseling on personal, social, educational, and vocational problems.

All individual counseling contacts with members of the Counseling Center staff are strictly confidential. No information is released to members of the University community, to parents, or to outside agencies (such as graduate schools, law enforcement agencies, or draft boards) without the student's explicit authorization in advance. When the need arises, the Counseling Center staff also administers psychological tests for assessing the student's abilities, interests, and personality. Such tests are interpreted to the student as part of the counseling process.

The Career Planning and Placement Service responsibilities include vocational counseling and the administration of the affairs involved in aiding students to seek appropriate positions and careers. While this service provides vocational and career counseling for all undergraduates, the emphasis is on aid to seniors in planning their futures following graduation and pro-

viding them with the best means for finding permanent employment. The office arranges for employers from business, industry, government, schools, and other areas to visit the campus to interview prospective graduates during the school year.

Cumulative student personnel records, occupational information and industrial literature and preparation of credentials (including personal resumes and recommendations), in addition to counseling and guidance, are provided to aid seniors and registered graduates in accomplishing their career objectives.

Teacher Certification—Employment in public schools requires teachers' certification. Students enrolled in an approved program through the School of Education meet the specified requirements for the Commonwealth of Massachusetts. Others, not so enrolled, should review their programs with the Educational Placement Officer prior to their senior year to make sure that requirements will be met upon graduation. Questions concerning certification locally and in states other than Massachusetts, specialized certification, documents that must be supplied, supply and demand, existing and projected vacancies, and the like, may also be directed to the Educational Placement Officer.

Health Services

The University Health Services provide guidance for the development of optimum physical, emotional, and social welfare in the University community.

In the Health Center are located an outpatient department, with supporting X-ray, laboratory, and physical therapy facilities, and an inpatient service for the care of students who need hospitalization.

Hospitalization for conditions requiring more specialized care than is available in the Health Center can be arranged at the Cooley Dickinson Hospital in Northampton.

Any care rendered on the campus by members of the staff of the Health Services is provided without additional charge to anyone who has paid the student health fee. The provision for care off campus can be arranged by the Health Services, but the cost of this care is a responsibility of the student. A supplementary insurance program has been developed to provide for most hospital and surgical care not available at the Health Center. This optional program can be elected in September only. The insurance provides coverage for twelve months. *All candidates for and members of intercollegiate athletic teams are required to subscribe to this supplementary insurance plan.*

The health status of participants in the athletic program, both intramural and intercollegiate, is under Health Services supervision, and care is available for injuries resulting from these activities.

Recognition of the specific emotional needs of students in an educational environment has led to the provision of an active mental health program including diagnostic and limited treatment services.

The student is urged to consult a member of the Health Services staff as soon as any indication of a physical or emotional disorder is evident. It is much easier for the staff, and less time-consuming for the student, to rectify minor difficulties before they have become sources of disability.

Any student who is under medical supervision prior to entrance is urged to have the personal physician write the Health Services, giving reports and instructions in appropriate detail. In brief, the Health Services attempt to provide each student with a coordinated and comprehensive program of health supervision formerly provided by the family physicians.

All visits and information gained as a result of visits to the Health Services are treated as confidential. No such information will be released without the permission of the student.

The Health Education staff concerns itself with helping to develop attitudes and behavioral patterns which will promote healthful personal and community living.

The Environmental Health and Safety staff operates to ensure a safe and healthful environment for all who live or work on campus. Food services, housing, radiation use, building and traffic safety, and fire control are major areas of activity.

Campus Center Complex

The Campus Center Complex is composed of the Murray D. Lincoln Campus Center, the Parking Garage, and the Student Union. It houses the offices of the Assistant Dean of Students and his Student Activities staff; the Campus Center Manager and his staff; and the University Ombudsman.

Service departments of the complex include the University Store; the Campus Information Center; the Cashier's Office; automatic U.S. Post Office; barber shop; games area; music library and listening lounge; and overnight accommodations with parking facilities and food services (four cafeterias and the Top of the Campus restaurant and cocktail lounge). Meeting rooms, lounges, reading rooms, and art galleries are available for student and general campus use.

The Campus Center Governing Board, comprised of undergraduate and graduate students and alumni, determines policy for the operation of the Center. The Program Council, a standing committee of the Board composed wholly of students, selects, plans, and executes all Center activities in art, music, dance, movies, special events, etc. Any student may apply for membership.

Construction and operating costs are met from student fees and income generated from general operation, particularly of the Food Service Department, the University Store, and overnight accommodations. In effect, a portion of every dollar generated within the Complex is recycled back into the Center to benefit the student body in one form or another, that is, through building services, Program Council activities, the assistance of professional staff, etc. Full use of income for these and other positive purposes is, of course, a major factor in maintaining student fees at a reasonable rate.

The Campus Center hosts programs sponsored by the Division of Continuing Education, the alumni of the University, and many service organizations. The Complex is also used heavily for conferences, institutes, workshops, and short courses.

Student Activities Office

In addition to serving as the headquarters for Recognized Student Organizations (RSO), the Student Activities Office in the Campus Center provides resource material and counsel on program planning, organizational work and leadership training, entertainment selection and procurement, service and aid projects for campus and community, special interest activities, and recreation, as well as counsel on budgeting, purchasing, contracting, and other business procedures. The Student Activities Office also provides banking, bookkeeping, and auditing services for student organizations.

More than fifty professional organizations exist on campus as a means of extending classroom interest through closer contact with members of the faculty and representatives of the professions. Student government offers a forum for debate on matters of importance to the entire University community. There are several student publications and a student FM radio station. Approximately 400 student organizations range in interest from political, religious, and cultural to social, professional, and recreational.

The University expects that no student will be excluded from membership in any club, society, fraternity, sorority, or other organization for reasons of race, religion, or national origin. Campus groups belonging to national bodies which openly or covertly endorse such discrimination would be in violation of this University principle.

Student Government

The Student Government Association (SGA) works for fundamental academic and social reform on campus while providing a variety of services to students. These services include draft counseling, a lecture-note program, book loans, the bus service, the course description guide, the attorney for students, and funding for a wide variety of student groups and services. The SGA is working toward full student self-determination in social and academic life.

All undergraduates are members of the SGA and are eligible to join its activities. The Student Senate is the legislative arm of the SGA. The seven area governments determine policies in the separate residential areas. The SGA President coordinates the activities of the SGA and represents the student body to the administration and faculty. The President becomes, ex officio, a member of the University Board of Trustees.

The student role in running the University has increased greatly in recent years. Students interested in University reform should contact the SGA President.

Student Organizations

There are more than 450 recognized student organizations at the University of Massachusetts, Amherst. Among these are:

Campus Publications

The Daily Collegian. Daily newspaper published by undergraduates.

Index. University yearbook.

Spectrum. Magazine of essays, short stories, poetry, and art.

Music Organizations

Campus music organizations provide experience in musical and allied activities for performers and technicians with various kinds of interest and ability.

The University Symphony Orchestra, the bands, and the choral organizations are in the Department of Music. Membership is open to all students, faculty, alumni, and others in the community.

Theatre

The University of Massachusetts Theatre, an activity of the Theatre Program, schedules several productions, workshops, and other theatre activities each year. The productions serve as the laboratory for all students electing the theatre concentration in the Department of Speech; however, all phases of work on these productions are open to all students regardless of school or major.

Debate

The University Debate Union is an academic and co-curricular activity of the Department of Speech. Each year, debate teams research and debate an intercollegiate proposition dealing with an important national or international problem. The debaters attend tournaments at colleges and universities throughout the United States.

Student Honor and Service Societies

Adelphia. Men's honor society (senior and junior classes).

Mortar Board. National honor society for senior women.

Maroon Key. Men's sophomore honorary-service society.

Scrolls. Women's sophomore honorary-service society.

Revelers. Group of upperclassmen who promote and encourage freshman interest in campus activities.

Alpha Phi Omega. National service fraternity.

Gamma Sigma Sigma. National service sorority.

Delta Sigma Rho-Tau Kappa Alpha. National honorary forensic fraternity.

Belchertown Volunteers. Group of students who, each Saturday, go to Belchertown State School for the retarded to provide exercise, companionship, and social events for the patients.

Northampton Volunteers. Group of students who provide services similar to those of the Belchertown Volunteers at Northampton State Hospital.

Northern Educational Service. Urban tutoring service provided by students who are trained on campus.

Room to Move. Drug counseling drop-in center, cooperating with the Health Services.

Guide Service

The University Guide Service, ARCON, disseminates information about the University and conducts tours for visitors and official guests. The guides, fraternity men and sorority women of the junior class, are required to uphold the highest standards of responsibility and leadership.

Professional and Special Interest Clubs

Approximately fifty professional clubs, established in connection with the various major courses of study, stimulate students' professional interest in their chosen fields and afford opportunity for discussion of technical subjects of mutual interest.

Special interest groups cover an even wider range of interests, in many cases offering learning experiences in subjects not included in the academic areas of the University (e.g., religion, politics, sports, hobbies, etc.). A partial list includes Free University, Young Socialists Alliance, Flying Redmen, Precisionettes, Amateur Radio Club, Student Afro-American Society, Students for a Democratic Society, Volunteer Fire Department, National Ski Patrol, Outing Club, Ski Club, SCUBA Club, Equestrian Club, Crew Club, Bike Club, Square Dance Club, Music Theatre, Residential Area Governments, and a variety of other organizations.

Fraternities

Men's social fraternities include Alpha Tau Gamma (Stockbridge School), Beta Kappa Phi, Delta Chi, Kappa Sigma, Lambda Chi Alpha, Phi Mu Delta, Phi Sigma, Phi Sigma Kappa, Pi Lambda Phi, Sigma Alpha Epsilon, Sigma Phi Epsilon, Tau Epsilon Phi, Theta Chi, and Zeta Nu. Women's social fraternities include Alpha Chi Omega, Chi Omega, Iota Gamma Upsilon, Kappa Alpha Theta, Kappa Kappa Gamma, Lambda Delta Phi, Pi Beta Phi, Sigma Delta Tau, Sigma Kappa and Sigma Sigma Sigma. Coed fraternities include Boomtown and Sigma Alpha Mu. A Greek Council consisting of the presidents and one representative of these fraternities is the area government for this residential area. The

Greek Council provides service to all its member organizations, the University, and the community, as well as dealing with general matters pertaining to fraternity life. A cooperative organization—The Fraternity Managers' Association—pools the financial resources of twenty of the fraternities for the purposes of effecting orderly, economical purchasing and accounting procedures. A professional fraternity manager administers the association's program, while the Greek Area Director's Office administers all other matters pertaining to fraternity life. Each of the fraternities owns its own house, and the members are responsible for the daily maintenance, financial management, meal planning, governing, and organizing of special events or programs.

Fine Arts Council

The Fine Arts Council is composed of five undergraduates and five faculty members appointed by their respective Senates. The Council meets regularly with its full-time staff to plan a varied, balanced series of professional events for the University community. Presently included are the Celebrity Series, five pairs of outstanding classical artists and large ensembles; the Chamber Music Series, five single concerts by leading small ensembles; three distinguished dance ensembles in extended residencies; two theatre residencies; and numerous special events. The Council's 1972-73 Third World Cultural Series focused on the art forms of third world peoples.

The Fine Arts Council also supports the University Art Gallery and the University Music Theatre. The University Art Gallery in Herter Hall provides outstanding traveling shows as well as faculty and student exhibitions in all media throughout the academic year. The University Music Theatre (formerly The Operetta Guild) is a student-operated organization producing fully staged works form the lyric theatre. Inquiries may be directed to the Fine Arts Council office in Herter Hall.

The Fine Arts Council program emphasizes extended residencies, which allow the visiting artist and students to meet on an informal basis. A full schedule of Fine Arts Council activities may be obtained by contacting the Council's ticket office, 125 Herter Hall.

Athletics

The University values the educational advantages of a well organized intercollegiate and intramural sports program. In intercollegiate athletics, the University is represented by teams in football, soccer, cross country, basketball, swimming, wrestling, indoor and outdoor track, hockey, golf, tennis, baseball, lacrosse, gymnastics, skiing, and crew.

The University also sponsors a broad program of intramural activities, in which all students are encouraged to participate. Team sports available each year include touch football, powder puff football, basketball, bowling, volleyball, soccer, badminton, softball, horseshoes, handball, bicycle racing, and tug-o'-war. Individual activities include cross country, squash, paddleball, wrestling, wrist wrestling, swimming, table tennis, weight lifting, and tennis.

The University is a member of the Yankee Conference, the National Collegiate Athletic Association, the Eastern College Athletic Conference, and the New England College Athletic Conference.

Alumni Association

The Associate Alumni is the general alumni organization of the University, with headquarters at Memorial

Hall, erected by alumni and friends in honor of those men of the University who died in World War I. *The Alumnus* magazine is published by the University five times a year. According to its bylaws, the association is constituted for the purpose of promoting the general usefulness of the University; of cultivating mutual regard among its graduates and former students; and of strengthening their attachment to their Alma Mater. Under sponsorship of the University of Massachusetts Building Authority, composed of alumni who volunteered their services, nineteen residence halls, two faculty apartment centers, and a Student Union Building have been constructed on the campus. The governing body of the Associate Alumni consists of its officers and a board of directors. Six directors are elected each year and serve a term of four years.

Religious Activities

The University gives support to the religious life of its students in various ways. It affords the use of University facilities for student groups of all faiths. It cooperates with the official agencies of the three faiths most largely represented at the University by recognizing the contributions of their privately supported chaplains and by giving them facilities and privileges for their work.

On campus, the religious life of Catholic students is enriched by activities and daily and Sunday services at the Newman Center. Jewish students participate in services and activities sponsored by the B'nai B'rith Hillel Foundation. Protestant students are served by the United Christian Foundation, an ecumenical ministry providing counseling services as well as opportunity for involvement in service and social action.

Other religious groups such as the Baha'i Club, the Christian Science Organization, the Inter-Varsity Christian Fellowship, the Lutheran Club, and the Orthodox Club also meet regularly on campus and students interested in their programs are welcome to attend. The Campus Religious Council provides a cooperative interrelationship among the campus religious groups and serves the whole University community by sponsoring book and clothing drives, the Religious Handbook for Freshmen, and ecumenical discussion and action.

The local Protestant and Catholic churches of Amherst provide opportunities for Sunday worship, and Sabbath services for Jewish students are held on Friday evenings. Students are encouraged to attend the services of their respective faiths. Several denominations sponsor active student programs centered in the local churches, and students are welcome to attend events and join groups sponsored by the denominations.

Motor Vehicles

All student, faculty, and staff motor vehicles must be registered with the Parking Office, Hampshire House, Room 103.

Any student may be permitted to have a motor vehicle on campus provided it is registered with the Parking Office and complies with published University regulations. Copies of the University regulations concerning motor vehicles should be obtained at the Parking Office, Hampshire House, Room 103.

Visitors are requested to use the new multi-level Campus Center Parking Garage unless another lot is suggested. A University bus service, free of charge, covers the campus and environs.

All parking areas are under roving security surveillance. Visitors may secure information at the Parking Control Booths or at the Security Building. Inquiries concerning parking should be directed to the Parking Coordinator, University of Massachusetts, Amherst, Massachusetts 01002.

Financial Aid

All information relative to financial assistance is available through the Financial Aid Office, Room 232, Whitmore Administration Building. Financial assistance includes scholarships, loans, grants, and employment.

Application Deadline

The deadline for filing an application for financial aid is March 1. Applications received after this date are late and may not be considered. A new application must be filed every year, whether or not the applicant has received aid previously.

Application procedures vary for single, married, and emancipated students. Detailed procedures to be followed by students and their parents are available on request from the Financial Aid Office.

Loans

UNIVERSITY LOANS

Through the generosity of friends of the University, loans are available for a limited number of students of good scholarship of the three upper classes to assist in the paying of tuition or other college expenses. All loans are secured by notes endorsed by responsible parties as collateral.

In general, loans taken out by seniors must be repaid before graduation; otherwise, they are due before the beginning of the next school year. Loans automatically become due upon recipients' withdrawals from the University.

On most of the funds, interest is charged at the rate of 3 percent to maturity and 5 percent thereafter. No loan under this plan will be granted in excess of $200 in any one year.

HIGHER EDUCATION LOAN PLAN

The student may obtain a loan of up to $1,500 per year from the bank of his choice through the Higher Education Loan Plan. Certification of attendance and other information relative to the student's overall record will be submitted to the bank prior to the granting of the loan.

NATIONAL DEFENSE STUDENT LOAN PROGRAM

A student may borrow up to $1,000 per year under this program. Interest at 3 percent begins nine months after completion of the program; the loan is to be repaid within ten years. Because of the amount available this program is necessarily limited and selective.

Employment

Under the College Work-Study Program, a student who meets established financial-aid criteria can be assigned to a part-time job on campus or to a job with a nonprofit agency in his community during the summer months.

Benefits for Veterans and Their Dependents

Details involving veterans' benefits should be cleared through the Veterans' Coordinator in the Financial Aid Office.

Veterans or their dependents eligible for educational benefits under the Veterans Bill, P. L. 358; the Disabled Veterans Bill 894; or the War Orphan Bill 634, should present a Certificate of Eligibility at registration. This may be obtained through the nearest Veterans Administration office.

Military Service

The Financial Aid Office provides information on draft status and assistance in verifying the status of any student transferring to the University.

Through this office, a student may register for the draft within thirty days of his eighteenth birthday; it is unnecessary for him to return to his local Board to register.

Scholarships

Scholarships are of two types: One is a straight monetary award; the other is a work scholarship called an Undergraduate Assistantship, in which the recipient is required to do work of an academic or educational nature (about eight hours per week) under faculty or staff supervision.

Monetary awards may be granted to members of all undergraduate classes; Undergraduate Assistantships are awarded only to members of the sophomore, junior, and senior classes. Scholarships are awarded only to needy and deserving students whose scholastic records are satisfactory. The scholastic requirement for both types of aid is a 2.8 cumulative quality-point average or a 2.0 to 2.8 average with an average of at least 3.0 in the fall semester.

A scholarship award is paid in installments at the beginning of each semester in the form of a credit on the recipient's bill. If the scholarship student withdraws from the University, any refund of University fees or charges must first be applied to the scholarship fund to reimburse the fund for the full amount of the scholarship received by the student for the semester.

University Library System
The University Library System is composed of the main University Library, a new 28-story building scheduled to open in 1973, and several branch libraries, of which the two principal ones are the Morrill Biological Sciences Library and the Physical Sciences Library.

Present holdings include over one million books, periodical volumes, and governmental documents, and over 250,000 microforms. The University currently receives more than ten thousand periodicals, which are housed in the main Library or the branch libraries according to subject matter. Holdings and their locations are listed in both the card catalog and the *Pioneer Valley Union List of Journal and Serial Holdings*, a computer-produced book which also includes the serials of Amherst, Smith, and Mount Holyoke Colleges and the Hampshire Inter-Library Center. A computer project to provide on-line access to all University serial holdings is currently underway.

A library handbook and information series is available at the reference desk of the University Library and in the branch libraries. Librarians are available in the University Library and the two principal branch libraries to assist the University community in using the Library and its collection.

HAMPSHIRE INTER-LIBRARY CENTER
The University Library is a participating member of the Hampshire Inter-Library Center, a cooperative facility for the acquisition, storage, and servicing of research materials, especially journals, documents, and scholarly sets. Incorporated in 1951 to augment library resources in the area, HILC is jointly operated by the libraries of the five Connecticut Valley colleges and the Forbes Library of Northampton, Massachusetts. The collection numbers about 35,000 bound volumes; approximately 1,000 journals are received currently.

Guided Tours
Through the University Guide Service, ARCON, guided tours are available during the regular academic year on weekdays from 1:30 to 3:30 p.m. Saturdays from 9:00 a.m. to 12:30 p.m., and Sundays from 1:00 to 3:00 p.m.

The University Press
A member of the Association of American University Presses, The University of Massachusetts Press is dedicated to publishing outstanding scholarly and artistic works. Manuscripts are approved for publication by a committee appointed by the Faculty Senate. The Press was founded in 1964.

Scholarly Journals
The Massachusetts Review is a national and international quarterly of the arts, literature, and public affairs, published independently with the support and cooperation of Amherst, Hampshire, Mount Holyoke, and Smith Colleges, the University of Massachusetts and its Alumni Association, and others. It is now in its thirteenth year of publication.

The English faculty also edits and publishes three scholarly journals: *English Literary Renaissance* on English literature in the age of Shakespeare and Mil-

ton (1485-1665); *Early American Literature* on the colonial and Puritan periods (1760-1880); and *RSVP*, a journal on Victorian English periodical publications. Graduate students in that department publish *MSE*, Massachusetts Studies in English. The quarterly *Polity* is published by the Department of Political Science. Students in the School of Engineering publish the *Engineering Journal*.

Language Laboratories
The James W. Butler Language Laboratories provide special study facilities to students enrolled in foreign language courses. Three of the labs, equipped with student-controlled tape recorders and monitoring facilities, can accommodate up to ninety students in three elementary classes. Another room, with twenty booths, is available to students who make use of the Open Library Usage service for independent study.

A fifth lab was designed and equipped for intermediate and advanced language students. Its twenty-eight booths are furnished with dialing pads which enable its users to listen to any program tape available in the banks of the Random Access Library (RAL). It is anticipated that in the future these tape-machine banks can be reached over telephone lines.

Lesson tapes and RAL program masters are produced, transcribed, and programmed in the Recording Studio and the Transcription Center. A highly trained technical staff is available at all times.

Office of Public Affairs
The Office of Public Affairs serves as liaison between the campus community and the general public, and as an internal information center for the benefit of faculty, students, and administration. Its primary function is to provide accurate information about the University's current and projected programs and thus to foster understanding of the institution's mission as a nationally recognized facility of higher education, research, and public service. The office assigns specific responsibilities to three departments—Publications, News, and Photographic Services and also to Radio Station WFCR. Through these departments the office supplies information to all communications media as well as to agencies of government, schools and other educational institutions and foundations, professional societies, research organizations, extension agencies, and to individuals who request data of various kinds.

Office of Budgeting and Institutional Studies
The Office of Institutional Studies collects, analyzes, and disseminates information about the Amherst Campus—students, faculty, and programs—as well as University-wide concerns. The office also conducts research about various aspects of higher education, both in terms of the internal activities at Amherst and the external relationships with other institutions. The office stands ready to aid members of the campus community in understanding the nature and operation of the University, and provides these members those services needed for the planning, improving, and implementing of their programs and activities.

Cooperative Extension Service
The Cooperative Extension Service, affiliated with the College of Food and Natural Resources and the School of Home Economics, was established by federal and state legislation to help people identify and solve their farm, home, rural, and urban community prob-

lems. It is a cooperative educational program planned, conducted, and financed jointly by the county governments, the University, and the United States Department of Agriculture.

Massachusetts Agricultural Experiment Station
The Massachusetts Agricultural Experiment Station, established by state and federal legislation, is associated with the College of Food and Natural Resources. The purpose of the Station is to conduct research bearing directly on the problems of the agricultural industry and the welfare of consumer groups. It is financed by federal appropriations and state offset funds. Research is conducted at the Cranberry Experiment Station in East Wareham, the Suburban Experiment Station at Waltham, the Horticultural Research Center in Belchertown, the College Farm in South Deerfield, and on the Amherst campus. The Environmental Forestry Research Center of the United States Forest Service has been established on the campus in cooperation with the Experiment Station.

Other Facilities and Services
Audiovisual Center
Cooperative Fishery Unit
Cooperative School Service Center
Cooperative Service Bureau
Cooperative Wildlife Research Unit
Institute of Agricultural and Industrial Microbiology
Labor Relations and Research Center
Massachusetts Population Research Institute
Northeast Regional Media Center for the Deaf
Polymer Research Institute
Program in Urban and Regional Problems
Technical Resource Service
University Computing Center
Water Resources Research Center

Academic Honor Societies
Phi Beta Kappa (arts, humanities, and sciences)
Phi Kappa Phi (all fields of study)
Sigma Xi (pure and applied science)
Sigma Gamma Epsilon (earth sciences)
Omicron Nu (home economics)
Phi Tau Sigma (food science)
Phi Eta Sigma (freshman men, all fields of study)
Tau Beta Phi (engineering)
Beta Gamma Sigma (commerce and business administration)
Alpha Lambda Delta (freshman women, all fields of study)
Eta Kappa Nu (electrical engineering)
Alpha Zeta (agriculture)
Xi Sigma Pi (forestry)
Alpha Pi Mu (industrial engineering)
Kappa Delta Pi (education)
Phi Sigma Alpha (political science)

Overseas Study
The Amherst campus offers a wide variety of overseas study and international exchange programs. The International Programs Office may be consulted for all specific information on these and other overseas study opportunities. Information on summer programs is given in the Bulletin of the Summer Session as well.

Freiburg Program. In cooperation with the University of Freiburg, Germany, the University of Massachusetts operates its year-long Freiburg Program. The University of Massachusetts has a permanent facility in Freiburg, the University of Massachusetts Freiburg Center,

which serves as the headquarters of the Freiburg Program. Students enrolled in the Program are regularly enrolled students of the University of Freiburg, and take courses in a wide range of social science and humanities courses. The Freiburg Program is not restricted to students concentrating in German, but admits students in philosophy, music, English, history, comparative literature, and other fields. Enrollment is limited to graduate students and superior upper division undergraduates with fluency in German.

Field Program in Anthropology, Europe. A four- or seven-month field program in anthropology in Europe is offered by the Anthropology Department to graduate and advanced undergraduate students in anthropology during the spring or spring and summer. Location of the program in Europe in any given year depends upon the selection of the faculty director. Prerequisites for participation in the program include a working knowledge of the language required for field research and prior coursework in both field methods and the culture area where research is to be conducted. A limited number of stipends are available to offset costs of international travel and maintenance while in the field.

Semester Program, New University of Ulster, Coleraine, Northern Ireland. Primarily for undergraduate students majoring in education. A small number of students go each semester for study in Northern Ireland. The New University of Ulster is Britian's newest university and has about 2,000 students.

Grenoble Program. The University of Massachusetts Semester in Grenoble Program is offered in cooperation with the Comité de Patronage des Etudiants Etrangers of L'Université de Grenoble and is open to approximately forty students. The three levels of courses offered facilitate the acceptance of students of varied interests and levels of proficiency in French. Students with little or no prior knowledge of the language may pursue studies in the French language and civilization at the elementary level. Majors and other proficient students pursue courses in language, literature, and civilization at the middle or upper level depending on placement by examination upon arrival at Grenoble. Students may choose to live with French families, in "foyers," or in inexpensive hotels catering to students.

Academic Year Program, Keele University, England. Through an exchange program, several undergraduates may spend their junior or senior years at Keele University, Staffordshire, England. The program is open to superior students concentrating in social sciences, humanities, and science.

Academic Year Program, Chelsea College of Physical Education, England. This is a junior-year program for undergraduate women majoring in physical education. A good academic record is required.

Academic Year Program, University of Victoria, British Columbia. An undergraduate student exchange program with the University of Victoria, British Columbia, Canada, permits several undergraduates each year to spend their junior or senior years at that university. Courses of study include drama, social sciences, humanities, education, and science.

Summer Programs. Summer study programs, concerning which information may be secured from the International Programs Office and the *Summer Session Bulletin,* include offerings in Bologna, Italy; Madrid, Spain; Freiburg, Germany; Pau, France; Oxford,

England, and St. Vincent, West Indies, the latter in anthropology.

Graduate School

Graduate work leading to the Doctor of Philosophy degree may be taken in the following fields: Agricultural and Food Economics, Animal Science, Anthropology, Astronomy, Biochemistry, Botany, Business Administration, Chemical Engineering, Chemistry, Civil Engineering, Comparative Literature, Computer and Information Science, Economics, Electrical Engineering, English, Entomology, Environmental Engineering, Food and Agricultural Engineering, Food Science and Technology, Forestry and Wood Technology, Geology, Hispanic Languages and Literatures, History, Human Movement, Industrial Engineering and Operations Research, Linguistics, Mathematics, Mechanical Engineering, Microbiology, Nutrition and Food, Ocean Engineering, Physics, Plant Pathology, Plant Science, Political Science, Polymer Science and Engineering, Psychology, Sociology, Soil Science, Speech, Wildlife and Fisheries Biology, and Zoology.

A cooperative Ph.D. program involving Amherst, Hampshire, Mount Holyoke, and Smith Colleges and the University is also available in all the departments of the biological sciences and the departments of Chemistry, French, Geology, Germanic languages and literatures, Hispanic languages and literatures, Philosophy, and Physics.

The School of Education offers several specialized programs leading to the Doctor of Education degree for those employed in the educational field. The requirements for this degree follow closely those outlined for the Doctor of Philosophy. Residency must be met by attendance on campus for two consecutive semesters.

The following departments offer major work leading to a master's degree: Agricultural and Food Economics, Animal Science, Anthropology, Art History, Astronomy, Biochemistry, Botany, Business Administration, Chemical Engineering, Chemistry, Civil Engineering, Comparative Literature, Computer and Information Science, Dramatic Arts, Economics, Education, Electrical Engineering, English, Entomology, Environmental Engineering, Fine Arts, Fisheries Biology, Food and Agricultural Engineering, Food Science and Technology, Forestry and Wood Technology, French, Geology, Germanic Languages and Literatures, Hispanic Languages and Literatures, History, Home Economics, Human Development, Industrial Engineering and Operations Research, Labor Studies, Landscape Architecture, Linguistics, Management Science, Marine Sciences, Mathematics, Mechanical Engineering, Microbiology, Music, Nursing, Nutrition and Food, Ocean Engineering, Philosophy, Physical Education, Physics, Plant and Soil Sciences, Plant Pathology, Political Science, Polymer Science and Engineering, Psychology, Public Administration, Public Health, Regional Planning, Slavic Languages and Literatures, Sociology, Speech, Statistics, Wildlife, Wood Technology, and Zoology.

Holders of undergraduate degrees desiring further information should write for a Graduate School Bulletin to Graduate Admissions Office, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002.

Summer Session

The Summer Session at the University, of eight weeks' duration in 1972, is open to freshmen who wish to

begin their college education immediately upon graduation from high school, to seniors completing requirements for September graduation, to other regular University undergraduates, and to special students currently enrolled in other colleges. Graduate courses are provided for area teachers and graduate students who wish to continue their work during the summer. Some courses are offered for professional workers in specialized fields. A bulletin describing the entire summer program is available from the Registrar's Office in April of each year.

Students who begin their college careers in the summer are advised to plan their programs carefully with the aid of advisers. Normally, it is wise to plan to take the required courses during the summer and to take electives and major courses during the fall and spring semesters. Sequential required courses are generally offered during both of the main semesters, so that work begun in the summer can be completed during the fall semester.

Five College Courses

Amherst, Hampshire, Mount Holyoke, and Smith Colleges and the University of Massachusetts/Amherst combine their academic activities in selected areas for the purpose of extending and enriching their collective educational resources. Certain specialized courses not ordinarily available at the undergraduate level are operated jointly and are open to all. In addition, any qualified student in good standing at any of the institutions may take a course without cost at any of the others, if the course is significantly different from any available to him on the home campus. The course must have a bearing on the educational plan arranged between the student and the adviser. Approval by the student's adviser and the Academic Dean of the College (Provost at the University) at the home institution is required. Permission of the instructor is required for students from other campuses if permission is required for students of the institution at which the course is offered.

Students should apply for interchange courses at least six weeks prior to the beginning of the semester since they may find some courses already filled after that time. Free bus transportation among the five institutions is available for interchange students.

Students interested in such courses will find current catalogs of the other institutions in departmental offices, the University Library, or the Office of the Registrar. Applications may be obtained from the Office of the Provost.

Regional Student Program

The University participates in a regional cooperative program administered by the New England Board of Higher Education. This program, known as the Regional Student Program, permits qualified residents of the New England states to study with in-state tuition and admission privileges at any of the state universities, the Lowell Technological Institute, and the public two-year colleges and technical institutes in a wide variety of study areas.

The purpose of the program is to expand opportunities for higher education for New England residents by making available on an equal basis to all those courses not commonly offered at every institution. This practice tends to reduce duplication of courses and thus to utilize most efficiently the higher educational facilities in each state.

Detailed information about this exceptional program can be obtained from any guidance counselor or from the New England Board of Higher Education, 20 Walnut Street, Wellesley, Massachusetts 02181.

Continuing Education

The Division of Continuing Education at the University is responsible for helping to meet the educational needs of all part-time undergraduate students; for managing all conferences, institutes, workshops, short courses, and clinics on the Amherst campus and throughout the Commonwealth sponsored by the University; and for designing special educational programs for citizens of the Commonwealth and the region who are not regular full-time students at the University. The Division has its own undergraduate degree program, designed for part-time students who wish to design a curriculum more appropriate to their educational goals than those offered by the traditional undergraduate departments. The Bachelor of General Studies requires one hundred and twenty hours of credit, up to seventy-five of which may be transferred from other institutions. Students may be admitted to evening courses or to day courses on a space-available basis after consultation with an adviser in the Division of Continuing Education. Undergraduate part-time students who meet the requirements for any standard University undergraduate degree may have this degree awarded through the Division of Continuing Education in addition.

The Division serves as an educational doorway between the University and potential clients and stands ready to assist anyone in the Commonwealth with an educational problem with which the University might assist. Inquiries may be directed to the Director of the Division, 920 Campus Center.

University Without Walls

The University Without Walls program at the University is one of twenty-two UWW units across the country developed under the sponsorship of the Union for Experimenting Colleges and Universities. The program enables students to earn a B.A. or B.S. from the University of Massachusetts through a totally individualized learning program allowing independent study, internships, field experiences, credit for significant past learning experience, and other self-directed projects outside the classroom and campus. It welcomes participants of all ages and diverse backgrounds and interests, especially those who would not normally have access to the University but who are highly motivated and self-disciplined enough to succeed in directing their own learning projects. Upon admission to the program, students choose a faculty sponsor and adviser and prepare a learning contract outlining learning objectives, activities to meet those objectives, and evaluation procedures. Students must negotiate 120 credits in order to receive a degree, including University Core Requirements (33 credits) and residence credits (45 credits). Further information and applications may be obtained from the University Without Walls, 320 Arnold House.

University Year for Action

The University Year for Action program is a full-year, full-time program which offers undergraduates significant service opportunities for attacking poverty in connection with community agencies while earning normal college credit. Students accepted into the pro-

gram become volunteers in Action (a new federal agency comprising Peace Corps, VISTA, and several other federal volunteer programs). They work full time in a community agency, located either in a major city of Western Massachusetts or in a rural area; it may be a CAP agency, a community center, a legal assistance program, a correctional institution, or an educational project. Community agencies provide field direction and supervision, while the University provides instruction, academic credit, and program management.

The University Year for Action program represents a new model for education, a model of effective service to the larger community and of a reciprocal exchange of resources, needs, and personnel.

Details concerning eligibility, application procedure, pay, tuition, fees, and other information are available at the Action office, 513 East Pleasant Street, Amherst.

Handicapped and Disabled Veteran Students

The University is developing a program for handicapped students. Efforts have been made to eliminate as many architectural barriers as are necessary to meet the needs of our handicapped students. Although some barriers remain, most handicapped students can move over most of the campus without serious problems. Elevators exist in most buildings and ramps are conveniently placed to allow entry.

An area of particular concern is special academic services. The University is in the process of coordinating efforts to offer special academic advising and will be ready to meet the needs of handicapped students in the near future. Special scheduling is available if the proper amount of time is allowed.

Handicapped students and returning disabled veterans are urged to contact the Admissions Office so that they may work toward coordinating individualized programs for qualified students.

Pre-Law Advising Program

The Pre-Law Advising Program was instituted to provide students with information on the nature of legal education, admission to law school, and career opportunities in the legal profession. Law schools do not prescribe any particular method of preparation or program of courses for admission; consequently, there is no Pre-Law major at the University. Interested students are urged to register with the Pre-Law Adviser. Current catalogs from every accredited law school in the United States and other materials pertaining to the legal profession are available in this office.

Special programs include:

Honors Program
Bachelor's Degree with Individual Concentration
Pre-Law Advising Program

Undergraduate major programs are available in the following areas:

College of Food and Natural Resources

Agricultural Business Management
Agricultural Engineering
Animal Sciences (Also Pre-Veterinary)
Entomology
Environmental Design (Park and Open Space Administration, Pre-Landscape Architecture, and Pre-Planning)
Fisheries Biology
Food Marketing Economics
Food Science and Technology
Forestry
Hotel, Restaurant, and Travel Administration
International Agricultural Studies
Natural Resource Economics
Natural Resource Studies
Plant Industry (Agronomy, Horticulture, and Turf Management)
Plant Pathology
Plant Science
Wildlife Biology
Wood Science and Technology

Areas of concentration within those listed may be chosen with the approval of the department head or the Dean.

College of Arts and Sciences

Afro-American Studies
Anthropology
Art
Astronomy (Five College Cooperation Program)
Biochemistry
Botany
Chemistry
Classics (Five College Cooperation Program)
Comparative Literature
Economics
English
French
Geography
Geology
German
History
Italian
Journalistic Studies
Latin (Five College Cooperation Program)
Mathematics
Microbiology
Music
Philosophy
Physics
Political Science
Pre-Dental Studies
Pre-Medical Studies
Pre-Veterinary Studies
Psychology
Russian
Sociology
Soviet & East European Studies
Spanish
Speech
Zoology

School of Business Administration

Accounting
Business Administration and Economics
Business Administration and Quantitative Methods
General Business
General Management
Financial Management
Marketing
Personnel Management and Industrial Relations
Production Management
Public Relations Management
Retailing
Systems Management
Urban and Regional Studies

School of Education

Education
Elementary Education

School of Engineering

Chemical Engineering
Civil Engineering
Electrical Engineering
Industrial Engineering
Mechanical Engineering

School of Home Economics

Child Development
Dietetics and Institutional Administration
Fashion Merchandising
Foods in Business
Secondary Education and Extension

School of Nursing

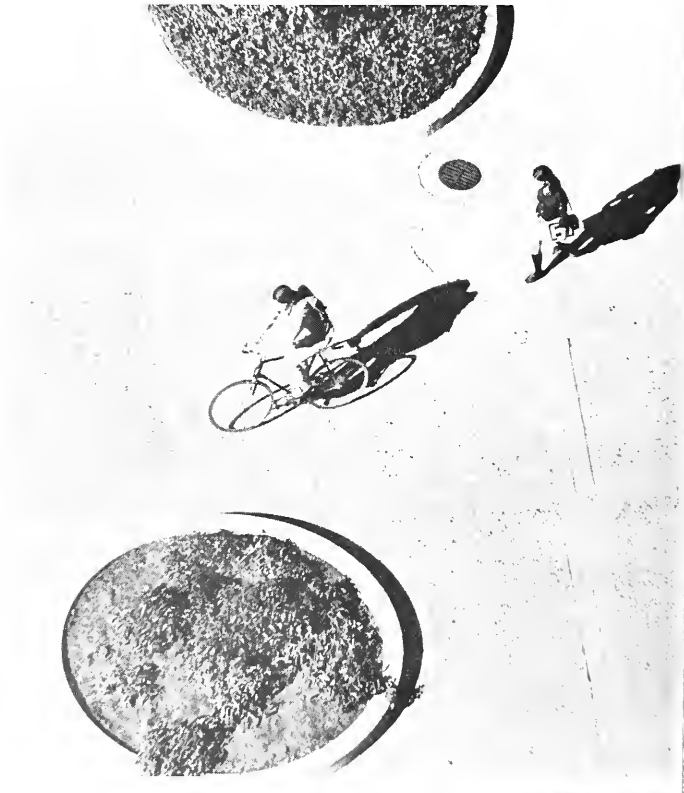
Basic Nursing

School of Physical Education

Physical Education for Men
Physical Education for Women
Recreation

Department of Public Health

Community Health and Health Education
Environmental Health
Medical Technology



The College has programs of study leading to four bachelor's degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music. All departments offer a program leading to the B.A. degree. The B.S. degree may be earned only if the major is mathematics, science, or psychology. The B.F.A. programs have a strong emphasis in art and the Bachelor of Music programs reflect an emphasis in music. All of the degree programs combine a study in depth in one area with supporting study in the other two of the three main divisions: (a) Fine arts and humanities, (b) Social and behavioral sciences, and (c) Natural science and mathematics. Courses appropriate to the distribution requirements in these three areas are noted in University Catalogs by the respective codes (C), (D), and (E).

A program of study which conforms with the following five provisions qualifies the student who completes it for the appropriate degree. Advanced placement and transfer credits may be applied toward any or all of these qualifications; but at least half of the major program must be completed in residence.

1. A basic proficiency or experience in communicative skills must be achieved by completing six credits in rhetoric; the two rhetoric courses must include at least one of Rhetoric 100 or 110.

2. For the B.A. and B.S. degrees only, a basic proficiency or experience with foreign language must be demonstrated by (a) completion of a foreign language course at the college fourth-semester level, (b) a satisfactory performance on an achievement or placement test, (c) four entrance units in one foreign language or three units in one and two units in another foreign language, (d) a year in a school in which English is not the basic language, or (e) an approved substitution of language-related study if there is clearly demonstrated difficulty in language study which has been approved by the foreign language board.

3. Distribution is achieved by completion of courses in each of the two divisions of the College other than the one in which the major falls. With the understanding that work in the major is applicable to one or more of these divisions, this qualification is stated for all three divisions and all degrees as:

	Core Code	Number of Courses for B.A.	B.S.*	B.F.A.	B. MUS.
Division					
Fine Arts and Humanities	(C)	4	3	4	4
Social and Bahavioral Sciences	(D)	4	3*	3	3
Natural Science and Mathematics	(E)	4	4*	4	4

*To qualify for a B.S. degree, at least 60 credits must be earned in science, mathematics, and/or psychology courses; distributional courses may be part of this minimum of 60.

4. An approved major program of the College must be completed. The traditional departmental major programs are the most common, and they are described in the following pages. A few others are specified and administered by standing committees of the faculty and are described below. Several other interdisciplinary programs are being worked on at this time. All major programs have these features in common: (a) faculty guidance, (b) a coherent program of study made up of

 at least 24 credits, at least 15 of which must be in upper division courses in this College, and (c) the student has at least 12 completely free electives.

Advisory System:

When a student elects a special major, or is admitted to a specialized degree program, he is assigned a faculty adviser from that major. The faculty adviser helps the student choose his program of study and also serves as a communication link between the student and the Registrar's Office. The student may choose a specific major on entrance or he may postpone this choice until his fourth semester. Until he chooses a specific major, he is listed as a College of Arts and Sciences major, and the College of Arts and Sciences Information and Advising Center (CASIAC) serves as the student's adviser. Faculty members from a broad selection of disciplines form the staff of CASIAC, and the student may continually meet with the same staff member or he may talk with whomever is on duty at the time. A primary goal of the Center is to help the student choose a major which is consistent with his interests and potentialities.

A student has considerable freedom in choosing his program of study and his major. However, a few of the major programs require sequences of courses which extend over seven or eight semesters. A student who does not take the right courses in his freshman year may have to use a summer session or extra semesters to accommodate these sequences if his ultimate major is Astronomy, Biochemistry, Chemistry, Mathematics or Physics, or if he is in the Bachelor of Music or Bachelor of Fine Arts program. Some standard freshman year programs are:

Bachelor of Fine Arts:

Rhetoric
Introduction to Art
Studio Art
Physical Education
and two of the following:
Math or Science
Humanity
Social Science

Social Science (B.A. or B.S.):

Rhetoric
Social Science
Physical Education
and three of the following:
Foreign Language
Humanity or Fine Art
Math or Science
Second Social Science

Mathematics (B.A. or B.S.):

Rhetoric
Math (Calculus)
Science
Physical Education
and two of the following:
Foreign Language
Social Science
Humanity

Bachelor of Music:

Rhetoric
Music Theory
Music Literature
Physical Education
and two of the following:
Math or Science
Social Science
Humanity, other than Music

Humanity (B.A.):

Rhetoric
Humanity or Fine Art
Physical Education
and three of the following:
Foreign Language
Social Science
Math or Science
Second Humanity

Science (B.A. or B.S.):
Rhetoric
Chemistry or Physics*
Math (Calculus, if prepared)
Physical Education
and two of the following:
Foreign Language
Humanity
Social Science
Second Science

*Chemistry majors elect Chemistry 113; Biology and Geology majors elect Chemistry 111; and Physics and Astronomy majors elect Physics 181.

Latin American Studies

Undergraduates interested in Latin America may enroll in the Latin American Studies Program. The Program does not constitute a major and is designed to supplement the work done in a regular discipline. However, those students who fulfill the requirements of the Program will be awarded the Certificate in Latin American Studies attesting to their attainment in area and language studies. To earn a certificate a student must 1) satisfactorily demonstrate a practical working knowledge of Spanish or Portuguese and elementary proficiency in the other, 2) satisfactorily complete four courses focused on Latin America, and 3) participate in the Interdisciplinary Seminar on Latin America. The requirements of the Program are to be met partly through courses that fulfill existing requirements of the College and partly through the careful use of electives.

The Committee on Latin American Studies administers the Program and advises interested students. Members of the Committee are: P. Barreda-Tomas (Hispanic Languages and Literatures); R. A. Potash, Chairman (History); D. Proulx (Anthropology); F. B. Sherwood (Economics); and H. A. Wiarda (Political Science).

Pre-Dental, Pre-Medical, and Pre-Veterinary Programs

A student planning to enter a dental, medical, or veterinary school should select a major department in the field of most interest to him. This will usually be in the College of Arts and Sciences but may be in other colleges or schools. Pre-veterinary students frequently select a major in the College of Food and Natural Resources. Preparation for the professional schools requires relatively few specific courses beyond those necessary to obtain the bachelor's degree and can be completed within the four-year curriculum of most departments in the University.

A liberal education is felt to be one of the best backgrounds for entering the medical or dental field. Although many students may be inclined to concentrate in the sciences, this will not necessarily improve the opportunity for entrance into a professional school. Rather, the field of concentration should be determined by the student's strong secondary interests; i.e., he should choose that area most likely to lead to a satisfying alternative career.

Minimum preparation for the pre-professional student should include one year of inorganic, one year of organic, and one semester of analytical chemistry, three semesters of biology, one year of college mathematics, and one year of physics. Certain additional courses in biology, chemistry, or mathematics, as well as a foreign language may be required by some dental, medical, and veterinary schools. Students should consult their advisers as well as professional school catalogs in regard to specific requirements of particular schools. Freshmen who intend to include the pre-professional courses in the curriculum should discuss their plans with the summer counseling adviser, as some

change in the normal course sequence may be desirable.

Students, who by their work in the first year demonstrate a potential for success, may, in their third semester, apply to the Pre-Professional Advisory Committee for entrance into the pre-medical, pre-dental, or pre-veterinary major. This program is designed to give qualified students the opportunity to broaden their background by providing for increased flexibility in the curriculum of the last two years. These students will have advisers specifically for this program, will be interviewed in the sophomore and junior years, and, upon application to medical school, will be given a written evaluation by the pre-medical committee. However, admission into a pre-medical, pre-dental, or pre-veterinary program is not a prerequisite for application to the professional schools. Many students prefer to complete a full major in an academic department; these students should also apply for entrance into the pre-professional program, and they will be interviewed and evaluated in the same manner as those who are accepted as majors.

A file of dental, medical, and veterinary school catalogs and other pertinent material is maintained in the committee office, Room 409, Hasbrouck Laboratory. Students are encouraged to visit this office for further information concerning preparation for careers in dentistry, medicine, and veterinary medicine.

Individual members of the advisory committee are available for counsel to all interested students at any stage of their program and whether or not they have been accepted into the curriculum as majors. The committee membership for 1972-73 consists of the following: B. C. Crooker, Chairman (Physics), S. Balagura (Psychology), H. E. Bigelow (Botany), E. L. Davis (Botany), R. S. Feldman (Psychology), E. J. McWhorter (Chemistry), J. H. Nordin (Biochemistry), G. J. Oberlander (Chemistry), W. B. O'Connor (Zoology), R. E. Smith (Veterinary and Animal Sciences).

Afro-American Studies, W. E. Du Bois Department Of

The first responsibility of the department is to offer a major in Afro-American studies which is interdisciplinary in scope. The department has the parallel responsibility of leavening and affecting the quality and focus of the educational experience of all Black students regardless of their major field of study; thus it is responsible for the designing of courses and sequences of courses which are of general interest and of specific relevance to students in disciplines other than Afro-American studies.

The major in Afro-American studies is recommended only to students intent on a career in teaching or advanced scholarship in Afro-American studies or in one of the relevant professional disciplines. The maximum of 60 required major credits is spread over many disciplines with a heavy emphasis on History, Sociology, Political Science and Literature. This means that within the scope of the major there are included courses which correspond to and fulfull requirements of offerings in other departments. The student is required to take at least 24 credits within one discipline, and a minimum of 24 within the other disciplines of the department. The major is designed to give the student a specialist's training in one area of the Black experience reinforced by a general and theoretical knowledge of other relevant areas of scholarship.

In its study of mankind in terms of origins, ways of life, physical and cultural differentiation, and contemporary problems, anthropology bridges the social and biological sciences. Its courses are offered with the aim of providing both a foundation for specialized graduate study in all four subfields of anthropology (archaeology, physical anthropology, social and cultural anthropology and linguistic anthropology) and also the understanding of mankind that can be of value to anyone regardless of particular interests.

Anthropology majors must take Anthropology 104 plus *at least one* more of the following: Anthropology 102, 103, or 105. All majors are also required to elect a minimum of 21 credits above the 100 level in anthropology which, in combination with the introductory courses, must total at least 30 credits for graduation. With his adviser's approval, an anthropology major may be allowed to take as part of this requirement non-duplicating courses in anthropology given at one of the cooperating Valley institutions. The maximum allowable credits in anthropology for graduation is 45. Also required is at least one course in the social sciences outside of anthropology and foreign language proficiency through the intermediate (140) level. Professor Donald Proulx is Chief Adviser for Anthropology.

Art

The Art Department's three major programs contain eight distinct areas of specialization. The three programs provide objectives ranging from a broad background of extensive coverage to highly specific professional investigations.

The B.A. degree program is designed to provide an aesthetic and historical knowledge of the visual arts and an opportunity to develop creative ability in several media. While all programs are subject to the University and College of Arts and Sciences core requirements, the B.A. degree program requires a greater involvement than the B.F.A. degree program in courses not directly within the Art Department. The B.A. degree program offers three majors: Art History, Studio Art, and the Combination Major of both studio art and art history. All B.A. degrees in the *Studio* or *Combination* Major areas require a minimum of 39 art credits, consisting of five elementary courses: Art 115, 100, 102, 120 and 122; and eight upper division courses (numbered 200 and above), two of which must be art history electives. The B.A. degree in *Art History* requires six credits at the introductory level, plus twenty-four upper division credits, which will include at least one seminar (300 level course). It is recommended that a student begin as early as possible with the historical survey (Art 111-113). This can, however, be substituted by any combination of Art 111, 113, 115, or a departmentally approved course. At the upper division level, a student should include courses in at least one non-western and three western areas from the following offered by the department: Primitive, Far Eastern, Indian, Islamic, Ancient, Medieval, Renaissance, Baroque, Modern and American. As the declaration of a major is prerequisite to the selection of a faculty adviser, it is best to declare an Art History major within the freshman or sophomore years.

The other two programs are of a professional nature and lead to a Bachelor of Fine Arts degree. Accept-

ance to all B.F.A. degree programs is effected during the sophomore year or after having completed 12 studio credits in art, through the submission of a portfolio to a faculty selection committee. Admission is based on the criteria of demonstrated ability and high academic standard. Transfer students may make arrangements to submit a portfolio during their sophomore year at another institution, otherwise the transfer students' portfolios should be submitted early in the Junior year. Before acceptance, during the first two years, the student experiences a foundation program of several courses in drawing, two and three dimensional design, and the general history of art. Because of its contemporary nature and relevance it is required that Modern Art 287 be taken as early as possible by B.F.A. program candidates. The B.F.A. degree program in Studio Art provides professional intensive coverage of one chosen medium: ceramics, painting, printmaking or sculpture, to be selected by the end of the sophomore year after acceptance through the submission of a portfolio. After selecting an area of specialization, it is the student's responsibility to notify the Art Department and the faculty members teaching in the major area. It is advisable for each student to have a faculty member in their major area assigned as adviser to their B.F.A. degree program. The B.F.A. degree program allows greater latitude of core requirements for further concentration within the Art Department. This program builds the best foundation for graduate study in Studio Art. It involves minima of 63 credits in Studio Art, 12 credits in Art History, and 48 credits in other disciplines. B.F.A. degree candidates will be reviewed by a committee of three art faculty members at the end of the Junior year. Approval by the committee constitutes permission to embark on a Degree Project during the Senior year. During the Senior year a student may elect from 6 to 12 credits in a Degree Project directed toward the exploration of personal objectives in the specific major area. All senior B.F.A. Studio Art majors must select a faculty member in their major area to direct their Degree Project and act as chairman of their B.F.A. Degree Project Committee. The Degree Project must be evaluated and approved by this committee which consists of the chairman and two other art faculty members. The Degree Project should include a statement of intent describing what the project will consist of and what the student plans to do, a technical section describing any pertinent technical information, an evaluative conclusion, and a collection of color transparencies of the actual work completed. The format is identical to that prescribed for a University Master Thesis and is bound in a 9″ x 12″ black ring binder.

The B.F.A. degree in Art Education program provides the student with a strong background in studio work, and the necessary courses in education and student teaching, which enable the graduate to be certified as an art teacher in the Commonwealth of Massachusetts. This certification permits the teacher to work on both elementary and secondary levels. Through a reciprocal arrangement teachers certified in Massachusetts may be qualified to teach in several other states. Student teaching is done for a full semester and usually at schools located in the vicinity of Amherst. Currently, through the Off Campus program conducted by the School of Education, students may also do student teaching in off campus sites. These range from California to England and from Quebec to Florida. The program's re-

quirements include minima of 33 credits in Studio Art, 9 in Art History, 6 in Art Education, 15 for teacher's certification (including sixteen weeks of observation and student teaching in either the elementary or secondary level), and 51 in other academic disciplines. Art Education majors are required to take introductory courses in each major studio area early in their program.

Asian Studies

There are majors leading to the B.A. in both Chinese and Japanese language and literature in which students may place emphasis on either modern or classical language. Students following either major receive a substantial foundation in reading, speaking, and understanding the language, as well as a basic knowledge of the respective literatures. Majors are encouraged to acquire a background in the history, government, society, religion, and arts of China and Japan—a background essential for an understanding of the cultures and literatures of the Chinese and Japanese people.

In addition to courses offered in language and literature in the Asian Studies Program, various departments in the University and the Five College system offer courses dealing with specific aspects of China, Japan and other parts of Asia. Consult offerings of the Departments of Anthropology, Art, Comparative Literature, Geography, History, Political Science, and Sociology.

Undergraduates interested in Asian Studies may wish to enroll in the University's Asian Studies Certificate program. The program does not constitute a major and is designed to supplement the work done toward a bachelor's degree in a regular discipline. Students who fulfill program requirements are awarded the Certificate in Asian Studies attesting to their attainment. Requirements for the Certificate are a total of 24 credits selected from the Asian Studies course list. There are no language requirements for the Certificate; however, any student interested in the serious pursuit of Asian Studies is strongly urged to acquire competence in an Asian language.

Astronomy

(Also see Physics)

The Five College Department of Astronomy is administered jointly with Amherst, Hampshire, Mount Holyoke, and Smith Colleges. The elementary courses for nonmajors are taught separately at each campus but all advanced courses are given on a joint basis for students from the five participating institutions. Five College courses are identified in the Undergraduate Catalog by ASTFC. The Astronomy Program at the University is also a part of the Department of Physics and Astronomy. The graduate program in astronomy is developed in close cooperation with the program of physics.

The Five College Astronomy Department offers undergraduate courses which furnish 1) specialization for those students planning graduate study in astronomy, 2) a more general major for students interested in careers in teaching, scientific journalism, technical editing, or similar areas for which astronomy may form the basis for a suitably broad science background, and 3) a background for all students who are interested in astronomy for its cultural and scientific value. Professor T. T. Arny is the Chief Adviser for Astronomy.

Students who plan to go to graduate school should obtain a firm foundation in physics and mathematics and should plan to finish satisfactorily Physics 184 or 163, Mathematics 174 or 186, and Astronomy 122 by

the end of the sophomore year. During the junior and senior years a student must complete Physics 255-256 and Physics 251-252, Mathematics 343, and three courses selected from Astronomy 237, 238, 343, 344, and independent study. It is also strongly recommended that the student take Mathematics 341, Physics 271-272 and/or 285-286, and obtain a good reading knowledge of German, French or Russian.

More flexibility in planning courses is available to those majors for whom the B.A. or B.S. will be a terminal degree in astronomy. In some circumstances Physics 142 and Astronomy 101-102 will be acceptable lower division courses. A minimum of three upper division astronomy courses and nine additional credits of upper division astronomy or physics must be satisfactorily completed. These may include Astronomy 231 and 234 but should be chosen in consultation with the Chief Adviser. In some cases advanced courses in the history or the philosophy of science may be desirable.

Those students wishing a B.S. rather than a B.A. degree need a total of 60 credits of science courses. The credits required beyond those explicitly needed for the astronomy major may be chosen from any science or behavioral science courses.

Independent and honors work are encouraged for all majors. Opportunities for theoretical and observational work are available in cosmology, cosmogony, radio astronomy, planetary atmospheres, relativistic astrophysics, laboratory astrophysics, gravitational theory, infrared balloon astronomy, stellar astrophysics, spectroscopy, and exobiology. Facilities include the Laboratory for Infrared Astrophysics, balloon astronomy equipment (16-inch telescope, cryogenic detectors), the Five College Radio Observatory, access (under supervision) to the 120-foot NEROC radio antenna, and a modern 16-inch Cassegrain reflector. Opportunities for summer research are also frequently available including an exchange program with the Observatory of Bonn University. Original publications often result from undergraduate research.

SAMPLE PROGRAM I

Rhetoric	Astro 237
Math 123 (135)	Phil 230
Elective	Physics 200
Elective	Elective
Elective	Elective
Rhetoric	Astro 234
Math 124 (136)	Astro 386
Physics 161	Elective
Elective	Elective
Elective	Elective
Physics 162	Astro 385
Math 173 (185)	Physics 254
Elective	Math 200
Elective	Ed. Psych
Elective	Elective
Physics 163	Ed. Block
Math 174 (186)	
Elective	
Astro 122	
Elective	

Rhetoric	Physics 251
Math 123 (135)	Physics 255
Physics 181 (161)	Math 341
Elective	Elective
Elective	Elective
Rhetoric	Physics 252
Math 124 (136)	Physics 256
Physics 182 (162)	Math 343
Elective	Astro 238
Elective	Elective
Elective	Physics 271
Math 173 (185)	Physics 285
Physics 183 (163)	Astro 343
Astro 122	Elective
Elective	Elective
Elective	Physics 272
Math 174 (186)	Physics 286
Physics 184	Astro 344
Elective	Elective
Elective	Elective

Note: Electives include courses needed to satisfy college and University distribution requirements.

Biochemistry

The biochemistry major provides a curriculum for those students who have an interest in both biology and chemistry and who wish to achieve a balanced and mutually supporting education in these two areas. Formal education in biochemistry is started with the general biochemistry course in the junior year and continued by requiring advanced tutorial and/or honors programs in the senior year. Professor T. Robinson is Chief Adviser.

For students who, early in their college years, already plan on graduate school and a professional career in biochemistry, this major would be an obvious choice. At present, most students arrive in graduate school to study biochemistry with no background in the subject and must spend a full year before they even have the background for deciding on an area of interest. This major would be valuable for students going into many areas of molecular biology.

For pre-medical, pre-dental, and pre-veterinary students a major in biochemistry would have many attractions. It is well-known that undergraduate experience in biochemistry and related fields can soften the difficult first year of medical school. Furthermore, a movement toward flexibility in the medical curriculum has been developing. A student who majors in biochemistry can look forward to exemption from biochemistry at growing numbers of medical schools with consequent free time for elective research, other courses, etc.

An undergraduate major in biochemistry could be valuable for future junior college and secondary school science teachers who may be expected to have competence in several areas of science. Finally, students who are merely undecided between chemistry and biology may find that a major in biochemistry will provide them with the background for a decision. The curriculum outlined below is flexible enough to allow a student to change his major to biology or chemistry as late as the end of the sophomore year without finding that he has deficiencies to be made up. In addition, the informal discussions during the freshman and sophomore years will provide him with guidance in his final choice of major.

The sample curriculum outlined below conforms to college requirements and closely follows recommendations made at the 1965 Symposium on Pregraduate Education in Biochemistry of the American Society of Biological Chemists.

First Year: Chemistry 113-114, Mathematics 123-124, Elementary Biology I-II, German 110-120, Rhetoric 100 or 110.

Second Year: Chemistry 165-166 or 261-262, Chemistry 167 or 263-264, Mathematics 174, Physics 141-142, German 130, 140 and English, Humanities I or II.

Third Year: Biochemistry 223-224, Biochemistry 225-226, Chemistry 210 (I)—Elem. Biol. Sci. (II), Chemistry 281-282 or 285-286, Social Sciences (I, II), Humanities (I, II), Computer Science (II).

Fourth Year: Two advanced courses in chemistry or biology, Advanced Biochemistry (including lab.) 5 cr. (e.g., Bio. 388 or 399), Social Science (I or II).

Botany

The Botany Department has a strong commitment to undergraduate education at several levels:

First, Botany majors are assured a thorough grounding in basic concepts in such fields as plant morphology, plant physiology, ecology, and genetics and cytology, as well as being offered a variety of other courses in more specialized areas. Students are encouraged to take at least one semester of Special Problems, which involves laboratory research in close cooperation with a member of the Faculty. This overall program equips the student especially well for teaching and research in biological sciences in high schools, universities, industry and experimental stations.

Second, the options available to those Botany majors also seeking certification for secondary school teaching provide not only an adequate training in basic botany, but exposure to material considered to be especially useful for teaching.

Many of the courses offered in the above two curricula are, of course, open and valuable to majors in other areas of science, such as Geology, Forestry, Agriculture, etc.

Third, the Botany Department offers courses without prerequisites designed for non-science majors. These courses, which include Natural History of Man, Genetics and Evolution, Plants and Environment, etc., provide a broad, although in no way superficial, approach to biological principles, and can be used to fulfill science core requirements.

Students majoring in Botany are required to complete the following courses: Chemistry 111-112.

Chemistry 261-262, 263-264 or Chemistry 160 + either Chemistry 281 or Biochemistry 220 or Botany 212.

Physics 141-142.

Mathematics—2 semesters of calculus, or one semester of calculus + one semester of either statistics or computer science or probability.

Zoology 240.

Botany—100, 211, 221, 228, 281, 291, 125 or 303-304, 311 (under some circumstances, and at the discretion of the Botany Department, equivalent courses may be substituted for any of these required Botany courses).

Students planning to teach in secondary school must fulfill the above Chemistry, Physics, Mathematics and Zoology requirements, and must also take the following courses:

Either Microbiology 140 or 250 or any Zoology course with a Zoology 101 prerequisite.

Botany 100 or 101 or 103, 125 or 303-304, 126, 211,

228, and at least 9 additional credits in 200- or 300-level Botany courses.

Additional requirements for certification are Psychology 303 and Education 251 in the junior year, and Education 285, 310 and 311 which are required in one semester in the senior year.

Chemistry

The prime purpose of the Department of Chemistry is to offer sound preparation for graduate study in chemistry. Accordingly, emphasis is placed upon intellectual accomplishment and broad understanding rather than on terminal training for specific chemical tasks. The program also affords sound preparation for work in chemical industry, chemical institutes, or governmental laboratories. A slightly modified program permits preparation for secondary school teaching. Professor G. Richason is the departmental Chief Adviser.

Students planning to major in chemistry should take Chemistry 113, 114; German 110, 120 (recommended, but Russian may be substituted); Mathematics 123, 124; and Physics 161 in the freshman year. It is recommended that the student elect one or more courses in biological science such as Botany 100, Zoology 101, Microbiology 140, 150, 250 or Entomology 126.

The sophomore year should include Chemistry 165, 166, 167, 168; Mathematics 174; Physics 162, 163 (Physics 141, 142 may be taken but provide less background than the 161, 162, 163 sequence); German 130, 148. The junior chemistry major takes Chemistry 210 and 285 during the first semester; and 269, 286, and 287, second semester. Chemistry 288 is to be taken during the first semester of the senior year.

To complete requirements for the B.S. degree with a major in chemistry and to qualify for certification to the American Chemical Society the student must take Chemistry 213 and 246, and two additional courses selected from the listing below. One of these two additional courses must be selected from either the "Physical Group" or the "Organic and Biochemistry Group," and with one of the courses being a laboratory course.

Physical Group: 290, 295, 388, Honors (and certain advanced physics and mathematics courses by approval of the Head of Department).

Inorganic, Analytical, and Radiochemistry Group: 213, 215, 244, 246, 388, Honors.

Organic and Biochemistry Group: 271, 272, 388, Honors; Biochemistry 223, 224.

Students in secondary education may use the Education Block to substitute for the two additional courses.

A student may qualify for the B.S. degree in chemistry (but not for certification to the American Chemical Society) without completing Chemistry 269, 213, or 246. However, the curriculum must then include four courses selected from the above listing. One of these must be a laboratory course, and two different groups must be represented by the selection. Students in secondary education may use the Education Block to substitute for two of the courses in the above groups.

A less vigorous program qualifies the student for a B.A. in chemistry. Students may satisfy requirements for the B.A. degree by completing the following: Chemistry 113, 114; 165, 166, 167, 168; 210; 281, 282; and two courses from the above listing, one of which must be a laboratory course. The same supporting courses are required as listed for the B.S. curriculum, except that German or Russian is not required, nor is the second year of calculus.

Classics

The study of ancient Greek and Roman civilization and culture, the oldest of humanistic disciplines, occupies a position central to all the humanities and still forms a broad base for the disciplines of history, English, philosophy, art history, comparative literature, and religious studies. It can provide a meaningful core in every student's education.

Courses labeled "Classics" on the 100 and 200 levels are offered for purposes of general education. They require no knowledge of Latin or Greek; all readings are done in English translation. Courses of this sort are offered in Greek and Roman civilization, ancient mythology, and Greek and Latin literature in translation. There is also a special language skills course in Greek and Latin elements in English designed to increase the student's knowledge and understanding of English vocabulary by study of the roots, prefixes, and suffixes incorporated into English from Greek and Latin. A full range of courses is offered in the Latin language and its literature. The offerings in Greek may be supplemented with courses at the neighboring colleges. Arabic, Armenian, Hebrew, Persian, and Turkish are presently being offered in the Classics program.

Students majoring in Classics arrange their own individual programs of study in close consultation with a faculty adviser. Emphasis may be placed on Greek and/or Latin language and literature, ancient history, ancient art and archaeology, ancient philosophy, ancient religion, mythology, the Classical tradition, or a comparative study of ancient and modern literatures. Courses may be chosen from those available in the Classics Department, from related courses in other departments at the University, and from appropriate departments at the neighboring colleges, Amherst, Smith, and Mount Holyoke.

A major in Classics can be designed to serve any of the following purposes:

1) to provide a meaningful humanistic core in a liberal arts education,

2) to provide training for professional careers in teaching Latin and Classics on the elementary or secondary school levels, or

3) to provide preparation for graduate work in the field leading to a Ph.D. in Classics and teaching on the college level.

Requirements for the Classics major:

I. Prerequisites to the major: Latin 110, 140 (or four years of secondary school Latin), 150, 160 or Greek 110, 140, 150, 160. (Recommended collateral courses: Classics 100 and 102.)

II. The major: At least 10 upper-level courses (= 30 credits) in Greek, Latin, Classics, ancient history, ancient art, ancient philosophy, ancient religion, mythology, the Classical tradition, or appropriate courses in comparative literature. The courses chosen should constitute a coherent program of studies. No work in the ancient languages is required beyond the 160 level.

For more information, consult Professor Edward Phinney, Herter 402 (545-0514) or any member of the Classics staff.

Comparative Literature

The study of comparative literature has the following aims: to develop the student's ability to read literature with critical perceptiveness; to provide a more accurate sense of literary history than the study of a single litera-

ture makes possible; to encourage detailed scrutiny of literary masterworks selected from more than one language, place, or time; to prepare the student for more advanced, methodical investigation of problems involving more than one literature; and to attempt to make clear the meaning and function of literature in itself and in its interdisciplinary dimensions.

Two different types of major program lead to the B.A. degree in Comparative Literature. One is designed for the student who plans to go on to graduate study in comparative literature or in some closely allied field; the other is directed toward the needs of a student who is not planning graduate study but wishes to read widely and with some depth in at least two different literatures.

The first type of program normally involves the study of literature in two languages, a major and a minor; one of these may be English. Majors must also fulfill a requirement in a third language, preferably ancient, either by taking six hours of elementary course work or by passing the appropriate reading examination. The usual program for this first type of major consists of 42 hours of course work, not including the work done in the third language. These 42 hours should be distributed as follows: 15 in the literature of the major language, 12 in the literature of the minor language, and 15 in Comparative Literature (including 3 directed toward the literature of the major language). Any student who is capable of doing upper-level work in a third language may elect the following distribution: 15 in the major literature, 9 in one minor literature, 6 in another, 15 in Comparative Literature, and 3 to be elected in any of the preceding categories.

The second type of program involves the study of literature equally in two languages. The normal program will consist of 45 hours of course work, distributed as follows: 15 in the literature of one language, 15 in the literature of the second language, and 15 in Comparative Literature.

Neither language department courses taught in translation nor Comparative Literature courses numbered lower than 203 may be counted as part of the major. Comparative Literature 203 and 204 may be counted only if the student has arranged beforehand with the instructor to do reading in the original language. All Comparative Literature courses at the 200 level are, however, strongly recommended to prospective majors as providing essential backgrounds and introductions to more advanced study. Language department courses numbered higher than 140 may be counted as part of the major.

Comparative Literature 380, Theories of Literature is required of all majors without exception. Comparative Literature 204, Classics of European Literature is required of all majors who have a primary interest in modern literature. It is also recommended that majors take at least three hours of their work in the form of a non-Western humanities course or a course in the Department of Afro-American Studies. Except for Comparative Literature 380, courses may not normally be counted as a part of the major program if they are taken on a pass/fail basis.

Economics

Economics is the study of an imposing, hard fact of life, that what we as a society would like to have exceeds the capacity of our resources to provide it. We are forced, therefore, to choose--and simultaneously exclude—those goods and services we will have from the larger menu of possibilities. Economics develops the basic

principles stemming from this scarcity and applies them to analyze the various aspects of human activity where such choices must be made.

The Economics Department at the University offers courses spanning this naturally broad range of interests within economics. The courses are subject to continuous review as the findings and techniques of economic science improve. In recent years substantial numbers of new courses have been added and many existing courses revised.

Courses are offered in such topics as economic theory, international trade, industrial structure and regulation, labor economics and human capital, mathematical economics, economic history, lesser developed economies, comparative systems, regional and urban economics, public finance and history of economic thought.

Thus the individual student is faced with a choice. The department has far more course offerings than he, even as a major, could reasonably take. But his decisions have been made much easier by the flexibility deliberately built in the course structure. A student who wishes a basic understanding of economics or completion of a (D) distribution requirement will probably take Economics 100, Elements of Economics. If he is interested in a particular topic he may take Economics 121, International Trade; Economics 141, Labor Problems; Economics 171, Comparative Systems; and Economics 181, Urban Problems; all of which presume no previous economics courses. A student expecting to take more than one economics course should begin with Economics 103, Microeconomics and continue with Economics 104, Macroeconomics. Then, if the economics of a particular subject interested the student, he may enroll in the appropriate one from among most other courses offered by the department. A student interested in developing economic tools of analysis further for a career in business or systems analysis, for example, can take Economics 203 and 204 after the two introductory courses.

The same freedom of choice extends to majors in economics. Graduates of the undergraduate program in economics continue in a wide variety of categories such as graduate school, law school, government, or business so that they should be able to structure their own appropriate program.

Along with university and college requirements the department requires majors to complete 24 credits in economics which must include 104, 203, 204 and at least 3 other courses of the 200 or above level. The only other requirement is one of calculus such as 116, 127, 135, or 146 so that students have some familiarity with the language in which so much of modern economics is conducted. Majors are assigned to a permanent adviser when they enter the department but are not required to obtain his signature on semester programs. In practice many economics majors follow an informal advising system of consulting faculty members from whom they have had courses or who are well versed in specific areas.

English

The student who majors in English will gain a considerable knowledge of Western literature; he will develop skill in expository and creative writing; and he will increase his capacity to read literary works with perception and to judge them by critical standards. Such a program has maximum value as liberal education, and is especially useful to students whose interests are in writing, editing, criticism, and teaching. Randall Current

is departmental Chief Adviser; James Leheny is Director of Undergraduate Studies.

The Department of English offers courses in composition, literature, and language. The Program in Journalistic Studies is also administered by the Department. Students majoring in English must take 1) one period course in English literature before 1800, 2) one semester of study in a non-English literature, read either in the original language or in English translation, and 3) three of the following four options: a) one course that has as its primary concern the study of the English language, b) one course in the works of Shakespeare, c) one course that studies intensively a single major British or American author, d) one course in the development of a literary genre such as tragedy, comedy, satire, lyric poetry, the novel. The student should elect his remaining six English courses and appropriate courses in other departments, including University core requirements and electives, to provide himself a coherent unit of study that accords with his own needs and interests. He is invited to consult with appropriate members of the Department about such areas of coherence as medieval studies, Renaissance studies, literature and psychology and American studies.

An English major must take at least 30 and no more than 45 hours of upperclass English courses except to the extent that he earns credits beyond the 120 hours required for graduation. Honors theses may be included in or excluded from the 30-hour total at the writer's discretion. A quality-point average of 2.0 or better must be maintained in the upperclass courses listed in the preceding paragraph. The student may count in the 30 hours required for the major up to six credits for any upperclass course in Comparative Literature, or in any foreign literature read in the language or in translation; any upper-level course in Journalistic Studies or in Linguistics; and any upper-level course in Speech primarily concerned with language or literature. Furthermore, upon presentation to the Chief English Adviser of sufficient justification, the student may obtain permission to count other courses not here included.

A student who intends to apply for admission to the Education Block in preparation for secondary school teaching should consult with Gary Aho, Chairman of the English Department's Committee on Teaching.

French

The vast richness of France's long cultural life—royal, imperial, and republican—as well as the tenacity of France's citizenry wholeheartedly bound to that life, have given the world an unforgettable gift. Apart from the natural grace and incisiveness of its language, French literature, rarely stolid, is a continual and exhilirating plunge into intellectual and spiritual turmoils committed to an understanding of human dilemma. For that reason, the best of French literary works needs no dusting off to be appreciated today, for they either forecast or they are already the contemporary image of a questioning, vibrant civilization. Ties of language bind parts of Belgium and Switzerland to metropolitan France, but without loss of identity, while new, different, and often brilliant expressions of man's condition emerge with increasing rapidity from artists in French Canada, Africa and the Antilles.

Students planning to major in French have access to programs ranging from language skill courses at all levels to a rich body of courses devoted to literature and civilization. To supplement the major, requirements

 of which are outlined in several other brief documents, students are urged to take advantage of our overseas programs in Grenoble and Pau, or to spend their entire junior year in Paris under the auspices of the University of Massachusetts-Boston. Majors will also find living in the French Corridor not only a successful way of learning spoken French outside of the classroom, but also an important introduction to life in France. The department regularly invites exceptional scholars to spend a semester or year on campus to teach undergraduate courses; it also receives the annual visit of a theatrical troupe offering a varied repertoire; it makes available a film series open to the public.

Special departmental advisers determine the major's proper placement within the department, help to formulate the future program of each student, and resolve academic problems that may arise during the major's four years on campus; other special advisers clarify overseas programs. For their part, majors may and should elect (within the limits of the 36-credit major field) related courses in other fields: philosophy, art history, English literature, French history, and so on. Advisers will always assist majors in selecting those extra-departmental courses meant to enrich and enhance the major field.

The major in French is carefully designed both in breadth and in depth to form the well educated citizen. At the same time, portions of the major program are calculated to prepare for teaching at the secondary level and to serve as a preliminary training leading to the degrees of Master of Arts, Master of Arts in Teaching, and the Doctor of Philosophy. Students may wish to discuss many additional programs leading, for example, to foreign service careers or posts requiring both a proficiency in spoken French as well as a wide knowledge of French thought and life. As a support for future professional life, the French language is used exclusively in all major courses.

For complete information concerning the major in French, please consult Professor Micheline Dufau, Chairman of the Department of French and Italian, or designated advisers.

Geology

For students considering Geology as a career, the opportunities are many. Those interested primarily in basic science may look to positions in teaching, in museum work, on state and Federal surveys, and in various research organizations. Those concerned with applied science may work in mining geology, petroleum geology, engineering geology, environmental geology, groundwater geology, coastal geology, surficial geology, and economic mineralogy. The fields of space science and oceanography also provide opportunities for students with geological training.

The Bachelor of Arts degree program in Geology is intended for those wishing a broader education in liberal arts than is possible with the Bachelor of Science degree. The Bachelor of Science degree provides adequate preparation for graduate work in Geology. The Bachelor of Arts degree may also be adequate preparation for graduate work in Geology when planned in consultation with an adviser.

The Bachelor of Science degree program is divided into two options, a Geology Option and an Earth Science Option. The Geology Option is designed for those planning a professional career in Geology, and provides preparation for graduate work. The Earth Science Op-

tion prepares students specifically for careers and certification in the teaching of Earth Science at the secondary level. The departmental Chief Adviser is Mr. T. Rice.

Bachelor of Arts in Geology degree requirements are: fulfillment of the general University and College of Arts and Sciences requirements for the B.A. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or alternatively, Geology 105, 106, 107, or 108 and Geology 160); a minimum of 24 credits in upper division Geology courses (Geology 192 is considered an upper division Geology course); a minimum of 15 credits in supporting natural sciences and mathematics (Natural Science and Mathematics courses may be elected from the offerings of the following departments: Astronomy, Biochemistry, Botany, Chemistry, Microbiology, Mathematics, Physics, Statistics, and Zoology; supporting science courses may also be elected from the offerings of Computer Science, Marine Science, and certain other departments with the approval of the student's adviser). Any student following this degree program who may plan to go on to professional work in Geology or related science is expected to consult with his adviser before selecting his supporting natural science and mathematics courses. (These courses should include Chemistry 111-112, Physics 141-142, and the necessary supporting mathematics courses, usually at least Calculus I.)

Bachelor of Science, Geology Option, degree requirements are: fulfillment of the general University and College of Arts and Sciences requirements for the B.S. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or, alternatively, Geology 105, 106, 107, 108 and Geology 160); followed by Geology 192, 220, 230, 231, 240, 250, 251, and a minimum of 3 credits of work elected from upper division Geology courses; summer field experience (ways in which this requirement may be fulfilled should be discussed with the student's adviser); and work in supporting Natural Science and Mathematics courses (for list of Departments see description of B.A. degree) consisting of Calculus I and II plus one additional 3-credit course in Mathematics, Statistics, or Computer Science, Physics 141 and 142 (Introductory Physics for science majors), and a minimum of 3 credits elected from the course offerings in the supporting disciplines; plus a minimum of 6 credits elected from upper division Geology courses or the supporting disciplines.

Bachelor of Science, Earth Science Option, degree requirements are: fulfillment of general University and College of Arts and Sciences requirements for the B.S. degree; 3-5 credits in Introductory Geology courses (Geology 100, 101, or 130; or, alternatively, Geology 105, 106, 107, or 108 and Geology 160); followed by Geology 192, 220, 230, 240, 250, 251, and a minimum of 2 credits of work elected from upper division Geology courses; work in supporting Natural Science and Mathematics courses (for list of Departments see description of B.A. degree) consisting of Calculus I and II, Chemistry 111 and 112 (General Chemistry for science majors), Physics 141 and 142 (Introductory Physics for science majors), or 6 credits in Astronomy, and 12 additional credits (other than Geology) in the Natural Sciences or Mathematics selected with the student's adviser to constitute a "minor" concentration; and the Secondary Education Block (Psychology 101 and 301 plus courses specified by the School of Education). Students electing this degree option should register with the Secondary Education Office in the School of Education during their

 Sophomore or Junior year to be sure that they are accepted for admission to this program.

Geography

The program in geography provides a sound preparation for majors intending to proceed to graduate study and a broad array of elective or required courses in systematic and regional geography for students majoring in other fields.

For students specializing in geography there is a wide variety of possible careers in teaching at all levels in planning, industry and government agencies.

The faculty is prepared to discuss a program of courses in geography and related fields which best fits the career intentions and interests of the individual student. The minimal major requires that the student take one Introductory course (135 or 155), two courses in Regional Geography (200-239), Cartography (250), two courses in Systematic Geography (260-399) and any other three upper division geography courses.

Prof. Terence Burke is the Chief Adviser for Geography.

Germanic Languages and Literatures

To fulfill an undergraduate major in German, a student must complete 33 credits in the department's junior-senior courses. Two programs are available: one is designed principally for those who wish to teach in elementary or secondary school (Program A), the other for those who are primarily interested in continuing their studies in graduate school (Program B).

Students selecting Program A should take 161, 201, 202, 211, 221, 241, 283 and 284, and a minimum of three courses in German literature, one of which must be in the twentieth century (331, 332, 333, or 334).

Students selecting Program B should take 161, 201, 202, 211, 221, 284, 321, and 391, and one course in each of the following categories: (a) 331, 332, 333, 334 (b) 311, 312, 313 (c) 301, 302, 303.

One course in history or philosophy is required of all German majors.

Freshmen who fulfill the language proficiency requirement upon entrance should take 161 or 201.

Students are urged to supplement their course work with at least one summer session at an approved summer school of German or by participating in a summer program abroad, such as the University offers in Freiburg, Germany.

Hispanic Languages and Literatures

The department offers a major in Spanish and a number of courses in Portuguese. A major in Portuguese is planned.

All the department's programs stress training in and the use of language skills. The courses in Hispanic literature are taught for their basic literary values and for the insights these afford into the cultures of Spanish- and Portuguese-speaking peoples. The department also offers courses which directly stress the use of the Spanish language and which are of particular advantage to those Spanish majors who plan to teach the language.

The undergraduate major program consists of 36 junior-senior credits, 9 of which may be in related areas and disciplines approved by the department. Entering Spanish majors who achieve an intermediate year level in the placement tests are urged to take Spanish 146, an intensive course which will permit them to start their Spanish concentration one semester

sooner than if they were to take Spanish 130-140, the usual intermediate course.

Prerequisite to a major in Spanish are the following courses: Spanish 131-141, 161-162, 181-182, 190.

The successful completion of courses from the following areas will constitute partial fulfillment (24 credits) of a major in Spanish:

(a) Three courses in Conversational Spanish: Spanish 251, 252, 253 (one credit each).

(b) One course from the Medieval Literature group: Spanish 315, 317, 318.

(c) Two courses from the Renaissance and Golden Age Literature group: Spanish 325, 330, 335, 340.

(d) One course from the Eighteenth- and Nineteenth-Century Literature group: Spanish 355, 365.

(e) One course from the Twentieth-Century Peninsular Literature group: Spanish 381, 382, 383, 384.

(f) Two courses from the Spanish-American Literature group: Spanish 370, 371, 372, 373, 374, 375.

Additional options are being planned, with the object of allowing students to choose either the major program outlined above or an alternate program which would give greater emphasis to language and linguistics. Among the possibilities of the alternate program is preparation for work in Bilingual-Bicultural education.

History

Courses in history are designed to provide an understanding of man through a study of patterns of development in the past. The study should also give the student an introduction to major problems in world affairs. A major in history has value to the general student as a humanistic discipline. It has application as preparation for careers in such fields as teaching, law, government, journalism, ministry, library science and business.

History majors must take as required courses in their freshman and sophomore years two year-long sequences chosen from History 100-101 or 110-111, 115-116, 120-121, 140-141, 150-151. The history major will select one of four areas of specialization (European, British, American or Latin American history) and take within it a minimum of 15 to 18 credits of upper-level course work. Students specializing in European history will be required to include in their program at least 3 credits in ancient or medieval history and an additional 3 credits in the early modern period (from the Renaissance through the 18th century). In addition a student will take 6 or 9 credits outside the specialization for a total of 24 upper division credits.

Italian

The immeasurable wealth of Italy's long cultural life as well as its contribution to Western civilization are manifest. Apart from the beauty of its language, Italian literature is a never ending search for a better understanding of the human condition. Italian literary works are among the most appreciated today for their probing questioning of historical events and social phenomena, their avant-garde character, and their artistic representation of reality.

Students planning to major in Italian have access to programs ranging from language skill courses at all levels to a rich body of courses devoted to literature and civilization. To supplement the major, requirements of which are outlined in other brief documents, students can take advantage of the University Summer Program in Bologna, Italy. Often, at times in conjunction with

other colleges in the Amherst area, the department invites exceptional scholars to spend a semester or year on campus to teach undergraduate courses.

Special departmental advisers determine the major's proper placement within the department, help to formulate the future program of each student, and help resolve academic problems which may arise during the major's four years on campus. Majors should elect (within the limit of the 36-credit major field) related courses in other fields such as philosophy, Italian history, Italian art, and upper division courses in other literatures. Advisers will always assist the major in selecting those extra-departmental courses intended to enrich and enhance the major field.

The major in Italian is carefully planned both in breadth and in depth to form the well educated person. At the same time aspects of the major program are designed to prepare for teaching at the secondary school level and to serve as a preliminary training leading to the degrees of Master of Arts, Master of Arts in Teaching, and the Doctor of Philosophy. Students may wish to discuss many additional programs leading, for example, to foreign service careers or posts requiring both a proficiency in spoken Italian as well as a wide knowledge of Italian life and thought. As a support for future professional life, the Italian language is used exclusively in all major courses.

For complete information concerning the major in Italian, please contact Professor Zina Tillona, Associate Chairman for Italian Studies.

Journalism

This co-curricular (non-credit) tutorial program is open to all students, regardless of their majors, who think they are interested in journalism careers.

Newspapers in Northampton, Greenfield, Holyoke, and Springfield cooperate in this co-curricular journalism program. The college daily also cooperates, and any student who writes for it may obtain tutoring in journalistic writing techniques. Undergraduates interested in journalism careers should spend a few hours weekly writing for the college daily, starting in their sophomore year, and should seek work on a commercial newspaper during the summer of their junior year. Summer placement aid is provided as part of the tutorial and counseling program.

As a rule, the director of the journalism program arranges for students to participate in the tutorial program with commercial newspapers after they have participated in the tutorial program with the college daily.

Journalistic Studies

This liberal arts curriculum program introduces students to journalism as an academic discipline (communications research). Majors in Journalistic Studies must choose either an *interdepartmental major* in which the student earns at least 15 junior-senior credits in Journalistic Studies along with 15 junior-senior credits in one other liberal arts department, or a *double major* in which the student earns 15 credits in Journalistic Studies while also completing all the requirements for a major in one other liberal arts department, such as English, History, or Political Science. A student's choice of an interdepartmental or a double major is made by agreement with his or her adviser. The interdepartmental major is generally limited to honor students who must apply to the Chairman of Journalistic Studies.

All writing courses are taught by the Department of English, and any two of its eight advanced writing courses are acceptable in meeting the major requirement of at least 15 credit hours in Journalistic Studies. Because the writing process is the same regardless of the product, no particular writing courses are recommended. No more than one writing course should be elected in any one semester. All majors must elect at least three of the following eight content courses in Journalistic Studies:

Introduction to Mass Communication
Language and Communication
Independent Study and Research (I and II)
The Communication Process (Summer Course)
Mass Communication Theory
International Communication
Freedom of the Press Seminar

The Journalistic Studies courses provide background for students interested in such diverse career objectives as communications research, law, advertising, editorial work for newspapers or magazines or publishing houses or radio and TV stations, public relations, teaching, and creative writing. Graduate study is required for careers in communications research.

Students interested in the Journalistic Studies program should see Dr. Howard Ziff.

Linguistics

Though it is a humanistic discipline, linguistics is best described as the science of human language. Through the scientific study of the structure of language, linguists seek to understand the nature of that human mental faculty by which we produce speech from an intended meaning, understand meaning from spoken or written language, and acquire our native language. Linguists study the nature of the knowledge a human being possesses when he "knows" his native tongue. Although Linguistics has no undergraduate major, courses in linguistics are counted for major credit in several departments, and are relevant to majors in English, the foreign languages, Anthropology, Speech, Psychology, Philosophy, and Computer and Information Sciences.

Mathematics

(See also Probability and Statistics)

The student electing mathematics as a major will find a variety of stimulating program options. These include preparation for a career in teaching at the secondary school level, graduate and research work in mathematics, computer programming and data processing, actuarial work, statistics, or an industrial position. Mathematics is also a good general major for students who are uncertain of their career plans. In addition, there are many opportunities for interdisciplinary study based on mathematics. Both Bachelor of Arts and Bachelor of Science degrees are offered, and the choice between them is usually based upon the interests and intentions of the student.

All mathematics majors are required to complete a two-year sequence in calculus and linear algebra, or the equivalent. In addition, eight upper-division courses are required. These may be chosen from the department's offerings or from certain mathematics-related courses in other departments. Five of these upper-division courses must be taken in the form of two two-semester sequences in two of the areas of algebra, analysis, applied mathematics, and geometry and topology, and a one semester elective from a third of these

 areas. Students who have taken calculus in high school may be entitled to advanced placement with credit for their previous work; they should consult the mathematics placement counselor during the summer counseling period. Further detailed information about mathematics major requirements may be found in the Mathematics Major's Information Leaflet which may be obtained from the department.

The student majoring in mathematics will have ample opportunity to shape his major program to fit his interests. If he is interested in computer and data processing he would probably take courses in computer and information science, logic, linear programming and possibly probability and statistics. The student aiming for a teaching career at the secondary level might elect courses in geometry and number theory, and then spend one semester of his senior year practice teaching in a public secondary school. A student interested in actuarial work would take courses in analysis and probability and statistics, and also computer science. Those interested in industrial work would do well to take advantage of the department's offerings in analysis and applied mathematics.

Students interested in statistics will find a good basic preparation in the mathematics department's course offerings, and will have an opportunity to take statistics courses for credit toward a major in mathematics.

Those planning on college level teaching or research in mathematics should be thinking of graduate school and are urged to take a number of the "pure" mathematics courses such as group theory, topology, differential geometry, and set theory.

Students who demonstrate unusual mathematical aptitude by the completion of their junior year are encouraged to enroll in a graduate course or to participate in the Senior Honors Program in which the student undertakes a substantial independent study project and writes an honors thesis.

Every student majoring in mathematics is assigned a faculty adviser. Further opportunities to meet with faculty members on an informal basis are provided by various department-sponsored activities. In the past these have included a mathematics club for undergraduates, and a junior colloquium at which special lectures for undergraduates were given by faculty members. For those who enjoy mathematical competitions, the department has entered a team in the national Putnam Prize competition for the past several years. Professor S. Allen is the departmental Chief Adviser.

Microbiology

The major program in microbiology is designed to offer students sound preparation for more intensive graduate study and research in microbiology, as well as basic preparation for a wide variety of positions as microbiologists in research and non-research laboratories. In either event, microbiology majors should immediately begin preparation in chemistry. Microbiology majors are required to have broad training in collateral sciences, and minimum requirements include chemistry through quantitative analysis and organic, and one year each of introductory biological science, physics, and mathematics. Those students contemplating graduate study will be advised to emphasize stronger training in these collateral sciences. Courses in microbiology are designed to offer fundamental training in the basic core areas and disciplines of this field. Microbiology 250, 280, 340, senior seminar, and elective courses contributing

to a total of at least 17 credits in microbiology are required of majors. Prof. R. P. Mortlock is departmental Chief Adviser.

Music

The Music Department offers the Bachelor of Music degree and the Bachelor of Arts degree. A student must apply to the department for admission. An audition is required of all applicants.

The Bachelor of Music degree may be earned with one of three areas of concentration: performance, theory-composition, or music education. The three programs have a considerable part (91 credits) in common: The University core requirements (33 credits—36 when Music 111 is counted as the "C" course), a series of background courses in Music (58 credits) consisting of theory courses 111, 112, 113, 114, 211, 212, 215, and 216 (23 credits), music history and literature courses 102, 201 and 202 (9 credits), performance courses each semester (24 credits), and course 363, Conducting, (2 credits).

The additional requirements for a concentration in performance are: music courses 217, 385, 386, 18 credits in performance, and 12 elective credits, 6 of which may not be music credits (totalling 129 credits). A senior solo recital is required.

The additional requirements for a concentration in music education depend upon whether the student's primary skill is vocal or instrumental. In either case, 5 additional credits in performance work and 15 credits for the teacher certification courses are required. For voice students, 16 credits in music education, 6 credits in Italian, and 6 elective credits (totalling 139 credits) are required. For instrumental students 7 credits in music education, 18 credits in instrumental techniques, and 3 elective credits (totalling 139 credits) are required.

The Bachelor of Arts program for a music major is pre-professional, serving the needs of the student who wishes to broaden his cultural background. All majors will take 111, 112, 113, 114, 201, 202, 211, 212, and must register for applied music and either band, orchestra, or chorus every semester. The student will choose as his area of concentration music history, theory, or applied music. The junior-senior years will include a sequence of advanced courses suggested by the department. Students whose major area is applied music are required to present a senior solo recital. Prof. J. Contino is the departmental Chief Adviser.

Majors in other departments may elect a minor in music. This program should include 111, 112, 201, 202, and 4 credits in ensemble or individual applied music. Education majors, upon completion of 111-112, should elect 242 in lieu of 201.

The band, orchestra, chorus, and various small ensemble groups are open to all University students who wish to participate in a performing organization.

The Music Department is an associate member of the National Association of Schools of Music.

Philosophy

Philosophy deals with questions of central and perennial human concern: large questions, having to do with reasoning, or right and wrong, or man, or the world, in general terms; and small questions about the fine structure of knowledge, existence, and value. There is a special pleasure in thinking about such questions, and in learning how to think about them clearly, responsibly, and effectively. A philosophy student becomes

 acquainted with an important part of our common intellectual heritage; but he also acquires intellectual habits and skills which serve him well in other fields and disciplines and indeed in daily life.

The core fields in philosophy are logic, ethics, metaphysics, and theory of knowledge. There are also specialized fields, such as philosophy of science, political philosophy, aesthetics, philosophy of religion, and philosophy of language. A student may wish to develop a competence in one of the specialized fields, or in the philosophy of ba certain period (e.g., in ancient philosophy or in the philosophy of the 17th century), or in a particular school or style of philosophy (say in existentialism, or in analytic philosophy).

The Philosophy Department offers courses in all areas of philosophy at all levels, from the most elementary to the most advanced. Majors in philosophy take 30 credits in departmental courses. No particular course is required, but each major has to have one semester course (3 credits) in logic, one in ethics, and four in the history of philosophy. The 100-level courses may be counted in meeting these requirements. Students with specialized interests can arrange independent study courses; and those with a B average or better can do honors work in their senior year, in which an honors thesis, written under the supervision of a faculty tutor, is presented in lieu of 6 of the required 30 course credits. Professor Gareth Matthews is Director of Undergraduate Studies and Chief Adviser for the major.

Physics

(See also Astronomy)

The Department of Physics and Astronomy offers programs of study and individual courses in physics for students in science and science related areas and for liberal arts students.

For the liberal arts student a variety of one and two semester courses is available. Physics 115, 116, 117 and 118 consider topics in music, special relativity, nuclear energy, and quantum physics respectively. Physics 121-122 provide a broader view of the ideas and concepts of physics for the non-science student.

Physics 141-142 are designed for students in the life sciences as well as pre-med, pre-dent, and pre-vet majors. Physics 161-162-163 provide the necessary physics background for engineering, chemistry, and other physical science majors. Honors sections are available in Physics 161-162. These sections are identified by the numbers 171-172. An introductory course in physics for Elementary Education majors is available as Physics 130.

Physics 100 is appropriate for students who want to be exposed to some of the highlights of Physics in one semester. This course offers an excellent opportunity for a student to test his interest in Physics as a possible major area.

Students planning to major in Physics may consider one of two kinds of programs. The R program is aimed at those who wish to pursue research and university careers and plan to go on to graduate study in Physics. The T program is designed for those who plan to go into inter-disciplinary work, physics teaching at the high school level or science-oriented, administrative, technical, and business careers. Considerable flexibility is available in this latter program to suit the needs and goals of the individual. Although it is possible to switch between the two programs until fairly late

stages, students are strongly urged to plan their courses early in consultation with faculty advisers in the Department. Dr. Morton M. Sternheim, Director of Undergraduate Studies in this Department, will provide information concerning counseling. Either the series Physics 181-182-183-184 or Physics 161-162-163 is appropriate for Physics Majors in the Freshman and Sophomore years, although Physics 181-184 is the preferred start for students interested in the R program. This series is also available for non-physics majors who may wish to learn Physics with a more substantial degree of mathematical sophistication. Minimum mathematics courses are Mathematics 123-124-173-174 (or equivalent background). These should be started at the beginning of the Freshman year if possible. The Freshman and Sophomore years should include two science elective courses (such as Chemistry 111, 112).

In addition to the above, the following are minimum requirements for a B.A. or B.S. degree in Physics: 18 credits in upper division courses in the Department of Physics and Astronomy, which must include at least 4 credits in electricity and magnetism with a laboratory, 3 credits in modern physics and 3 credits in advanced experimental work or an experimental honors project. Normal preparation for graduate study in Physics (R program) consists of several Physics and Mathematics courses in addition to the minimum requirements (see the following typical program). The distinction between the B.S. and B.A. degrees is made on the basis of distribution requirements set by the College of Arts and Sciences.

Typical programs for both types of majors are:

R Program

Freshman year	
Phys 181	Phys 182
Math 123	Math 124
Science elective	Science elective
Sophomore year	
Phys 183	Phys 184
Math 173	Math 174
Junior year	
Phys 251, 255	Phys 252, 256
Phys 387	Phys 319
Senior year	
Phys 271, 285	Phys 272, 286
Phys 375	Phys 376 or Honors project

T Program

Freshman year	
Phys 100	Phys 161
Math 123	Math 124
Science elective	Science elective
Sophomore year	
Phys 162	Phys 163
Math 173	Math 174
Junior year	
Phys 200	Phys 301, 375 or 376, 210
Senior year	
Phys 302, 386, 390	Education block or other electives

Political Science

Courses in Political Science investigate the nature, functions, and problems of political systems, and of the place of politics in the modern world. These courses can be broadly grouped into the fields of Political Theory, American Politics and Public Law, State and Local Politics and Public Administration, Comparative Politics and Area Studies, and International Relations.

The degree program in Political Science provides a thorough foundation for enlightened citizenship and to prepare them for a wide range of careers, such as graduate study leading to academic or research positions, public service at the federal, state or local level, political office, the study and practice of law, foreign service, business and education. Professor Jerome Mileur is the Chief Undergraduate Adviser.

The Political Science Department offers three introductory courses: 100 American Politics; 150 Comparative Politics; and 161 World Politics. Any of these courses meets the University requirement of an introductory course in social science. Political Science majors are required to take two of the above three courses, the two selected depending upon the background, interest and experience of the student involved. Credit will not be awarded for more than 6 hours of introductory work.

Majors in Political Science are normally expected to complete the basic courses in their freshman or sophomore years. A minimum of 10 additional courses is required. At least one course must be selected from each of the five fields: political theory, American politics and public law, state and local politics and public administration, comparative politics and area studies, and international relations. Any four additional Political Science courses will complete the Departmental distribution. In addition, the Department requires a minimum of 12 credits from among the non-introductory offerings in history, philosophy, anthropology, economics, psychology, and sociology. Any combination of four courses above the 200 level satisfies this requirement.

The curriculum is flexible enough to accommodate a wide range of career and vocational interests. Students are encouraged to develop their individual programs in consultation with Departmental advisers. Opportunities also exist for independent research (through the Senior Honors Program), for exchange programs (within the Five College area, among a number of participating universities and colleges in the United States, and with a number of universities abroad), and for various internships and training programs at the local, state, and national levels.

Probability and Statistics

(See also Mathematics)

The curriculum in probability and statistics is intended to develop student insight into the nature of scientific method, with emphasis upon probabilistic models of its chief tool, the experiment. Distinctions between deductive and inductive methods of reasoning are explored. Statistical techniques for dealing with data in small or large quantity are developed and studied. Courses offered introduce the student to analytic devices for dealing with data that are commonly used in the social, biological, and physical sciences; business, engineering and other disciplines.

Students with training in calculus should elect Statistics 315 and 316. Students without calculus who desire a thorough grounding in the concepts under-

lying statistics should elect Statistics 231 and 232. Those who wish merely to obtain some familiarity with elementary statistical ideas and techniques should elect Statistics 121 and subsequently Statistics 251.

Any of the three courses Statistics 121, 231, or 315 serve as prerequisites for sampling theory (S271), design of experiments (S261, S262), and multivariate analysis (S281, S282).

There is at present no undergraduate major in statistics. Those who intend to study statistics at a graduate level should concentrate on mathematics and elect courses in computer science. Statistics finds useful applications in diverse fields such as animal and plant breeding, econometrics, engineering, market research, sociology and psychology. Advanced courses in statistics require a background of at least two years of calculus and preferably Mathematics 225/525 Advanced Calculus and Mathematics 211/511, 212/512 Abstract Algebra.

The Statistical Laboratory is open to students and staff wishing to use its facilities. Students wishing to use the calculating machines will be instructed in their proper use. Professor R. Kleyle is Chief Adviser.

Psychology

The courses in the Psychology Department are planned to impart an understanding of the basic principles, methods and data of psychology as a science and the application of this knowledge to current issues. The Department recognizes that interest in psychology is not limited to those who intend to pursue careers in the discipline. Course offerings are therefore designed so as to permit students to pursue study of various aspects of the subject to differing levels of depth. The wide range of the discipline further permits students to pursue programs of study which lead to either the B.A. or the B.S. degree, depending on the pattern of courses the student elects in the Department and the College.

Psychology 101 is the prerequisite entrance course for all students. Both psychology majors and non-majors may then elect any of the following additional courses without further prerequisite: 141, 145, 201, 210, 220, 230, 260, 262, 263, 270, 280, 290, 301, 305, 311, 325.

Students interested in majoring in psychology should elect Psychology 141 following completion of Psychology 101 and may then pursue a general psychology major or one designed for those preparing for graduate study and professional careers in the field. The general psychology major provides opportunities either for those seeking a general education or for those entering career fields for which psychological information is relevant to pursue a major in psychology without the emphasis on laboratory methodology that would normally be part of the program of those seeking admission to graduate study in the field.

The *general psychology major* must elect, in addition to Psychology 101 and 141, the following: Psychology 305 and a minimum of 21 (and no more than 27) credits of advanced level courses in the Department. Included in the electives must be at least two courses from each of the following two groupings: *A)* 210, 220, 230, and 250; and *B)* 260, 270, and 280. This program allows the student considerable flexibility to elect a variety of courses both within and outside the Department suited to his interests and needs. Students completing this major will fulfill the *Departmental requirements* for the Bachelor of Arts degree.

NOTE: Students who have entered the B.A. program may elect the additional courses indicated below to complete a "career" major *without* shifting to a B.S. program, or they may elect to become B.S. degree candidates if in the balance of their program they fulfill the *additional science requirements of the College*. Depending on their backgrounds, certain transfer students may have difficulty fulfilling these requirements in the time they have available. Students who are in doubt as to which major or degree programs to follow should discuss the available options with the Undergraduate Advising Office in Tobin Hall.

The *career psychology major* must elect the same program as the general psychology major as a minimum. In addition, such students should plan to elect Psychology 145 and at least one laboratory course from each of the following two groupings: *A)* 211, 221, 222, 231, and 251; and *B)* 261, 271, 281, and 282. These laboratory electives must be taken in proper sequence with their associated non-laboratory prerequisites or corequisites. Students completing this major will fulfill the *Departmental requirements* for either the Bachelor of Arts or the Bachelor of Science degree.

Students in the "career" program (either B.A. or B.S.) who are otherwise eligible will be encouraged to participate in the Honors Program in their junior and senior years.

Selected majors in either program may from time to time be invited to participate in Special Problem programs, the Department's cooperative teaching program or both.

General vs. career major. Both majors permit a considerable degree of flexibility to students in electing courses to meet their individual needs. Graduates from either program (and with either B.A. or B.S. degrees) may pursue advanced study in psychology or related fields. The designation of one program as a "career" major is for the purpose of informing students of the *typical preference* of graduate psychology departments at the present time for applicants who have some background in quantitative and laboratory methods.

Students in the career major program would be assumed to have already made commitments to pursue graduate study, though of course they need not follow this implied intention. Those who for any reason choose to pursue the general program rather than the more intensive career program need not feel that they have excluded themselves from further study or careers in the field.

Only in respect of admission to courses with limited enrollments and to restricted honors and other special offerings will preference be given to those students electing the career major. Otherwise, students in both majors (and in both B.A. and B.S. degree programs) will have full access to the facilities of the Department.

Professor Morton Harmatz is Director of Undergraduate Studies. Students should contact the undergraduate secretary in Tobin Hall for advising.

Rhetoric

The Rhetoric Program offers a flexible and varied experience for students fulfilling the University's core requirement. The requirement states that all students (with certain exceptions for advanced placement) will take two courses in Rhetoric, one of which must be Rhetoric 100 or Rhetoric 110. Through an inter-disciplinary effort, involving teachers from English and

Speech as well as other departments, the Program seeks to give students help and practice in many kinds of writing and oral communication.

In a world where problems of reaching people through words have become crucial to us all, an effort to study and try out for oneself a number of forms of expression becomes a worthwhile educational task. At present the Program devotes attention, in its several courses, to such examples as formal and informal exposition both oral and written, imaginative literature, mass media, and film.

There is no undergraduate major in Rhetoric, though a graduate program is offered by the Speech Department.

Professor Malcolm Sillars of the Speech Department is Acting Director of the Program. Professor John Harrington is Associate Director, with special responsibility for those courses staffed by members of the English Department.

Slavic Languages and Literatures

The Russian major is a relative newcomer in the curricula of most of our major educational institutions. Yet the importance of Russian, along with Chinese and English, as one of the three major world languages cannot be denied. The major role played by the Soviet Union in world affairs makes it essential to keep informed about all aspects of Soviet life. Moreover, the Russian language is the vehicle of one of the world's great literatures, as well as the avenue of an increasing body of vital technological information.

The Russian major aims at maximal proficiency in all four language skills; for this reason, language study is the most significant component of the major program. Opportunity is also provided for the student to achieve a background in the literature and history of Russia, as well as to gain some competence in related areas of economy, political science, sociology and anthropology.

The range of career opportunities open to the Russian major includes service in the Federal government, in private business, in library work, in research institutions, in the mass media and in the teaching of Russian at all educational levels. The study of Russian also provides a rich and rewarding cultural experience and an expanded knowledge and understanding of the Russian people and their society.

Department requirements for a major are the successful completion of:

a) Six semester courses of language study at the junior-senior level (18 credits): Russian 261, 262, 271, 272, 281, 282.

b) Two semester courses of literature study at the junior-senior level (6 credits): Russian 291, 292.

c) At least two additional courses within the department, to be chosen in consultation with an adviser on the basis of the student's post-graduate plans.

d) Two semester courses in Russian History: History 214, 215.

The student is encouraged to select more than the minimum number of required courses in order to achieve the strongest possible background in the discipline. The choice of additional courses, both within and outside the department, will depend in large measure on the student's career plans. For this reason, it is essential that majors and prospective majors consult early and often with the departmental advisers. Professor Maurice I. Levin is Chief Adviser for the department.

Sociology

The courses in sociology are planned to give the student an understanding of the factors which influence man in his activities and interests as a member of society and to introduce the fundamental methods of research in sociology. The course offerings are designed so that students who desire to prepare for graduate work, as well as those who do not, will find suitable programs for study available within the department.

Career opportunities are open in a wide range of fields which include public and private welfare agencies, governmental and private research organizations, and education. Those interested in research careers should incorporate within their programs courses in statistics and methodology beyond the introductory levels and should plan on graduate training if they aspire to full professional status in the discipline. The American Association of Schools of Social Work indicates that the pre-professional subjects most closely related to professional work in that field are economics, political science, psychology and sociology.

All majors are required to take Sociology 101 (Introductory Sociology), and a minimum of eight to a maximum of ten 200-level courses selected from among courses offered by the Sociology Department. Sociology majors, especially those who are considering graduate studies, are strongly advised to take a statistics course, Sociology 282 (Sociological Theory), and Sociology 295 (Research Methods). Sociology majors must take four courses from the "E" group in the catalog from at least two of the groups, (a) Biological Science, (b) Physical Science, (c) Mathematics, and are required to select two courses of 3 credits each from Economics, Geography, Political Science, Psychology, and Anthropology. Prof. Robert Faulkner is the departmental chief adviser. Mr. William D. Bathurst is Information Officer for Sociology majors.

Soviet and East European Studies

This program provides an opportunity to study the Soviet and East European area from the perspective of several academic disciplines. Requirements for a major are:

1. Proficiency in a relevant language (usually Russian) at a level adequate to enable the student to conduct research in that language;
2. successful completion of 10 courses dealing with the area in a minimum of three disciplines to be chosen from Anthropology, Economics, History, Political Science, Slavic Languages and Literatures, and Sociology;
3. two courses in modern European history.

The major in Soviet and East European Studies was established in 1971 as an alternative to the major in Slavic Languages and Literatures and to a major in one of the several disciplines offering courses on the Soviet and East European area. This major program is designed for those students who want to acquire a knowledge of this large and important part of the world through study across disciplinary lines. It may be particularly useful for students contemplating work in teaching, government service, journalism and other fields.

Students interested in graduate study in the area may also find the major useful, although it should be noted that most graduate programs are in a single academic discipline only. Accordingly, a student contemplating work toward an advanced degree is advised to have at

least a minor in the discipline in which he or she is most interested. (It is possible to take sufficient courses to fulfill the requirements for two majors, with this fact indicated upon the official transcript of the student. This type of program may be devised by an individual student to fit specific plans for graduate study.)

The Committee on Soviet and East European Studies administers the program. Members are: Joel Halpern (Anthropology); Paul Hollander (Sociology); Robert Jones (History); Maurice I. Levin (Slavic); Stanley Radosh (Slavic Bibliographer) and Karl Ryavec (Political Science), Chairman. Questions regarding the details of this program may be obtained from the Department of Slavic Languages and Literatures, Herter Hall 438, or from Professor Karl Ryavec, Department of Political Science, Thompson Hall.

Speech

Courses in speech are designed to enrich the student's understanding of man through theoretical study of the speech communication process and the application of this theory to various speech forms. A major in speech prepares a student not only for a career in one of the speech disciplines, but also for a career in law, government, the arts, or business.

Majors are required to select one of the following areas of concentration: 1) Communication Disorders (Speech Pathology and Audiology), recommended for students who plan to prepare themselves for graduate study in order to meet American Speech and Hearing Association (ASHA) certification standards for careers as speech therapists and audiologists; 2) Mass Communications, recommended for students who plan to pursue careers in educational or commercial media or to prepare themselves for graduate study in mass communications; 3) Communication and Rhetorical Theory, recommended for students who plan to pursue careers in law, the ministry, public affairs, and similar professions or to prepare themselves for graduate study in rhetoric; 4) Speech Education (a combination of courses from a combination of areas), required of all students who plan to earn a secondary school teacher's certificate in speech.

Majors must meet the requirements of the area of major concentration. Specific information may be secured in the departmental office.

Zoology

Beginning with the class of 1972, the curriculum for Zoology majors has been revised extensively. The new curriculum reflects the following opinions of the faculty.

1. Students who major in Zoology should acquire a broad knowledge of biological concepts and principles, reinforced by factual knowledge without which these concepts and principles are professionally meaningless.
2. Within this framework, or core curriculum, a considerable degree of flexibility in selection of courses is both possible and desirable.
3. The core curriculum should be supplemented by a coordinated group of elective courses. These will most often be in Zoology, other biological or physical sciences, mathematics, psychology or anthropology but may be in any other department of the University which best prepares each student for his own professional goals, which takes advantage of his interests, and which also takes into account limitations in his aptitudes.

Each student majoring in Zoology must complete the following Zoology courses: 240 (Principles of Genetics);

360 (Cell Physiology); 221 or 223 or 227 (Comparative Anatomy or Histology or Embryology); 281 or 282 or 283 (Biology of the Lower Invertebrates or Biology of the Higher Invertebrates or General Parasitology); 246 or 335 or 337 or 350 (Population Genetics or Limnology or Ecology or Animal Behavior); and 366 or 370 or 380 (Vertebrate Physiology or Comparative Physiology or Developmental Biology). The student must attain intermediate proficiency in one of French, German or Russian and complete satisfactorily the following collateral courses: Botany 100 (Introductory Botany); Chemistry 111, 112 (General Chemistry); Chemistry 261, 262, 263, 264 (Organic Chemistry); Biochemistry 222 or 223 (General Biochemistry); Mathematics 123, 124 (Analytic Geometry and Calculus), or Statistics 231, 232 (Fundamentals of Statistical Inference), or Computer Science 131, 132 (Introduction to Computers and Programming, Survey of Computer Applications); and Physics 141, 142 (Introductory Physics). Students with a special interest in chemistry or chemical biology may, with the approval of the Chemistry Department, substitute Chemistry 113, 114 for 111, 112; and those with a special interest in physics may wish to substitute Physics 161, 162, 163 (General Physics) for 141, 142. Special sections of Mathematios 123, 124 for Life Science majors are being developed.

All students should enroll in a chemistry sequence in their freshman year, because subsequent courses in Organic Chemistry and Biochemistry are prerequisite to Zoology 360 which in turn is prerequisite to all of the courses in the 366-370-380 group.

Botany 100 should be elected in the fall of the freshman year, as it will serve to review major biological concepts prior to the Zoology major's first Zoology course (genetics) in the spring of his freshman year.

Zoology 101 (Introductory Zoology) is not required of Zoology majors. Those who have not studied biology in high school or those who feel that their knowledge of introductory Zoology is inadequate may enroll in the course or audit the lectures prior to or concurrently with their enrollment in Zoology 240.

Students who, by advance placement, receive partial or full credit for English, Foreign Language, or Mathematics may take advantage of the increased flexibility in the freshman year to complete other general College or University graduation requirements, to enroll in courses of interest in other departments, or to begin or complete their Physics requirement in the freshman year.

The curriculum for those who plan to become certified secondary school biology teachers requires, in addition to the departmental requirements outlined above, Botany 125 (The Plant Kingdom) and 126 (New England Flora); Psychology 101 (General Psychology) and either 263 (Adolescent Psychology) or 301 (Educational Psychology); Education 251 (History of Education) and 282 (Pre-practicum) and, in the senior year, the concentrated "Secondary Education Block" of 12 credits of Education courses. Students in the Secondary Education curriculum may, with the permission of their adviser, substitute Zoology 135 (Introductory Physiology) for the requirement of one of the 366-370-380 group providing that the substitution is not made before the student's junior or senior year, when his plans for secondary teaching have become firm.

Because applications exceed available space, the department has had to limit the number of majors it can accept. The only fair basis on which such limitation

can be made is the student's over-all academic performance during his first three semesters. The required level of achievement varies but tends to be around a 2.0 quality point average or better.

Program in Computer and Information Science

The Program in Computer and Information Science offers a wide range of undergraduate courses in the areas of Computers, Theory of Computation, and Cybernetics.

An increasing number of undergraduates, irrespective of their major, are finding it useful to have the ability to program and use modern computing equipment. They will find four courses (Introduction to Problem Solving Using the Computer; Introduction to Computer and Information Science and FORTRAN Programming; Introduction to Computer Organization and Assembly Language Programming; Comparative Programming Languages) very useful in getting hands-on experience with the time-sharing system at the University and mastering batch processing using the FORTRAN IV language.

A number of courses introduce undergraduates to the design of computers, the design of compilers for communicating with computers in high level languages, and with new techniques for reducing complex problems to computer form.

Courses in automata theory, linguistics and automata, combinatorial theory, and related topics introduce the student with a mathematical background to the many exciting problems posed by the theoretical study of computation.

Students from all schools of the University have expressed interest in the new program in cybernetics. Of particular note are the courses "Cybernetics and the Brain," which introduces the student to the computational study of brain function; and "Ecological Cybernetics," which shows how mathematical techniques may combine with computer simulation to allow man to tackle large-scale problems of ecological interactions. In addition, the course "Computers and Society" helps students who want to understand the use of computers to solve social problems, and of the studies required to avoid "side effects"—including such problems as data banks, computerized voting, automated health care, and computer-aided instruction.

While no formal undergraduate major exists in Computer and Information Science, it is possible for students to seek a bachelor's degree with individual concentration, the program being worked out individually.

College of Food and Natural Resources

The College of Food and Natural Resources, the oldest college of the University, offers a broad general education with specific training in a specialized area. Upon the completion of the requirements for the Bachelor of Science degree, the student will have devoted his time to pure science, social and humanistic studies, and applied sciences and technology.

Undergraduate students in the College of Food and Natural Resources are exposed to an interdisciplinary, systems-oriented, problem-solving atmosphere that has been developed to a high degree.

A broad choice of electives within most of the major programs gives the student an opportunity to prepare for a career in business, industry, education, research, government, services or production agriculture.

A unique feature of the College of Food and Natural Resources is that the faculty for all the major programs is drawn from the three divisions of the College—research, resident teaching and extension, thereby bringing a depth of teaching to every student.

All departments—Agricultural and Food Economics, Food and Agricultural Engineering, Entomology, Food Science and Technology, Forestry and Wildlife Management, Hotel, Restaurant and Travel Adminstration, Landscape Architecture and Regional Planning, Plant Pathology, Plant and Soil Sciences and Veterinary and Animal Sciences offer graduate degrees in a discipline or professional field.

INTERNATIONAL AGRICULTURAL STUDIES (Interdepartmental Program). The unprecedented increase in the human population of the world makes mandatory rapid increases in world food production. Estimates indicate that total food production must double by the year 2000 to maintain our current inadequate nutritional levels and must triple if reasonable improvement is to be accomplished.

Students in this program will prepare themselves for careers in foreign agricultural development and trade. Students will be trained for international careers in the several technical fields within agriculture, in administration of agricultural programs, and in agribusiness. The program will require five years to complete, including a required year abroad in a developing country during the fourth year, and leads to a Bachelor of Science degree with a major in International Agriculture. A total of 132 credit hours, including six awarded for the overseas training and six for language certification, will be required for graduation.

In addition to University core curriculum requirements and professional courses in their individual majors, students will use electives to take the following recommended courses. (For Freshman year curricula, see major program for required Freshman courses.)

Agricultural and Food Economics 110 and 381
Sociology 101 and 252
Anthropology 104 and 379
Geography 255
Economics 266
Political Science 130

Certification of ability in the non-English language spoken in the region of the student's overseas training experience.

The year abroad will include language study and supervised work experience in a developing country.

Certification of language ability is required.

The program also involves farm work experience and participation in pre-departure orientation for year-abroad students.

STOCKBRIDGE SCHOOL. For those students interested in a two-year Associate Degree program in the food and agricultural industries, the University provides offerings in the Stockbridge School. A separate bulletin describes these offerings in detail.

MAJOR PROGRAMS IN THE COLLEGE OF FOOD AND NATURAL RESOURCES, B.S. DEGREE, ARE AS FOLLOWS:

Agricultural Business Management

Growing demand for food and fiber products, both for domestic and foreign consumption, increases the importance of planning and management in the production and marketing of these products.

Agricultural Business Management focuses upon the application of principles of economics and business management to the problems of supplying agricultural business and the production and marketing of agricultural products.

The rapidly changing agricultural industry offers increasing opportunities for students with specialized training in business and economics, as executives of marketing firms, farm supply organizations and food processing concerns. Many other opportunities are available in teaching and research and in adminstrative positions and public service.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
*Math. 111, 121 or 123 Introductory	3	Math. 113, 123 or 124 Introductory	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Agric. & Food Economics 110	3	Rhetoric Elective	3
Rhetoric 100	3	§Elective	3
	15		15

*On basis of placement tests at time of summer counseling Alg. & Trig. 121—(Not open to students having entrance credits in Trig.)

†Choose from Chem. 111 & 112, Physics 103 & 104, Bot. 100, Zool. 101, Microbiol. 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100, 101, 150, & 151, Psych. 105 & 106, and Sociol. 101 & 102.

§Recommendations for some elective courses are made from the fields of Economics, Business and Technical Subjects in Agriculture, depending upon the interests of the individual student.

Agricultural Engineering

This professional field includes engineering activities which relate macrophysical and microphysical environments to the production, preservation, and processing of food and other biological materials. The academic program is quantitative in nature and emphasizes the integration of mathematics and the physical sciences into the interpretation and solution of biological production and processing problems. Agricultural engineers find professional employment in a variety of industries as well as in public and private agencies engaged in research and development.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100	3	Rhetoric Elective	3
Mathematics 123 Anal. Geom. & Calculus	3	Mathematics 124 Anal. Geom. & Calculus	3

Chemistry 111	3	Chemistry 112	3
Engr. 103 Graphics	3	Engr. 104 Problems	2
Social Science Elective	3	Physics 161 General	4
	15		15

Animal Sciences and Pre-Veterinary

The curriculum in the Animal Sciences, including poultry, is designed to provide fundamental training and knowledge in the comparative nutrition, physiology, genetics, and management of various classes of livestock and to understand the role of animal production in the national and world economy. Options emphasizing commercial animal production are supported by electives in agricultural economics, agricultural engineering, and business administration. Students interested in graduate work in such specialized areas of the animal sciences as nutrition, physiology or genetics should elect programs with stress on the sciences.

Freshman pre-veterinary students in the College of Food and Natural Resources usually major in Animal Science, but may choose other departments if appropriate to the students' interests. Those who by their work in the first year demonstrate a potential for success should apply to the Pre-Professional Advisory Committee for admission into the pre-veterinary program (see page 47 under heading Pre-Dental, Pre-Medical, etc. for additional information). All pre-veterinary students, regardless of major, are counselled by the pre-veterinary adviser in the Animal Sciences Department.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Animal Sci. 121 Introduct.	3	Zool. 101 General	3
Botany 100 General	3	Chem. 112 General	3
Chem. 111 General	3	Math. 112 Finite	3
*Math.	3	Social Sci.	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Entomology

Courses in Entomology acquaint students with all phases of insects and insect control, including apiculture and medical entomology. Trained entomologists find positions in public service and industry, such as teaching at all levels; research, quarantine and regulatory work in state or Federal service, various roles in public health and pest control activities; research, sales and public relations work in the agricultural chemicals industry; and agriculture.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Chem. 111 General	3	Chem. 112 General	3
Zool. 101 Introductory	3	Entomol. 126 General	3
*Math.	3	Math. 112 Finite	3
Foreign Language or Agric. & Food Econ. 110	3	Foreign Language or Botany 100 Intro.	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Environmental Design

The Department of Landscape Architecture and Regional Planning offers an Environmental Design program

which prepares students for professional study at the graduate level and also provides an introduction to problems of the design of the physical environment for those not intending to pursue graduate study. Options are offered in Pre-planning, Pre-landscape architecture and Park and Open Space Administration.

The type of work in each of these professions is unique:

The landscape architect brings a concern for people, a concern for the natural environment and a concern for visual quality to bear on the design of developments and on the planning of communities and regions.

The park administrator is involved in park and open space planning and development and in the management of such areas to insure long range quality.

The planner is responsible for developing alternative methods of achieving goals. There are many kinds of planners, and planning can be approached from many disciplines. This department is concerned with city and regional planning. It emphasizes the constraints and opportunities provided by land as the primary resource base. In combination with courses in the appropriate departments, it stresses, also, social, economic, and political factors which influence planning at various governmental levels.

A 2.0 cumulative quality point average is required for admission as a major to the junior year of this program. Prospective majors are advised to take Environmental Design 221 and/or 244 as sophomores. Freshmen should concentrate on fulfilling University core requirements. Recommended courses are as follows:

Humanities: Art 100, 115; History 100, 101.

Social/Behavioral Sciences: Political Science 100, Sociology 101, Economics 125, Psychology 101.

Mathematics/Natural Sciences: Botany 100 or 101, Geology 101 or 280 for all areas of concentration.

Park & Open Space Administration: Entomology 126.

Pre-Landscape Architecture: Philosophy 125.

Pre-Planning: Statistics 121.

Freshman majors should contact the department early during the first semester to be assigned an adviser.

Fisheries Biology

Fisheries Biology is concerned in its broadest terms with the management of the aquatic environment in both freshwater and marine situations leading to maximum sustained yields of both sport and commercial catch. It deals with the management of resources and with fundamental factors affecting the biology of species from a research point of view.

Government, state and federal, provides the largest number of career opportunities.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 116 or 123 Calculus	3	Math. 117 or 124 Calculus	3
Botany 100 Intro.	3	Zool. 101 Introductory	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Forestry 222 Cons. of Natural Resources	3	Social Sci. Elective	3
	15		15

Food Marketing Economics

The food distribution industry is the largest single in-

dustry in the nation in terms of number of people employed and in dollar sales. The number of managerial and executive positions in the food industry is growing at a rapid rate because of the expansionary nature of the industry and the advancing state of scientific management being employed.

Abundant opportunities are available in private industry, government, and education. Students receive basic courses in Economics, Business, and Labor management.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
*Math. 111, 121 or 123	3	Math. 113, 123 or 134	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Rhetoric 100	3	Rhetoric Elective	3
Agric. & Food Econ. 110 Food & Nat. Res.	3	§Elective	3
	15		15

*On basis of placement tests at time of summer counseling. Math. 121—(not open to students having entrance credit in Trig.)

†Choose from Chem. 111 & 112, Physics 103 & 104, Botany 100, Zool. 101, Microbiology 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100. 101, 150, and 151, Psych. 105 & 106, and Sociol. 101 & 102.

§Recommendations for some elective courses are made mostly from the fields of Economics and Business, depending upon interests.

Food Science and Technology

A major in Food Science and Technology provides scientific and technological training in the principles concerned with the processing, preservation, and packaging of foods and food products. The student's training is directed to the application of modern science and technology to research and to the manufacturing and distribution of foods. Major fields open to graduates include: (1) product research and development; (2) food processing and packaging; (3) technological work and research in government, industry, and education; (4) advanced graduate study.

The curriculum in Food Science and Technology, of which approximately 30% of the credits are electives, is designed to provide flexibility to meet the interests and objectives of the student as well as the opportunity to obtain professional training as recommended by the Institute of Food Technologists.

Supporting courses are selected with the guidance of the major adviser and may include, among others: Agric. Eng. 386, Chem. 281, 282, Biochem. 224, Food Sci. 258, 365, 384, Microbiology, Nutritition, Statistics, and Computer Science.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 Language & Writing	3	Rhetoric 110 Language & Speaking	3
Chemistry 111 General	3	Chem. 112 General	3
*Math. 123 Anal. Geom. & Calculus	3	Math. 124 Anal. Geom. & Calculus	3
Zoology 101 Intro.	3	Food Sci. 101 Struggle for Food	3
Social Sci. or Elective	3	Social Sci. or Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Forestry

This major is concerned with the conservation and management, for the public benefit, of forests, park lands, and other open space through the production of

wood, water, wildlife, and amenity values such as recreation and aesthetics.

The curriculum in Forestry is based on the biological and natural sciences, a knowledge of the environment, economics, and social inter-relationships. Six curricular options are offered: General Forestry, Forest Resource Conservation, Forest-Business Management, Forest Hydrology, Forest Recreation, and Forest Science.

This accredited program prepares graduates for continued education at the graduate school level, and for employment with private industry, federal and state resource agencies, secondary school education, conservation and planning organizations.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 116 Calculus	3	Math. 117 Calculus	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Botany 100 Intro.	3	Forestry 112 Dendrology	3
Forestry 222 Cons. of Natural Resources	3	Elective	3
	15		15

Hotel, Restaurant, and Travel Administration

The curriculum in Hotel, Restaurant and Travel Administration provides technical and professional courses for persons who plan a career in ownership, management or sales in the hotel/motel, food service, and travel fields. In addition to the required core curriculum courses, students take courses in accounting and control; personnel and management; food planning, purchasing, preparation, and service; promotion, merchandising and sales; kitchen planning and maintenance, travel and tourism. Emphasis is on principles, analysis, computer application and decision-making.

The student selects one of these areas of concentration: Hotel Administration, Restaurant Administration, Institution Management or Travel and Tourism.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Hotel & Rest. Adm. 100 Introductory	3	**Humanities Requirement	3
Rhetoric 100	3	Nutrition & Food	
*Sci. Requirement	3	Food Prep. & Service	3
Math. (Basis of Test Results)	3	Rhetoric 110	3
Elective	3	*Sci. Requirement	3
		Statistics 121 or Equivalent	3
	15		15

*Elect three courses identified by letter "E" in catalog.

**Elect three courses identified by letter "C" in catalog.

Natural Resource Economics

The resource economics program is designed to train students to assist in making public and private decisions on resource development and management which will contribute to the twin goals of greater resource productivity and improved environment. Students will study the many problems of resource use, the forces which have combined to create these problems, and the possible solutions to these problems. Training in economic decision-making and the technical characteristics of specific natural resources provide a unique competence for performing these nationally important careers.

First Semester	Credits	Second Semester	Credits
*Math. 111, 121 or 123	3	Math. 113, 123 or 124	3
†Natural Sci.	3	†Natural Sci.	3
‡Social Sci.	3	‡Social Sci.	3
Agric. & Food Econ. 110 Food & Nat. Res.	3	Elective	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling. Alg. & Trig. 121—(not open to students having entrance credits in Trigonometry).

†Choose from Chem. 101 & 112, Physics 103 & 104, Botany 100, Zool. 101, Microbiol. 150, and Astron.

‡Choose from Pol. Sci. 100 & 150, Hist. 100, 101, 150, & 151, Psych. 105 & 106, and Sociol. 101 & 102.

Natural Resource Studies

A non-professional curriculum designed for students who wish to become generalists in the area of natural resource management and conservation, rather than specialists. Its primary objective is the education of an informed layman; it will not normally qualify students for employment within specific areas of the natural resource field. The curriculum has a minimal core of specified courses and offers great flexibility. Careful guidance coupled with early decisions will enable students to enter certain professional specialties and/or graduate school.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	Rhetoric Elective	3
Forestry 222 Cons. Nat. Res.	3	Natural Resource Elective	3
Botany 100 or Zool. 101	3	Botany 100 or Zool. 101	3
Math. (on basis of tests)	3	Chem. 110 (or higher)	4
Humanity or Social Science	3	Humanity or Social Science	3
	15		16

Plant Industry

The curriculum in Plant Industry provides students with a scientific basis of soil and plant relationships; a general knowledge of economic plants and an area of special study. By selection of option and elective courses and special problems, students major in: Agronomic Crops (i.e., Field and Forage Crops); Horticultural Crops (i.e., Flowers, Ornamentals (Nursery), Fruits and Vegetables); or Turf Management. Students are prepared for a variety of career opportunities in industry, business, marketing, production, sales, control, and regulatory services in state and Federal agencies.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100	3	Rhetoric Elective	3
Botany 100 General	3	Math.	3
*Math.	3	Plant & Soil Sci. 100 Basic Plant Sci.	3
Plant & Soil Sci. 110	3	Social Sci. Elective	3
Social Sci. Elective	3	Humanities Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Plant Pathology

Plant Pathology is concerned with the nature and control of plant diseases caused by fungi, viruses, bacteria, nematodes, certain higher plants and unfavorable en-

vironmental conditions. Plant pathologists fill positions in public service and in industry, such as teaching at all levels; research in state, Federal, university, and industrial laboratories and experiment stations; and Extension Service through Federal, state and county organizations. They are also employed in quarantine and regulatory work, in various roles in plant disease control, and in sales and public relations work.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
*Math.	3	Math. 112 Finite	3
Chem. 111 General	3	Chem. 112 General	3
Botany 100 General	3	Zool. 101 General	3
Foreign Lang. or		Elective	3
Agri. & Food Econ. 110		Rhetoric Elective	3
Food & Nat. Res.	3		
Rhetoric 100	3		15
	15		

*On basis of placement tests at time of summer counseling.

Plant Science

There is a great need for highly trained men in the plant sciences to teach and study the fundamental physiology and genetic processes taking place within plants. A more complete understanding of these processes and the influence of environmental factors upon them will lead to a significant improvement in the supply and quality of plant food and fiber. Students interested in such careers as plant breeder and geneticist, secondary or college teacher, research and resource development personnel and like professional positions should major in Plant Science. This option provides the breadth and depth in basic biological and physical sciences and mathematics necessary for graduate study.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Botany 100 General	3	Humanities Elective	3
Social Sci. Elective	3	Math.	3
*Math.	3	Social Sci. Elective	3
Plant & Soil Sci. 110		Plant & Soil Sci. 100	
Plant Propagation	3	Basic Plant Science	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Soil Science

Soil science deals with the physical, chemical and biological properties of soils as well as their relationship with higher plants. Men trained in this area become soil chemists, soil physicists, soil microbiologists, hydrologists and soil conservationists. Graduate study is mandatory for professional careers in soils. The soils curriculum provides the necessary breadth and depth in biological and physical sciences and mathematics for graduate study.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Botany 100 General	3	Humanities Elective	3
Social Sci. Elective	3	Math.	3
*Math.	3	Social Sci. Elective	3
Plant & Soil Sci. 110		Plant & Soil Sci. 100	
Plant Propagation	3	Basic Plant Science	3
Rhetoric 100	3	Rhetoric Elective	3
	15		15

*On basis of placement tests at time of summer counseling.

Wildlife Biology

The first professional degree in Wildlife Biology is the Master of Science; for this reason study toward the Bachelor of Science in Wildlife Biology should be regarded as pre-professional. Students planning to enter graduate school are urged to meet with their advisers.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	Rhetoric 110 or 100	3
*Math. 121 or 116	3	Math. 113 or 117	3
Chem. 111 General	3	Chem. 112 General	3
Botany 100 Intro.	3	Zool. 101 Introductory	3
Forestry 222 Cons.	3	Econ. 125 Elements	3
	15		15

*On basis of placement tests at time of summer counseling.

Wood Science and Technology

The program in Wood Science and Technology emphasizes studies in the nature and properties of wood, the engineering and chemical technology of its manufacture into a variety of useful products, and the business aspects of industrial management and marketing. Strong demands exist for graduates in wood-processing firms and service-related industries, and in marketing and merchandising.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 Language and Writing	3	Rhetoric 110 Language and Speaking	3
Math. 123 Calculus	3	Math. 124 Calculus	3
Botany 100 Intro.	3	Forestry 112 Dendrology	3
Chem. 111 Inorganic	3	Chem. 112 Inorganic	3
Engineering 103 Introductory	3	Engineering 104 Introductory	2
	15		14

School of Business Administration

The faculty of the School of Business Administration is keenly aware of the dynamic changes taking place in our economy, the extensive shifts in occupations and professions and the consequent need for intelligent and well-educated businessmen. The continuing advancement of technology, science, and the behavioral sciences has placed upon Schools of Business Administration the necessity to probe, not only into the developments of its own areas of education, but also into the relationships that exist among other areas such as mathematics, economics, psychology, sociology, and government.

The School of Business Administration prepares students to take advantage of important economic opportunities and eventually to assume positions of responsibility in business. The school's educational program is directed toward the broad aspects of business, encouraging high standards of ethical conduct, broad social responsibilities, and the development of competence in particular courses of study of the student's own interest, aptitude, and choice.

The first two years emphasize general education by providing fundamental courses in the humanities, mathematics, science, and social science. In addition, basic courses in accounting and economics prepare the student for further work in the School of Business Administration. The junior and senior years emphasize a greater degree of specialization and provide for this in the programs indicated below. But even in these last two years all students need to view business as a whole in so far as a "core" of courses can do this. This "core" consists of introductory courses in Finance, Marketing, Management, Business Law and Computer Programming. A total of at least 120 credits is required for graduation. Each course of study leads to a degree of Bachelor of Business Administration.

Students transferring to the School of Business Administration from any school or college within the University shall receive junior and senior elective credit only for those courses passed with a grade of C or better.

Students who intend to transfer from junior or community colleges should complete the program in liberal arts and not register for courses in Business Administration, except Principles of Economics and Elementary Accounting.

Transfer students who complete courses in their first two years that are offered in the junior or senior years will receive transfer credit only if such courses are accepted by the department concerned. An examination for such credit may be required.

The School of Business Administration is a member of the American Association of Collegiate Schools of Business.

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Rhetoric 100 or 110	3	Rhetoric 110 Elective	3
Mathematics 116	3	Mathematics 117	3
†History and/or Political Science	3	†History and/or Political Science	3
‡Natural Science	3	*Math 115	3
*Sociology	3	*Psychology	3

*May be taken either semester.

†Any sequence or combination of History 100, 101, 150, 151 or Political Science 100, 150, 160, 161.

‡Any course identified by the letter "E" in the catalog.

The accounting program prepares students for public accounting and for positions in business, industry, and government which require a knowledge of accounting.

General Business and Finance

The department offers five programs of study and specially designed programs for those students who wish to combine business administration with a related field of study outside the School of Business Administration. The program in Financial Management is designed for those students who wish to prepare for careers in the area of planning and controlling the financial operations of non-financial firms, financial firms, and governmental units. The program in General Business, emphasizing breadth of knowledge and viewpoint, is designed for those students who are uncertain as to their specific career objectives. The program in Business Administration and Economics recognizes the close relationships between areas of study and permits students to complete 27 credits in economics. The program in Business Administration and Quantitative Methods exposes students to operations research and systems analysis through a detailed treatment of the application of mathematics, statistics, and computer science to problems in all of the functional fields of business administration. Since the mathematics and statistics requirements for this program depart from the normal requirements, it is important that interested students elect this program early in their studies. Sophomore and transfer students who have not completed the specified quantitative courses may elect this program only with the permission of the program adviser. The program in Urban and Regional Studies combines courses from many disciplines, including economics, sociology, political science, civil engineering, landscape architecture, and agricultural economics. The specific content of a special program is mutually determined by the department chairman and the student.

Management

Management majors are prepared to assume leadership positions in various types of organizations: business, government, and non-profit institutions such as hospitals, universities, and research organizations. Basically, all management majors become thoroughly acquainted with the essential functions of organizations, particularly operations, financing, and marketing, and with the elements of managing such as planning, developing an organization structure, motivating employees, and controlling performance. Most importantly, thorough training is provided in the skills of human relations, and in understanding the behavior of people at work. Courses normally include such topics as management practices, personnel policies, manpower planning, social responsibilities of business, labor and industrial relations, the uses of computers in organizations, and theories of organizational behavior.

Majors are available in *general management*, *personnel management*, *operations management*, (emphasizes the efficient managing of the production of goods and services, and explores in greater depth the uses of computers and quantitative aids to planning and decision making) and *systems management* (prepares the student for work in systems analysis, management information systems, and for a management role in the large scale, multi-organizational systems found in education, health, and urban affairs).

Marketing

The role of marketing management in our economy is becoming increasingly important. The department of marketing offers a broad range of courses for those students interested in careers in marketing administration, advertising, marketing research, and wholesale and retail enterprise. The department's objective is to provide a specialized and comprehensive understanding of today's managerial marketing problems.

School of Education

The School of Education has revised its entire curriculum with the intent of providing students with a variety of alternatives, relying more heavily on self-directed learning and focusing on problems and areas which have a high degree of social relevance. This revision and reevaluation of curriculum and structure is an ongoing process which will result in many new programs not included in the following information.

There are a varying number of learning centers within the School, each dealing with a specific area of education: Aesthetics; Foundations; Higher Education; Human Potential; Human Relations; Humanistics; Innovations; International Education; Leadership and Administration; Media and Technology; Occupational Education; Research; Teacher Educators; and Urban Education. All centers offer courses which are open to undergraduates, regardless of major, for their own professional and personal development.

In addition to these areas of specialization, there are numerous, continually changing academic programs in a non-center classification. Examples of current programs in this area include Ecology, Futuristics, and Instructional Applications of Computers.

An integral part of the undergraduate program is the Modular Credit Program. This exciting spin-off from traditional education enables students and faculty alike to share in varied learning experiences. Each learning experience carries an agreed-upon number of modules of credit, which are cumulative. Fifteen modules is equivalent to one University credit. Independent study programs are also offered to undergraduates. The student negotiates a learning contract with a sponsoring faculty member and is enabled to pursue in-depth study in an area of education, fusing personal and social relevance into the program of study.

All teacher education programs leading to certification are coordinated and approved through the Teacher Preparation Planning Council (T.P.P.C.). There are fourteen alternative programs currently available for candidates in elementary or secondary Teacher Education. Internships, pre-practicums, tutorials and field experiences have been greatly expanded in most alternative programs. Placements for this field work are available in Western Massachusetts and as far off campus as California.

Programs currently in effect are in the areas of Early Childhood, Integrated Day, International Education, Explorations, Alternative Schools, Distributive Education, Media for the Deaf, Urban Education, Foundations, and Off-Campus Internships.

Complete details on all programs beginning in September will be available in May. Students are encouraged to inquire at the Undergraduate Affairs Office or the Graduate Affairs Office concerning specific courses and credential programs.

School of Engineering

The School of Engineering offers curricula in Agricultural Engineering, Chemical Engineering, Civil Engineering, Industrial Engineering, Mechanical Engineering, and Electrical Engineering. Each of the curricula leads to the Bachelor of Science degree in that particular branch of engineering. All curricula are accredited by the Engineers Council for Professional Development.

Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the material and forces of nature for the benefit of mankind. An engineer requires intensive technical training but at the same time he should acquire the broad education that distinguishes the professional man from the technician. His education does not end with formal schooling but continues throughout his life as he accumulates experience.

The curricula in engineering have been carefully prepared to offer each student the opportunity to acquire the sound training in mathematics and the basic sciences of chemistry and physics upon which is built the work in the engineering sciences. In the senior year, courses are offered which enable the student to use his previous training for engineering analysis, design and engineering systems in his particular field of interest. About 20 percent of his time is devoted to studies in the social science and humanistic area. Some opportunity is provided to elect courses from both the technical and humanistic-social fields. The curriculum of the freshman year is the same for all. Specialization to a limited extent begins in the sophomore year.

The School contains five administrative departments, and there are a variety of optimal programs available to upper-class students in each of these departments. Many of these are interdisciplinary in nature and cut across departmental lines. Thus, for example, students may concentrate in areas such as Materials, Systems, the Environment, Bioengineering, Food Engineering, Transportation, Urban Systems, and Energy.

Although the curricula within the School of Engineering are shown as eight semesters (normally four years), they require up to 130 semester hours credit for satisfactory completion. This is well above the University minimum of 120 semester hours for a degree and it requires intensive work in Mathematics, Science and Engineering. As a result even students in good academic standing frequently elect to extend their programs into a 9th and sometimes a 10th semester.

Freshman Engineering

All new students in engineering are enrolled in the Freshman Engineering Program until qualified to enter into a degree program. This is normal upon satisfactory conclusion of the uniform freshman year.

COURSE REQUIREMENTS—FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100	3	Rhetoric Elective	3
Math. 122 or 123	3	Math. 124 or 125	3
Chem. 111	3	Chem. 112	3
Engin. 103 or 104	3	Engin. 103 or 104	2
Soc. Sci. Elective	3	Physics 161	4
	15		15

Agricultural Engineering

This field includes engineering activities which relate macrophysical and microphysical environments to the production, preservation, and processing of food and other biological materials. The academic program is quantitative and emphasizes the integration of mathematics and the physical sciences into the interpretation and solution of biological production and processing problems. Agricultural engineers find professional employment in a variety of industries as well as in public and private agencies engaged in research and development.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100, Language & Writing	3	Humanity Elective	3
Chem. 111	3	Chem. 112	3
*Math. 123 Anal. Geom. & Calculus I	3	Math. 124 Anal. Geom. & Calculus II	3
Social Sci. Elective	3	Physics 161 General	4
Engr. 103 Graphics	3	Engr. 104 Problems	2
Physical Education 100	1	Physical Education 100	1
	16		16

*On basis of placement tests at time of summer counseling.

Chemical Engineering

Chemical Engineering centers around the creation, development, design and operation of processes for bringing about chemical and certain physical changes in materials. Chemical Engineers may be engaged in any of a wide range of activities concerned with converting an idea to a profit. These include research and development, economic and market analysis, design, construction, operation, production supervision, sales, technical service, and management. Basic research for new knowledge, teaching, and consulting also offer challenging and rewarding careers for many chemical engineers. Chemistry, physics and mathematics are the underlying sciences of chemical engineering and economics is its guide in practice.

Chemical engineers are in demand by industries manufacturing chemicals and also by the many related "chemical process industries," including petroleum refining and petrochemicals, plastics, synthetic fibers and textiles, pulp and paper, drugs and pharmaceuticals, natural and synthetic rubber, foods, soaps and detergents, paints and synthetic coatings, gas and coal chemicals, steel and all the metal manufacturing industries and many others. Much of the work of the atomic energy program is chemical engineering, and new fields to which chemical engineers are contributing include bio-medical, environmental, and ocean engineering.

Civil Engineering

Civil Engineering is concerned with all kinds of construction—buildings, bridges, highways and railways, airports, rivers and canals, harbors, dams, pipelines, etc. Transportation, the efficient and economical transfer of people and goods from place to place, is another concern to civil engineers. They are also deeply involved in providing adequate and safe supplies of water for homes and industries, in controlling and limiting the pollution of lakes, streams and oceans, and of the atmosphere. Civil engineers have assumed major responsibilities in ocean engineering, for construction and other operations, for underwater exploitation of mineral and other resources in the seas, and for planning and organizing the transportation that will be required

eventually in regions of underwater activity. Various specialized areas of civil engineering make essential contributions to programs such as hydraulic engineering and fluid mechanics, soil mechanics and foundations engineering, surveying and mapping, structural engineering and materials engineering.

In every area of Civil Engineering there is the choice of a wide range of activities: research to obtain new knowledge, development of practical methods, design of utilizing existing knowledge and the results of research, designing projects which satisfy known requirements, planning for maximum economy and efficiency, construction according to plans and specifications, and operation and maintenance. In addition, civil engineers are always deeply involved and are frequently in charge of large-scale projects which involve many fields of activity and require the coordination of backgrounds, such as urban planning, water resource management, and transportation systems. In general, Civil Engineering is a field of activity which is concerned with the public well-being through protection and control of our environment.

Electrical and Computer Systems Engineering

Electrical Engineering is the application of electrical and mathematical principles to the solution of engineering problems, and to the design of the electrical and electronic equipment of the future. A wide variety of electrical systems will serve mankind by performing important and complex tasks. Modern communication systems, high speed computers, and bio-medical instrumentation are just a few of the creations of electrical engineers. Because of the diversity of the electrical engineering education, graduates will be employable in sales, production, design, development, research and management positions.

The undergraduate curriculum is designed to prepare each student for work in any of these fields and to serve as a basis for further specialization. As continued study after graduation is essential in this rapidly growing field, basic physical and systems principles are emphasized in the undergraduate program. Courses taken outside of the department in liberal arts and other engineering disciplines provide the student with a broader understanding of engineering and its relationship to other fields.

The program leading to a degree of Bachelor of Science in Computer Systems Engineering is also available to all interested students. Further information on this program may be obtained from the Department of Electrical Engineering.

Industrial Engineering and Operations Research

Industrial engineers are concerned with the design, installation and improvement of integrated systems of men, materials and equipment. These systems are found in nearly all organizations (manufacturing and production, government, financial, health service, and sales to name a few) and at all levels within these organizations. Consequently, the placement of industrial engineers is varied. Also, since the responsibility of an industrial engineer normally spans several functional areas, he acquires an excellent background for management positions.

The curriculum is very flexible. The eleven required courses (33 credit hours) in the Industrial Engineering Department stress the quantitative approach to decision problems. Since the areas of application are so varied, a block of nine courses (27 credit hours) are set aside

so that each student may design a curriculum which matches his particular interest. This segment is developed in conjunction with his adviser and may emphasize a particular area of application and/or the development of more sophisticated methodology. Because continued education is a necessity, students completing the program are prepared for both professional and graduate work.

Mechanical Engineering

Mechanical engineers use the principles of dynamics, solid mechanics, fluid and gas dynamics, heat transfer, thermodynamics, and materials science together with mathematical and computer methods for application to research, development, design, and management in industry, government, and engineering education.

Students majoring in mechanical engineering may choose from alternative options emphasizing mechanical, aero-space, or materials studies. Mechanical engineers design and analyze a wide variety of systems in fields such as manufacturing, energy conversion, and transportation. Aero-space engineers design and analyze systems for aircraft and space such as propulsion, astrodynamical, and vehicular. Materials engineers study the atomic structure of materials, polymers, materials processing, and materials analysis. All options are fundamental and flexible so that students may prepare for either professional employment or graduate study.

Home Economics encompasses areas of study which apply the principles and concepts of fundamental arts and sciences to the physiological, psychological, social and economic environmental needs of man.

The School of Home Economics has four departments: Clothing and Interior Design (C&I D); Community Services (CO SERV); Human Development (HUM DEV); and Human Nutrition (HUM NUT). The letters in parentheses are area codes. Within these four departments the following undergraduate majors are offered:

In Clothing and Interior Design: Fashion Marketing, Consumer Services in Clothing, and Interior Design.

In Community Services: Consumer Economics, Community Services and Extension, and Home Economics Education.

In Human Development: Child Development, and Special Programs by Arrangement.

In Human Nutrition: Human Nutrition, Community and Public Health Nutrition, Dietetics, "Not for Profit Food Service Administration," Foods in Business, and Computerization in Nutrition and Food Service.

The undergraduate program leading to a Bachelor of Science degree, emphasizes a liberal education in the sciences, arts and humanities with specialized instruction as preparation for professional careers, seeking to develop a disciplined mind, mental curiosity and professional competence.

Professional home economists serve individuals, families, and communities through schools and colleges, extension programs, business organizations of many kinds all over the world, community and government organizations and agencies, newspapers, magazines, radio and television. Representative types of activities include teaching, research, writing, dietetics, extension work, interior design, fashion merchandising, food consulting, food service management and product development.

Clothing and Interior Design

This field of study encompasses the near environment, emphasizing clothing, the transitional factor between the individual and his surroundings, and housing, which provides shelter for the family.

The professional specialization in the area of Clothing can be obtained in Fashion Marketing and Consumer Services in Clothing. These majors provide opportunities for synthesis of knowledge from arts, humanities, social sciences and business in the understanding of human use of textiles, non-textiles and clothing. Basic to study in both majors is the interrelationship of aesthetic, historical, social, psychological, economic, cultural and physical aspects of textiles, non-textiles, and clothing—in addition to their effects on production, distribution and consumption. The retailing and professional opportunities associated with clothing, textiles, home furnishings, and related merchandise are numerous. Among these are positions with manufacturers, producers, retailers, buying organizations, newspapers and magazines, radio, TV and consumer groups, as well as educational programs and social and government agencies.

The program in Interior Design has two options. The profession encompasses a wide range of work, from restoration of historic buildings, through the design of public structures and private residences to the develop-

ment of highly specialized applications such as interiors of living spaces, set designs, displays, and furniture design. The professional interior designer is qualified to provide for the public, in a professional manner, planning, counsel and guidance with respect to the design, decoration and arrangement of interior areas of any private or public building or structure. An understanding of design also contributes to satisfying individual needs. The professional designer must also be cognizant of the sociological and psychological influences of his contributions. He is involved and exposed to the research and development of new products and techniques.

The program provides a broad general education and depth in the specialized professional area. For those who may wish to go on to graduate studies, depth in the social sciences should be pursued.

Community Services

The areas of Home Economics Education, Consumer Economics, and Management and Family Economics were merged in 1972 into the single department of Community Services. The three options available in the Community Service Major are Consumer Economics, Community Services and Extension, and Home Economics Education. These options lead to careers in public service such as in government agencies, cooperative extension programs, and teaching at the secondary school level. Many opportunities are also provided by business, particularly in the consumer related areas.

Students may elect a semester or full year affiliation with a developing or overseas nation, or they may elect to participate in the University exchange program such as at the Universities of Hawaii, New Mexico, Oregon or Alabama. Students may also wish to avail themselves of the opportunity to participate in the University Year for Action Program, BDIC or University Without Walls programs.

Human Development

Human Development is an interdisciplinary study primarily focusing on psychological, social, and biological factors affecting development of the individual from conception to senescence. However, the discipline relates human development to the biological and social history of man and to cross-cultural studies of human development.

Human Development is a social science leading to graduate work in Child Development, Human Development, Psychology, Sociology, Social Work or Education, and also offers at the undergraduate level a number of specializations leading to careers related to various stages of the life cycle: Child Development and Early Childhood Education; Special Child Programs, such as work with the physically handicapped, the emotionally disturbed, the mentally retarded, the blind, and the deaf; Social Programs, such as Head Start, day care centers, social agencies, adoption agencies, and community action programs; Youth Development; Family Life Education; Programs for the Aged; Interdisciplinary Programs such as programs involving ecology and human potential.

Directed experience with the children of the laboratory school and their families and with children in public and specialized schools and clinics provides the opportunity for students to develop a sound personal philosophy of early childhood education and child development.

Students may elect a semester or two of study at the

Merrill-Palmer Institute of Human Development, a semester or two at another university (in the United States or abroad), take courses in the other four colleges of the Five College Cooperation program or other special programs, such as BDIC, the Action Program, and University Without Walls.

Human Nutrition

The problems of nutritional well-being are of increasing concern to all segments of society. Undernutrition and deficiency diseases exist in the developing nations, and at the same time the richer nations suffer from obesity, degenerative diseases and the problems of additives and potentially hazardous food residues.

The program in Human Nutrition leads to an understanding of the causes of some of our present problems in nutrition and suggestions for their alleviation. There is one major program which is required for all students but recommended additional courses are shown for various specializations such as community nutrition and dietetics. Specialization in computerization in Nutrition and Food Service is a new field which requires both an understanding of Human Nutrition and also linear programming techniques.

The varied career options open to students with training in nutrition include research, community service, product development and demonstration, hospital dietetics and food service administration. Individual specializations other than those indicated can be arranged by discussion with members of the department.

School of Physical Education

The School of Physical Education includes the Departments of Physical Education for Men, Physical Education for Women, Department of Leisure Studies and Services, and Athletics. It offers undergraduate majors in Physical Education and Leisure Studies and Services, and graduate programs in Exercise Science and Sport Studies. Other programs in the School include the general physical education program, the intramural sport program and the intercollegiate athletic program.

General Physical Education Program

This program offers instruction in sport, dance, and other forms of physical activity to all undergraduate students in the University. Each student must fulfill the PE requirement (1) by taking a one-semester, 2-credit course on a graded basis, (2) by taking two semesters of 1-credit courses on a graded basis, or (3) by taking either of the above options on a pass-fail basis.

One of the few certainties facing college graduates is that they will be continually faced with choices regarding physical activity. Burgeoning leisure time, increasing spectator interest in sport, increasing opportunity to participate in carry-over sports such as golf, tennis, bowling, and gliding, as well as jogging and fitness programs, and increasing exposure to concern of medical people, particularly cardiologists, about inactivity, insure continued contact with the idea of physical activity and sport.

Some students enter the University with a background that enables them to fully appreciate and achieve satisfaction from participation in a sport and/or physical activity program. However, others are limited by insufficient preparation at earlier age levels. The General Physical Education Program offers (1) the opportunity for self-assessment in terms of skill competencies and fitness components and (2) the opportunity to gain the ability to assess and interpret a wide variety of programs involving sport and physical activity as they relate to the individual's well-being.

The student has almost unlimited choice in selecting specific courses from those in sport skill, dance, and conditioning, as well as theoretical courses (classroom instruction and laboratory work) probing the "why" of sport and physical activity.

Majors' Program

The Department of Physical Education for Women and the Department of Physical Education for Men cooperatively offer a co-educational program for those students who wish to pursue physical education as a major. Two major options are available. Students may elect to follow either the teacher education program or the related disciplines program which includes study in exercise science or the theory of sport. The teacher education option offers further opportunity for specialization. A student may select a concentration in secondary education, elementary education, or special education. Similarly, concentrations available through the related disciplines program are: dance, exercise physiology, kinesiology, sport history, sport psychology, and sport sociology.

The dance concentration affords opportunity to start course work in the freshman year. The program allows a student to gain depth in not only the art of dance, but other related areas. In addition, in the senior year

a student may choose the student teaching semester to meet certification requirements or select more advanced courses preparing for future academic or professional study.

Each student is expected to select an area of concentration during the second semester of the sophomore year. During the first two years of study, essentially the same for all majors, students fulfill the University core requirements and the physical education core requirements. The only variations from one student's program to another are in electives available within these requirements. The physical education core consists of the following courses:

Courses	Credits
Exc Sci 204—Human Anatomy Prerequisite: Zoology 101	3
Exc Sci 205—Kinesiology Prerequisite: Exc Sci 204	3
Exc Sci 278—Physiology of Exercise Prerequisite: Zoology 135	3

A student will select three of the following four courses:

PE 200—Sociology of Sport and Physical Activity Prerequisite: Sociol. 101	3
PE 201—Psychology of Sport and Physical Activity Prerequisite: Psych. 101	3
PE 202—History of Sport and Physical Activity Prerequisite: History 100 or 101	3
PE 203—Philosophy of Sport and Physical Activity	3
Skills and Coaching Courses	*14
Total	*32

*Only 8 of the 14 credits in skills and coaching courses will generally be taken during the first two years. Thus the student actually completes 26 credits in the physical education core during the freshman and sophomore years.

The recommended program for these first two years of study is as follows:

FRESHMAN YEAR

First Semester	Credits	*Second Semester*	Credits
Elective (C, D, E) (Select 2)	6	Elective	3
Zool. 101 Intro. Zool.	3	Electives (C, D, E) (Select 2)	6
PE Skills	2	Zoology 135 Intro. to Physiology	3
Rhetoric 100 or 110	3	PE Skills	2
	14	Rhetoric Elective	3
			17

Electives: Soc. 101 (D), Psy. 101 (D), Hist. 100 or 101 (C), Phil. 105 (C). These are prerequisites to Physical Education Core Courses.

SOPHOMORE YEAR

First Semester	Credits	*Second Semester*	Credits
Exc Sci 204 Human Anatomy	3	Elective	3
*PE 200, 201, 202, 203 (Select any 2)	6	Exc Sci 205 Kinesiology	3
PE Skills	2	*PE 200, 201, 202, 203 (Select any 1)	3
		PE Skills	2

100 Elective	3		Exc Sci 278	
			Phys. of Ex.	3
	14			14

*The student must take 3 of these 4 courses during the sophomore year. They may be taken in any order provided the prerequisites have been met.

Department of Leisure Studies and Services

The professional in Leisure Services is a diagnostician of the leisure needs of people and a developer and provider of opportunities to meet these needs. He or she works primarily at the executive, administrative, and supervisory levels, although a few settings involve more direct program leadership.

Options are available leading to a variety of careers in: voluntary and youth-serving organizations, college unions, military establishments, municipal and other governmental agencies, and commercial and private enterprises; as well as in hospitals and other institutions and agencies dealing with the mentally retarded, emotionally disturbed, physically handicapped, and other types of dependents. An option in environmental interpretation includes suboptions emphasizing natural history and environment, American history, archaeology, or natural resources planning and management, and outdoor education.

The curriculum presented below represents a core program. After becoming familiar with the various career opportunities, the student and adviser select an appropriate current option or develop an innovative plan to fit unique goals. Recent examples of the latter include leisure services in the inner city, community resources for recreation, leisure services in correctional agencies, outdoor recreation, and outward bound leadership. In each case a coordinated group of courses totalling 15 credits is selected by the student and adviser to constitute the option.

In addition to completing the curriculum below, the student is required to possess a current Red Cross Advanced First Aid Certificate. The student majoring in Leisure Studies and Services is also encouraged to gain as much practical noncredit experience as possible through volunteer service, as well as part time and seasonal employment in several settings and with varied types of participants.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
LSS 101, Man and Leisure	3	LSS 111, Program Activities I	3
Rhetoric 100, Language and Writing, or Rh. 110, Language and Speaking	3	Rhetoric Elective	3
Humanities & Fine Arts Elective (C)	3	Humanities & Fine Arts Elective (C)	3
Math. or Nat. Science Elective (E)	3	Math. or Nat. Science Elective (E)	3
Sociol. 101, Intro. to Sociology (D)	3	Psych. 101, Elem. Psychology (D)	3
PE 100	1	PE 101	1
	16		16

Department of Athletics

Members of the athletic department are responsible for the conduct and administration of the various phases of intercollegiate and intramural athletic programs.

The curriculum in Public Health is designed to prepare students for health career opportunities or further study in environmental health and health education.

The department also provides a course of study in Medical Technology. Students are expected generally to follow the course sequence outlined below. A minimum of 32 major credits is required of all students for the Bachelor of Science degree. Credits from other University departments are included in these major credits.

Environmental Health

Designed to prepare for career opportunities in radiological health, industrial hygiene, environmental sanitation, occupational health, public health laboratory, etc., or further study at the graduate level requiring specific technical knowledge and competence.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	Rhetoric 100 or 110	3
Math. 127 Calculus	3	Math. 128 Calculus	3
Chem. 111	3	Chem. 112	3
Zool. 101 (General)	3	Zool. 230	3
*Psych. 101 or Sociol. 101	3	*Sociol. 101 or Psych. 101	3
General Phys. Ed.	1	General Phys. Ed.	1
	16		16

*May be taken either semester.

If a language is elected, intermediate proficiency is required.

Community Health and Health Education

Designed to prepare for first level career opportunities in community health education, health services administration, non-medical administration, health program development, epidemiology, health statistics, etc., or for further study at the graduate level requiring specific professional and technical competence.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	Rhetoric 100 or 110	3
Math. 127 Calculus	3	Math. 128 Calculus	3
**Chem. 111	3	**Chem. 112	3
Zool. 101 (General)	3	*Sociol. 101 or Psych. 101	3
*Psych. 101 or Sociol. 101	3	[1]Elective	3
General Phys. Ed.	1	General Phys. Ed.	1
	16		16

*May be taken either semester.

**With approval of adviser may take Chem 101-102 but will have to take an extra science or public health course.

[1]Elective chosen from Humanities.

If a language is elected, intermediate proficiency is required.

Medical Technology

The program sequences outlined below are recommended for young men and women who are interested in the wide variety of career opportunities available in Medical Technology. Medical Technology graduates are eligible for laboratory positions in hospitals, clinics, health departments, pharmaceutical firms, and medical

 research foundations. The course of study is intended also to prepare students for continuation at the graduate level.

There are presently two courses of study which Medical Technology majors may opt in pursuit of a Bachelor of Science degree. Students electing Option I are required by the affiliated hospital schools of Medical Technology to have maintained averages of "C" or better in their science and mathematics courses. These students must have earned a total of 90 academic credits and satisfied the departmental and university curriculum requirements before beginning their hospital internship. Transfer students must, in most cases, elect Option II.

Option I. This curriculum consists of a three-year academic program followed by a 12-month internship in an accredited school of Medical Technology affiliated with the University. After successful completion of the 12-month internship and after satisfying the requirements of the department, a student will receive a Bachelor of Science degree in Medical Technology. A total of 130 academic credits is necessary for graduation with this option. Forty academic credits are earned during the fourth year, upon successful completion of the internship.

FRESHMAN YEAR

First Semester	*Credits*	*Second Semester*	*Credits*
Rhetoric 100 or 110	3	*Rhetoric	3
Math. 127	3	Zool. 145 (Human Genetics)	3
Zool. 101	3	Chem. 112 (General)	3
Chem. 111 (General)	3	**Social Science or Foreign Language	3
*Social Science or Foreign Language	3	Phys. Ed.	1
Phys. Ed.	1	Medical Technology 101	3
	16		16

*Rhetoric 110, 140, 145, 160, 165, or 170.

**Intermediate Proficiency is required if a foreign language is elected to fulfill the University's requirement.

Option II. This is a four-year academic program leading to a Bachelor of Science degree. Following graduation, the student will be assisted in arranging for a 12-month internship in an accredited school of Medical Technology. The student must complete all of the requirements established by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. A total of 120 academic credits is necessary for graduation with this Option.

Students electing Option II should follow Option I program for Freshman, Sophomore and Junior years.

Division of Military and Air Science*

The Division of Military and Air Science includes the Department of Military and the Department of Air Science. Both departments offer Reserve Officer Training Corps (ROTC) commissioning programs that enable the University graduate to fulfill his military obligation as a commissioned officer. Students who have completed a four-year or a two-year program may be commissioned in the respective services upon graduation from the University.

Students may register for the first course of the four-year program at the same time they register for other University courses. No formal application is required. Upon successful completion of the first two years, the student then may apply for admission into the final two years of the ROTC program.

The two-year program requires that the student have two academic years remaining at either undergraduate or graduate level. Successful completion of a six-week program on a military installation during the summer prior to enrollment is a prerequisite for these students. Those interested should apply two academic semesters before enrollment, since processing must be completed six months before the start of the fall semester. The two-year program is available to transfer students and students unable to participate in the four-year program.

Both departments offer scholarship assistance to qualified students. University tuition, fees, textbook allowances, and lab expenses, plus a stipend of $100 per month are received with a scholarship. Non-scholarship students receive a monthly stipend of $100 for the final two years of the four-year program or for both years of the two-year program.

Participation in the ROTC programs is voluntary. Uniforms and textbooks are provided.

Qualified students interested in becoming military pilots may participate in the Flight Instruction programs of the departments. Completion of a program leads to pilot qualification in Army Aviation or the Air Force. In addition to actual flight instruction, students take ground instruction in weather, navigation, and FAA regulations.

Students with previous military training may have this experience credited toward all or part of the first two years of the four-year program. Individuals with prior active service, previous ROTC training, military school attendance, Civil Air Patrol training, or service academy attendance should consult the departments.

In their senior year, students may request a delay in reporting to active duty in order to complete graduate work or to attend professional school.

Department of Air Science

The Department of Air Science offers courses of general interest to the University student and of specific interest to both male and female students who would like to prepare for and serve as officers on active duty in the U.S. Air Force. The curriculum is designed to study the need for military forces, the nature of military forces, their organization and mission with emphasis on the Air Force, and the nature of service as a profession-

*Academic credit for Military and Air Science courses taught at the University was restored by the Trustees on May 2, 1973, retroactive for the 1972-73 school year. This action was taken while this publication was at the printer, hence credit information contained herein relative to Military and Air Science courses is superseded and should be confirmed with that department.

 al Air Force officer. Courses encourage critical thinking, imagination, and a high degree of student involvement.

In the four-year program, the student enrolls in an Air Science course each semester and attends field training for four weeks between the sophomore and junior or junior and senior years. There are two major phases in the four-year program curriculum. The first phase is the General Military Course (GMC) which forms a single unit offered during the freshman and sophomore years. The studies cover the nature and causes of international conflict, the functions and employment of U.S. military forces, and defense policies in the contemporary world. This first phase carries no service commitment and is an excellent way for students to study the military and decide if they want to continue on for an Air Force commission. Enrollment in the General Military Course confers no military status on the student.

The second phase of the four-year program is the Professional Officer Course (POC) taken during the Junior and Senior years. Enrollment depends on academic and medical qualification and selection by the department. In the POC, academic concentration is on the preparation for service as an Air Force officer. Academically it deals with the historical development of airpower, aero-space power today, astronautics and space operations, Air Force leadership at the junior officer level, and a study of military management. The development of communicative techniques is an integral part of the POC curriculum.

A two-year program student enrolls in the POC, after the special six-week field training and receives the same instruction as a four-year POC member.

Corps Training is a non-academic, cadet-planned and directed activity centering on military customs and courtesies and the career environment of the Air Force officer. Corps Training provides practical experience in leadership and management.

Field Training involves a practical, firsthand experience with military life on an Air Force installation. Cadets receive instruction on junior officer activities, career field orientation, Air Force base functions and environment, aircraft and aircrew orientation, survival training, and physical conditioning. Applicants for the two-year program also receive academic instruction during their attendance at field training.

Scholarships may be awarded to qualified students in the four-year program. Students compete for college scholarships that start at the Freshman, Sophomore, Junior or Senior year. High School Seniors compete on a national basis for the scholarships that start at the Freshman year.

Varied extracurricular activities exist for interested students.

Successful completion of the Air Force ROTC program results in the awarding of a commission as a Second Lieutenant in the United States Air Force.

The first year courses meet for one classroom hour and one corps training hour per week:

FRESHMAN YEAR

First Semester	*Second Semester*
Air Science 111 U.S. Military Forces in the Contemporary World, I	Air Science 112 U.S. Military Forces in the Contemporary World, II

Department of Military Science

A program of general military subjects is presented by the Department of Military Science which qualifies the University graduate for a commission in any of the seven combat and seven non-combat branches of the United States Army. Thus, regardless of which academic major study program a student chooses, he will find appropriate leadership opportunities open to him in the modern Army upon graduation and attainment of a commission.

The program consists of a basic course, Freshman and Sophomore year, and the advanced course, Junior and Senior year. During the basic course students are introduced to American Military History, Map Reading and Tactics, and Military Leadership and Management. The advanced course provides instruction in Military Leadership and Management, Military Methods of Instruction, Tactics, Military Law and Defense Organization and Management.

Students participate in leadership laboratory during the basic and advanced courses. The purpose of leadership laboratory is to learn customs and courtesies of the Army and to provide experience in leadership, management, and discipline. The advanced course plans additional field exercises and students participate in field trips to military installations on the eastern seaboard.

Cadets designated as Distinguished Military Students, by reason of their achievement in academic and military studies, may apply for a commission in the Regular Army. Students receiving a Reserve Commission may be required to serve from three months to two years active duty. In addition to the normal four-year scholarship, one, two, and three year scholarships are offered to qualified students enrolled in the four-year program. The Professor of Military Science is responsible for the selection of students to receive these scholarships. High school seniors compete on a national basis for the four-year scholarships. The same financial benefits apply to this scholarship program as to the four-year scholarship program.

Various extracurricular activities exist for interested students.

FRESHMAN YEAR

First Semester	*Second Semester*
MS 111 American Military History I	MS 125 American Military History II

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All correspondence concerning the *University of Massachusetts at Amherst* should be addressed to the appropriate office, University of Massachusetts, Amherst, Massachusetts 01002.

All correspondence concerning the *University of Massachusetts at Boston* should be addressed to: 100 Arlington Street, Boston, Massachusetts 02116.

All correspondence concerning the *University of Massachusetts Medical School* should be addressed to: 419 Belmont Street, Worcester, Massachusetts 01604.

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