ANNOUNCEMENTS

SEPTEMBER, 1956—JUNE, 1958

THE RICE INSTITUTE

HOUSTON, TEXAS

NOTE

Publication of the *General Announcements* of the Rice Institute is biennial. The next issue will be for the period from September, 1958, to June, 1960.

In alternate (odd-numbered) years, the Institute publishes its *Graduate Announcements.*

These *Announcements* are the catalogues of the Rice Institute.

THE RICE INSTITUTE PAMPHLET *is also published at Houston, Texas, and is issued in January, April, July, and October of each year.*

GENERAL ANNOUNCEMENTS

for

SEPTEMBER, 1956—JUNE, 1958

of

THE RICE INSTITUTE

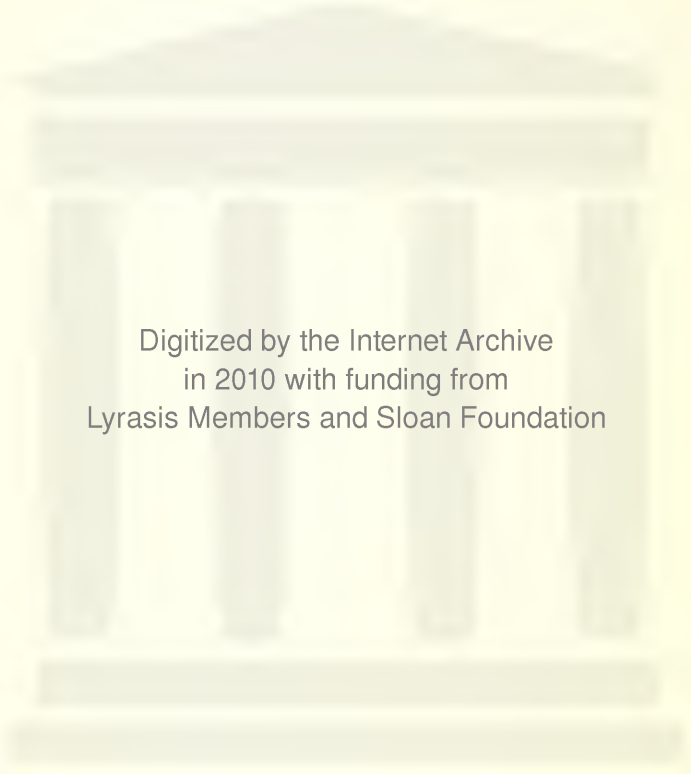
FOUNDED BY WILLIAM MARSH RICE

OPENED FOR THE RECEPTION OF STUDENTS IN THE AUTUMN OF NINETEEN HUNDRED AND TWELVE

Dedicated to the

Advancement of Letters, Science, and Art

HOUSTON, TEXAS



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1958

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ACADEMIC CALENDAR

1956

September 13-14	Registration
September 15	Matriculation Address
September 17	Opening of Courses
November 21	Beginning of Thanksgiving Recess at 6:00 P.M.
November 26	Resumption of Courses at 8:00 A.M.
December 22	Beginning of Christmas Recess at 6:00 P.M.

1957

January 7	Resumption of Courses at 8:00 A.M.
January 21-31	Midyear Examinations
February 4	Resumption of Courses at 8:00 A.M.
April 18	Beginning of Easter Recess at 6:00 P.M.
April 23	Resumption of Courses at 8:00 A.M.
May 17	Beginning of Final Examinations
May 30	Baccalaureate Exercises
May 31	Forty-fourth Commencement

September 12-13	Registration
September 14	Matriculation Address
September 16	Opening of Courses
November 27	Beginning of Thanksgiving Recess at 6:00 P.M.
December 2	Resumption of Courses at 8:00 A.M.
December 21	Beginning of Christmas Recess at 6:00 P.M.

1958

January 6	Resumption of Courses at 8:00 A.M.
January 20-30	Midyear Examinations
February 3	Resumption of Courses at 8:00 A.M.
April 3	Beginning of Easter Recess at 6:00 P.M.
April 8	Resumption of Courses at 8:00 A.M.
May 16	Beginning of Final Examinations
May 29	Baccalaureate Exercises
May 30	Forty-fifth Commencement

EDGAR ODELL LOVETT, PH.D., SC.D., LL.D.
President Emeritus

JOHN THOMAS McCANTS, M.A.
Bursar Emeritus

OFFICERS OF ADMINISTRATION

WILLIAM VERMILLION HOUSTON, PH.D., D.SC.
President

JOHN EDWARD PARISH, PH.D.
Assistant to the President

CAREY CRONEIS, PH.D., LL.D., D.SC., D.ENG.
Provost

GEORGE HOLMES RICHTER, PH.D.
Dean

GUY THORNTON McBRIDE, JR., SC.D.
Associate Dean for Students

MISS PAULA MEREDITH, B.A.
Adviser to Women

SAMUEL GLENN McCANN, M.A.
Director of Admissions

MICHAEL VINCENT McENANY, M.A.
Registrar

MRS. DOROTHY KELLY McGEE, B.A.
Assistant to the Registrar

ROLAND HEYNE
Bursar

HOWARD ALEXANDER THOMPSON, M.A.
Development Assistant

TRUSTEES EMERITI

EDGAR ODELL LOVETT
FREDERICK RICE LUMMIS
BENJAMIN BOTTS RICE

BOARD OF GOVERNORS

TRUSTEES

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GUS SESSIONS WORTHAM: VICE-CHAIRMAN
WILLIAM ALEXANDER KIRKLAND: VICE-CHAIRMAN
JESSE NEWTON RAYZOR: VICE-CHAIRMAN
JOHN SMITH IVY: SECRETARY-TREASURER
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W. ALVIS PARISH
JACK C. POLLARD
JOHN THOMAS RATHER, JR.

THE RICE INSTITUTE

HISTORICAL SKETCH

THE RICE INSTITUTE bears the name of the founder, the late William Marsh Rice. It is dedicated to the advancement of literature, science, and art and maintains an educational program of teaching and research in a limited number of departments. From its beginning it has aspired to university standing of the highest grade.

Over sixty years ago Mr. Rice took into his confidence a half-dozen friends and made known to them his desire to found a major educational enterprise for the permanent benefit of the city and state of his adoption. These gentlemen were organized into a Board of Trustees for the new foundation, which was incorporated in 1891 under a broad charter granting the trustees large freedom in the future organization of a non-political and non-sectarian institution. Under the terms of this charter the first members of the Board were William Marsh Rice himself, James Addison Baker, James Everett McAshan, Emanuel Raphael, Frederick Allyn Rice, Alfred S. Richardson, and Cesar Lombardi. Vacancies since the organization of the Board, which still consists of seven members and is self-perpetuating, have been filled by the election of William Marsh Rice, Jr., John Thaddeus Scott, Alexander Sessums Cleveland, Edward Andrew Peden, Robert Lee Blaffer, Harry Clay Hanszen, and Harry Carothers Wiess, deceased, and by the election of Benjamin Botts Rice, Edgar Odell Lovett, George Rufus Brown, Frederick Rice Lummis, Lamar Fleming, Jr., William Alexander Kirkland, Gus Sessions Wortham, Jesse Newton Rayzor, John Smith Ivy, and Harmon Whittington.

In 1908 the trustees called Edgar Odell Lovett, a professor in Princeton University, to assist them in developing the founder's far-reaching plans. Before taking up his residence in Houston, the future President visited the leading educational and scientific establishments of the world, returning in the summer of 1909

from a year's journey of study that extended from England to Japan.

About this time negotiations were completed by which the Institute secured a campus of three hundred acres situated on the extension of Houston's main thoroughfare, three miles from the center of the city. A general campus plan, the work of the late Ralph Adams Cram, was accepted by the board in the spring of 1910. In 1911, on the seventy-fifth anniversary of Texas Independence, the cornerstone of the administration building was laid. In 1947 this building was renamed Lovett Hall, in honor of President Emeritus Lovett. An inscription, carved near the Sallyport, expresses "grateful homage to the clear vision, unfaltering zeal, and beneficent labors" of the first president of the Rice Institute.

The administration building as well as the mechanical laboratory, the power house, and two wings of the first residential hall for men were ready for use at the beginning of the first academic year in the fall of 1912. By the end of the academic year of 1924-1925 a physics laboratory and lecture amphitheater, a chemistry laboratory, three residential halls for men, and an athletic field house had been completed. The Robert I. and Agnes Cohen House, a club-house for the faculty given by Mr. and Mrs. George Cohen of Houston in honor of Mr. Cohen's parents, was dedicated in 1927.

The formal opening of the Rice Institute was held in the early autumn of 1912, with the generous coöperation of the community and the nation and the heartening encouragement of several hundred scholars and scientists who came to Houston to assist in launching the new university. Among the distinguished representatives of life and learning were twelve foreign scholars who had consented to participate in the inaugural program by preparing series of lectures in the liberal humanities of philosophy, history, letters, and art and in the fundamental sciences of mathematics, physics, chemistry, and biology. A complete account of the proceedings of the four days devoted to this celebration has been embodied in three commemorative volumes, in which are included the inaugural lectures.

The actual work of instruction began on September 23, 1912,

the anniversary of the death of the founder. The scholastic work of the first academic year was limited to a single class of seventy-seven freshman. From that small beginning, the enrollment increased over the next twelve years until it reached the limit that could be effectively accommodated. Since 1924 it has been necessary to restrict the admission of new students in order to keep the total enrollment within the limits indicated by available funds. In its first forty-three years the Rice Institute has enrolled over seventeen thousand persons and has awarded more than eight thousand degrees.

In 1941, upon attaining the age of seventy, Dr. Lovett announced his retirement as President. He was prevailed upon to continue in active service until a successor could be appointed. Because of the second World War this appointment was delayed almost five years, until in March, 1946, William V. Houston, formerly of the California Institute of Technology, assumed the presidency and Dr. Lovett was made President Emeritus. The formal inauguration of President Houston, held a year later—on April 10, 1947, was attended by official representatives of more than two hundred and fifty institutions and societies of learning.

Meanwhile, the Board of Trustees was actively planning the post-war development of the Institute. Based on a comprehensive survey undertaken early in 1945, a long-range development program was formulated, whose spirit is indicated by the first of its twelve points.

> It shall continue to be the objective of the Rice Institute to provide especially good training for a limited number of students. The Institute will provide a broad and sound basic program with a well-developed and strong curriculum in arts and letters and with the emphasis on science and research that is required to meet changing circumstances.

The development program has been carried forward very actively. The most visible evidence has been the number of new buildings erected in the last nine years. The M. D. Anderson Hall, a classroom and office building, was opened in 1947. The Fondren Library was opened for use in May, 1949, and formally dedicated in the following November. In rapid succession have come the Abercrombie Engineering Laboratory; Wiess Hall, a fourth residence hall for two hundred men; a nuclear research

laboratory housing a six-million-volt Van de Graaff generator provided by the Atomic Energy Commission; a home for the President; a new football stadium which seats 70,000 persons; and a field house containing a swimming pool, several gymnasiums, and offices for the physical education department. In 1955 the Board of Trustees announced plans for the early construction of a geology building, a dormitory for women students, and extensive additions to the residence halls for men. Later in the same year it was announced that in the spring of 1956 work will begin on a new student center from which a cloistered walk will lead to a new chapel, with associated offices and meeting rooms for the various student religious groups.

Like the building program, all other phases of the post-war plans announced by the trustees have been rapidly developed. The number of faculty members, with the rank of instructor or higher, has grown from less than seventy before the war to over one hundred and forty. A department of geology and a school of music have been added. The undergraduate curricula have been revised, selective entrance procedures have been intensified, and programs of graduate study and research have been greatly expanded. During the academic year of 1955-56 there were two hundred and twenty-three graduate students enrolled, and there were fifteen post-doctoral fellows and research associates working in the laboratories of the Institute.

In September, 1949, the directing body of the Institute was enlarged to a fifteen-member Board of Governors, composed of the seven permanent trustees and eight governors appointed by the trustees for terms of one to four years. From this enlarged board a number of special committees are formed which give special attention to various phases of the Institute's activities. Then, in 1954, a new body, the Rice Institute Associates, was formed to provide a channel for the free exchange of ideas between the students and teachers of the Institute and a group of representative citizens who have been influential in civic, cultural, and educational affairs of the region. Members of the Rice Associates advise with trustees, governors, teachers and students on matters relevant to the further development of the Institute and its increased service to the community.

INSTRUCTIONAL STAFF

EMERITUS FACULTY

DEAN, ALICE CROWELL

B.A. (Rice) 1916, M.A. (Rice) 1919
Librarian Emerita

FREUND, FRIEDRICH ERNST MAX

Ph.D. (Leipzig) 1902
Professor Emeritus of German

LOVETT, EDGAR ODELL

A.B. (Bethany) 1890, M.A., Ph.D. (Virginia) 1895, Ph.D. (Leipzig) 1896, LL.D. (Drake, Tulane, Baylor, Bethany), Sc.D. (Colorado College)
President Emeritus of the Rice Institute

MCCANTS, JOHN THOMAS

B.S. (Marion Inst.) 1902, B.A. (Marion Inst.) 1905, M.A. (Virginia) 1906, M.A. (Yale) 1909
Bursar Emeritus

SLAUGHTER, JOHN WILLIS

A.B., B.D. (Lombard) 1898, Ph.D. (Michigan) 1901
Lecturer Emeritus in Civics and Philanthropy

WILSON, HAROLD ALBERT

M.Sc. (Leeds) 1897, D.Sc. (London) 1900, M.A. (Cambridge) 1904, F.R.S.
Professor Emeritus of Physics

FACULTY

ADAMS, JOHN A. S.

Ph.B. (University of Chicago) 1946, B.S. (University of Chicago) 1948, M.S. (University of Chicago) 1949, Ph.D. (University of Chicago) 1951
Assistant Professor of Geology

AKERS, WILLIAM WALTER

B.S. in Ch.E. (Texas Tech.) 1943, M.S. in Ch.E. (Texas) 1944, Ph.D. (Michigan) 1950
Associate Professor of Chemical Engineering

ALTENBURG, EDGAR

A.B. (Columbia) 1911, A.M. (Columbia) 1912, Ph.D. (Columbia) 1916
Associate Professor of Biology

AUTEN, JOHN H.

B.S. (Ohio State) 1947, Ph.D. (M.I.T.) 1954
Assistant Professor of Economics

BADGER, A. S.

B.S. in E.E. (Rice) 1948, M.S. in E.E. (Rice) 1949
Lecturer in Electrical Engineering

BAKER, LEE E.

B.S. in E.E. (Kansas) 1945
Instructor in Electrical Engineering

BARKER, J. R.

B.S. in Phy.Ed. (Rice) 1949, M.Ed. (Texas) 1954
Assistant Professor of Physical Education

BATTISTA, JOSEPH LLOYD

Certificat d'Études française (Bordeaux) 1919, Diplomé d'Études supérieures (Bordeaux) 1919, B.A. (Michigan) 1920, M.A. (Washington Univ.) 1923, M.A. (Harvard) 1929
Assistant Professor of Romance Languages

BEARDEN, FRANCIS W.

B.S. (Texas Tech.) 1947, M.A. (Columbia) 1949, Ed.D. (Columbia) 1954
Assistant Professor of Physical Education

BIRD, GEORGE RICHMOND

A.B. (Harvard) 1949, A.M. (Harvard) 1952, Ph.D. (Harvard) 1953
Associate Professor of Chemistry

BLACK, HUGH CLEON

B.A. (Rice) 1941, M.Ed. (Texas) 1947, Ph.D. (Texas) 1949
Associate Professor of Philosophy and Education

BLAND, ROBERT L.

B.A. (Central Washington) 1953, M.A. (Columbia) 1954
Instructor in Physical Education

BONNER, TOM WILKERSON

B.S. (Southern Methodist) 1931, M.A. (Rice) 1932, Ph.D. (Rice) 1934
Professor of Physics

BOURGEOIS, ANDRÉ MARIE GEORGES

Bachelier ès Lettres (Paris) 1921, Bachelier en Droit (Paris) 1923, Certifié d'Études supérieures de lettres (Paris) 1930, M.A. (Texas) 1934, Docteur d'Université (Paris) 1945, Officier de l'Instruction Publique 1945
Professor of French

BRAY, HUBERT EVELYN

B.A. (Tufts) 1910, M.A. (Harvard) 1916, Ph.D. (Rice) 1918
Professor of Mathematics

BROTZEN, FRANZ RICHARD

B.S. (Case Institute) 1950, M.S. (Case Institute) 1953, Ph.D. (Case Institute) 1954
Assistant Professor of Mechanical Engineering

BROWN, ARLEN

Ph.B. (Chicago) 1948, Ph.D. (Chicago) 1952
Assistant Professor of Mathematics

BRUNING, PETER

B.A. (Amsterdam) 1945, M.A. (Amsterdam) 1947, Ph.D. (Amsterdam) 1949
Assistant Professor of German

BURGHARD, HERMAN C., JR.

B.S. in M.E. (Rice) 1950
Instructor in Mechanical Engineering

BUSCH, ARTHUR W.

B.S. (Texas Tech.) 1950, S.M. (M.I.T.) 1952
Assistant Professor of Civil Engineering

CAMDEN, CARROLL

A.B. (Centre) 1925, M.A. (Iowa) 1928, Ph.D. (Iowa) 1930
Professor of English

CHANDLER, ASA CRAWFORD

B.A. (Cornell) 1911, M.S. (California at Berkeley) 1912, Ph.D. (California at Berkeley) 1914
Professor of Biology

CHAPMAN, ALAN JESSE

B.S. in M.E. (Rice) 1945, M.S. (Colorado) 1949, Ph.D. (Illinois) 1953
Associate Professor of Mechanical Engineering

CHILLMAN, JAMES, JR.

B.S. in Arch. (Pennsylvania) 1913, M.S. in Arch. (Pennsylvania) 1914, F.A.A.R. (Am. Acad. in Rome) 1922
Professor of Architecture

CLASS, C. M.

A.B. (Johns Hopkins) 1943, Ph.D. (Johns Hopkins) 1951
Assistant Professor of Physics

CONNER, JACK EDWARD

B.A. (Texas A. and I.) 1939, B.S. (Texas A. and I.) 1942, Ph.D. (Stanford) 1952
Assistant Professor of English

COOKENBOO, LESLIE, JR.

B.A. (Rice) 1947, Ph.D. (M.I.T.) 1953
Assistant Professor of Economics

COWLES, LAURENCE G.

B.S. in E.E. (Vermont) 1929, A.M. in Physics (Columbia) 1932
Visiting Lecturer in Electrical Engineering

CRAIG, HARDIN, JR.

A.B. (Princeton) 1929, A.M. (Harvard) 1931, Ph.D. (Harvard) 1937
Professor of History and Librarian

CRONEIS, CAREY

B.S. (Denison) 1922, M.S. (Kansas) 1923, Ph.D. (Harvard) 1928, D.Sc. (Denison) 1945, LL.D (Lawrence College) 1944, D.Sc. (Ripon) 1945, D.Eng. (Colorado Mines) 1949, LL.D (Beloit) 1954
Harry Carothers Wiess Professor of Geology and Provost

DAUGHERTY, JACK WOODWARD

A.B., B.S. (Southeast Missouri) 1939, A.M. (Missouri) 1940, Ph.D. (Wisconsin) 1949
Associate Professor of Biology

DAVIES, JOSEPH ILOTT

B.A. (Rice) 1928, M.A. (Rice) 1929, Ph.D. (Rice) 1937
Associate Professor of Biology

DEZURKO, EDWARD ROBERT

B.S. in Ed. (Illinois) 1939, B.S. in Arch. (Illinois) 1940, M.S. in Arch. (Columbia) 1942, Ph.D. in Fine Arts (New York) 1954
Associate Professor of Architecture

DOSCHER, LUELYNE B.

Ph.D. (University of California at Los Angeles) 1951
Visiting Lecturer in Psychology

DOWDEN, WILFRED SELLERS

B.A. (Vanderbilt) 1939, M.A. (Vanderbilt) 1940, Ph.D. (North Carolina) 1949
Associate Professor of English

DREW, KATHERINE FISCHER

B.A. (Rice) 1944, M.A. (Rice) 1945, Ph.D. (Cornell) 1950
Assistant Professor of History

DUNAWAY, JAMES KARL

B.A. (Rice) 1936, B.S. in Arch. (Rice) 1937, M.A. (Rice) 1938, M.S. (Columbia) 1941
Associate Professor of Architecture

DURST, LINCOLN KEARNEY

B.A. (U.C.L.A.) 1945, B.S. (Calif. Inst. of Tech.) 1946, Ph.D. (Calif. Inst. of Tech.) 1952
Assistant Professor of Mathematics

ENDERS, ALLEN C.

A.B. (Swarthmore) 1950, A.M. (Harvard) 1952, Ph.D. (Harvard) 1955
Assistant Professor of Biology

ETTLINGER, MARTIN GROSSMAN

B.A. (Texas) 1942, M.A. (Texas) 1943, Ph.D. (Harvard) 1946
Assistant Professor of Chemistry

FORNELL, EARL WESLEY

B.A. (New School) 1947, A.M. (New School) 1949, A.M. (Columbia) 1950
Instructor in History

FULTON, JAMES STREET

B.A. (Vanderbilt) 1925, M.A. (Vanderbilt) 1929, Ph.D. (Cornell) 1934
Professor of Philosophy

GALBRAITH, R. A. H., O.B.E.

B.A.Sc. (Toronto) 1923, M.A. (Toronto) 1924
Visiting Lecturer in Electrical Engineering

GALLEGLY, JOSEPH S.

B.A. (Rice) 1925, M.A. (Rice) 1926
Associate Professor of English

GARRETT, MARGARET

B.A. (North Carolina) 1951, M.A. (Stanford) 1954
Assistant Professor of Physical Education

GILES, JAMES BERNARD

B.B.A. (Texas) 1936, M.A. (Texas) 1937
Assistant Professor of Economics

HALL, ARTHUR E.

Mus. Bac. (Yale) 1924, M.M. (Baylor) 1952
Assistant Professor of Music

HARTSOOK, ARTHUR J.

A.B. (Nebraska Wesleyan) 1911, S.B. in Ch.E. (M.I.T.) 1920, S.M. (M.I.T.) 1921
Professor of Chemical Engineering

HEAPS, CLAUDE WILLIAM

B.S. (Northwestern) 1909, Ph.D. (Princeton) 1912
Professor of Physics

HERMANCE, GILBERT LESLIE

B.S. (Oregon) 1927, M.A. (Columbia) 1930
Professor of Physical Education

HODGES, JOHN ELTON

B.B.A. (Texas) 1935, M.B.A. (Texas) 1937
Associate Professor of Economics

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SHARP, JO ANN COLLINS

B.A. (Texas) 1948
Catalog Librarian

TURNBULL, PENDER

B.A. (Rice) 1919
Head of Bibliography Department

ZINGLER, GILBERTA M.

A.B. (Butler) 1932, B.S. in L.S. (Illinois) 1935
Order Librarian

STAFF OF THE ATHLETIC DEPARTMENT

BALE, ALLEN MELBERT

Assistant Coach of Football

BEALL, WILLIAM E.

Assistant Coach of Football

BRUNSON, EMMETT EVANDER

Business Manager of Athletics and Coach of Track & Field

DAVIS, JOE WALLACE

Line Coach of Football

GRIGG, CECIL BURKETT

Backfield Coach of Football and Assistant Coach of Track

MOORE, CHARLES EDWARD, JR.

Freshman Coach of Football and Basketball

NEELY, JESS CLAIBORNE

Director of Athletics and Head Coach of Football

RICHEY, GEORGE C.

Coach of Tennis

SUMAN, DONALD WARD

Coach of Basketball

WHITMORE, WILLIAM ROGERS

Athletic Publicity Director

WOJECKI, EDWARD J.

Head Athletic Trainer and Assistant Instructor in
Physical Education

RICE INSTITUTE ASSOCIATES

Mr. and Mrs. James S. Abercrombie
Mr. and Mrs. James A. Baker, Jr.
Mr. and Mrs. Edward R. Barrow
Mr. and Mrs. Dupuy Bateman, Jr.
Dr. and Mrs. Albert P. Beutel
Mr. and Mrs. Val T. Billups
Mr. and Mrs. John H. Blaffer
Mr. and Mrs. Herman Brown
Mr. and Mrs. Ernest D. Butcher, Jr.
Mr. and Mrs. George A. Butler
Mr. and Mrs. Stewart P. Coleman
Mr. and Mrs. John H. Crooker, Jr.
Mr. and Mrs. John M. de Menil
Judge and Mrs. James A. Elkins
Colonel and Mrs. Joseph W. Evans
Mrs. W. S. Farish
Mrs. Walter W. Fondren
Mr. and Mrs. Charles I. Francis
Mr. and Mrs. Claude T. Fuqua, Jr.
Mr. and Mrs. Grover J. Geiselman, Jr.
Mr. and Mrs. Cecil R. Haden
Mr. and Mrs. Karl F. Hasselmann
Mr. and Mrs. William P. Hobby
Mr. and Mrs. Roy M. Hofheinz
Mr. and Mrs. Edward J. Hudson
Mr. and Mrs. Gaylord Johnson
Mr. and Mrs. John M. Johnson
Mr. and Mrs. Jesse Holman Jones
Mrs. Edward W. Kelley
Mr. and Mrs. John W. Link, Jr.
Mr. and Mrs. James M. Lykes, Jr.
Mr. and Mrs. Francis H. Maloney
Mr. and Mrs. George P. Martin
Mr. and Mrs. John W. Mecom
Mr. and Mrs. Leopold L. Meyer
Mr. and Mrs. Frank W. Michaux
Mr. and Mrs. James P. Nash
Mr. and Mrs. Fred M. Nelson
Mr. and Mrs. George A. Peterkin
Mr. and Mrs. Lawrence S. Reed
Mr. and Mrs. Fisher Reynolds
Mr. and Mrs. Patrick R. Rutherford
Mr. and Mrs. John Schuhmacher
Mr. and Mrs. Dudley C. Sharp
Mr. and Mrs. E. J. Shimek
Mr. and Mrs. John D. Simpson, Jr.
Mr. and Mrs. William A. Smith
Mr. and Mrs. John Robert Suman
Mr. and Mrs. Howard Tellepsen
Mr. and Mrs. Milton R. Underwood
Mr. and Mrs. Wesley W. West
Mrs. Harry C. Wiess
Mr. and Mrs. James O. Winston, Jr.
Mr. and Mrs. Andrew Jackson Wray

REQUIREMENTS FOR ADMISSION

Because of the limited facilities available admission to the Rice Institute has become highly competitive. Not more than approximately four hundred and fifty new undergraduate students can be admitted in September of each year, and the Committee on Admissions will undertake to select those among the applicants who seem most likely to take advantage of the educational opportunities available. Candidates for admission will be expected to present evidence of good health; good character; satisfactory personal qualities such as industry, co-operation, and motivation; and satisfactory intellectual qualifications.

For further information, publications, or application forms, candidates for admission as undergraduates should communicate with the Director of Admissions. On requesting application forms, the candidate should clearly indicate whether he is a prospective high-school graduate or a prospective transfer from another college.

ADMISSION OF FRESHMEN

The qualifications of candidates for admission will be evaluated in three ways:

1. **The High School Record.** This will be carefully studied to appraise the candidate's past performance. Graduation from an approved public or private high school with not less than fifteen acceptable units is required. These units should include

English, 4
Social studies, at least 2
Algebra, 2
Plane geometry, 1
Trigonometry, ½
Foreign language, 2
Science, 2 (biology, chemistry, or physics)
Electives, 1½

Special attention is called to the fact that any student planning to major at the Rice Institute in either chemistry or physics should complete a high school course in the subject involved.

Variations from the above distribution of units are approved

only in exceptional cases at the discretion of the Committee on Admissions.

2. **Entrance Examinations.** Marked preference will be given to those candidates who earn satisfactory scores on examinations given by the College Entrance Examination Board. All candidates should take the Scholastic Aptitude Tests (Verbal and Mathematical Sections), and candidates wishing to enter the science-engineering program should take, in addition, the achievement tests in (1) English composition, (2) intermediate mathematics, (3) chemistry or physics. The Scholastic Aptitude Tests may be taken in January or in March, but the Achievement Tests must be taken in March.

The aforesaid tests are prepared and administered by the College Entrance Examination Board, Box 592, Princeton, New Jersey. They are given in Houston five times each year, and at other convenient centers throughout the United States.

General information regarding the nature of the tests and detailed information regarding locations of examination centers, the exact date, and the proper time for filing application for the tests is available in a bulletin of information which may be secured without cost from the College Entrance Examination Board.

When payment of the necessary fee and/or the cost of travel to the examination will work a *severe* financial hardship, an applicant in necessitous circumstances should not hesitate to complete the regular application forms for admission without planning to take the examinations. Such an applicant should communicate by *detailed confidential* letter before March 1 with the Committee on Admissions, and he will be granted consideration equal to that accorded the other prospective students who are taking the examinations. This is in accordance with the continuing policy of the Rice Institute of making its educational facilities available to highly qualified applicants regardless of financial circumstances.

3. **Personal Interviews.** All applicants who can conveniently present themselves at the Institute will be interviewed between December 15 and March 1 of each year. Applicants living at such a distance that they cannot conveniently come to Houston

will be given opportunities for interviews during the month of March in certain cities of the Southwest, at a date and a place to be announced individually to each applicant who submits his application papers before March 1. It is contemplated that if sufficient need exists students will be interviewed in Beaumont, Dallas, Fort Worth, and San Antonio. Those who, because of distance, are unable to meet interview engagements either in Houston or at one of these cities will be interviewed individually by alumni; or, if that should be impossible, their applications will be given full consideration without the interview. In no case need such an applicant assume any responsibility for the interview until notified of the time and place. However, applicants from a distance who find it convenient to come to Houston between December 15 and March 1 may be interviewed at the Institute at the time of their visit to Houston.

The first notices regarding action on applications for admission are sent to applicants about the first week in May.

ADMISSION WITH ADVANCED STANDING

THE NUMBER of candidates who may be accepted as transfers from other colleges and universities is limited by the capacity of the Institute to absorb them. In general, severe competition for these places calls for high standing in scholarship. The unit of credit at Rice is for the most part, the full-year course. Advanced credit will be given only for courses that are approximately the same in content as courses given at the Institute. Each case will be dealt with individually.

Candidates for transfer should communicate with the Director of Admissions between the November 1—March 1 time limits, if possible. When requesting the proper forms the applicant should indicate clearly the number of years of work he will have completed in his present college by the following June. The transfer applicant who is in his first year of college work will improve his chances by securing high scores on the Scholastic Aptitude Test. This may be taken in January or March.

Decisions regarding transfer applications will be reached in the latter part of April, and notice mailed to candidates by approximately May 15.

SPECIAL INFORMATION

A STUDENT who has been admitted to the Institute will be required within two weeks after the date on the notice of acceptance to submit a written statement of his intention to enroll, accompanied by a payment of $25.00, which will be credited to his account as full payment of the registration fee required at the opening of the session. The payment will be returned if the student changes his plans and serves notice before July 1. After July 1, it will be refunded only in cases of hardship, such as illness. Should such a student fail to register, without giving notice of change of intentions prior to July 1, the $25.00 payment will be forfeited.

ADMISSION TO GRADUATE STANDING

A CANDIDATE for admission to graduate standing to work toward an advanced degree should communicate first with the chairman of the department in which he wishes to study.

GENERAL INFORMATION

THE opportunities for study and research offered by the Rice Institute are open without tuition both to young men and to young women. Students are expected to meet all expenses incurred in the purchase of textbooks, drafting instruments, notebooks, examination papers, and certificates and diplomas. Laboratory expenses in the experimental courses in pure and applied science are partially defrayed by laboratory fees. Extra charges will be made for excessive use of material, for excessive and unusual breakage, and for other damage to equipment.

SPECIAL CHARGES

Late registration ..... $ 5.00

Late examination (Each course) 10.00

Diploma 5.50
(Required of all candidates for degrees.)

FEES

Registration fee 25.00
(An annual fee required of all students.)

Library fee 25.00
(An annual fee required of all students.)

Examination fee 5.00
(A fee to cover the cost of examinations)

Blanket-tax 10.00
(An annual charge for student activities.)

Health Service fee

DORMITORY RESIDENTS 10.00

TOWN STUDENTS 5.00

Gymnasium fee 4.00
(All students pay this fee for the use of gymnasium equipment.)

Orientation fee 3.00

Laboratory fees

Biology 100 ..... 30.00
300, 320, 470 ..... 25.00
310, 340a, 350b, 360a, 370b, 390, 440b, 490b ... 15.00

Chemistry 100, 120, 200, 310 ..... 30.00
230 ..... 15.00
220, 300 ..... 40.00
410a, 440b 25.00
500, 600, 700 ..... 50.00

Economics 350 ..... 5.00

Education 420, 430 ..... 25.00

Geology 200a, 201b, 330b, 400a, 401b, 405a, 410a, 411b, 460 ..... 10.00
310a, 311b, 390 ..... 15.00

History 100, 110 ..... 1.50

Physics 100, 200 ..... 30.00
300, 310 ..... 10.00
410 ..... 20.00

Psychology 400 ..... 5.00

Physical Education 125, 225, 325 ..... 5.00
425 ..... 15.00
410 ..... 20.00

Engineering 303, 360 ..... 5.00
203, 350, 432 ..... 15.00

Chemical Engineering 443 ..... 30.00
543 ..... 40.00
683, 783 ..... 50.00

Civil Engineering 402, 422, 523 ..... 5.00
332, 401, 421, 582 ..... 15.00
663, 613 ..... 25.00
503, 633 ..... 50.00
603 ..... 10.00

Electrical Engineering	340, 403, 433, 443	20.00
	523, 623	25.00
	543, 553, 593, 603, 613, 623, 633, 643, 653, 663	50.00
Mechanical Engineering	350, 403	20.00
	332, 513	10.00
	523	30.00
	532, 541, 542	12.50
	653	50.00
Architecture	(Every student classified as an architect)	40.00
Army R.O.T.C.	(Deposit)	10.00

If a student withdraws during the two weeks following the opening day of classes, all fees will be refunded. When withdrawal occurs within the third or fourth week after the opening of classes, 50 per cent of laboratory fees (only) will be refunded. No refund will be given if withdrawal is made more than four weeks after the the opening of classes.

No student in arrears in his bills, including obligations to loan funds, unpaid parking fines, etc., will be registered for the following term, or be given any certificate or report of academic standing.

RESIDENTIAL ACCOMMODATIONS

Rooms, completely furnished exclusive of linen, may be rented in the residential halls for men. Current students may reserve rooms in advance; in such case, a $25.00 advance rental payment is required before July 1. New students are required to make a $25.00 advance rental payment within a reasonable time after being notified of a reservation. The amount of rental charges will be announced by the Office of the Cashier in advance of the offering of any leases. As the charge for table board will be made at actual cost, the monthly price, payable in advance, will probably vary during the year. Rooms in the halls will be let in the order of applications received. Such applications should be addressed to the Office of the Cashier. The residential halls are

governed by a student Hall Committee, under the general supervision of the Associate Dean for Students.

At present there are no women's residence halls on the campus, but it is expected that a dormitory will be ready by September 1957. Until then most out-of-town women students will continue to live in an off-campus apartment unit operated by the Institute as a dormitory for girls, with a house mother. There are also several approved boarding and rooming houses in the vicinity. Information about places of residence for women may be had by writing to Miss Paula Meredith, Adviser to Women.

HEALTH SERVICE

A HEALTH SERVICE located in West Hall is maintained for students. This service includes dispensary and infirmary care. The school physician makes scheduled sick calls and can be called in case of an emergency. A registered nurse is on duty during school hours; a qualified attendant is available at all hours. Information about the facilities and care, and about insurance, can be secured at the Office of the Health Service (reached by the east entrance of West Hall). A Hospitalization and Accident Insurance policy with a nationally known company is available for students who desire this coverage.

STUDENT CENTER FACILITIES

TEMPORARY quarters are provided in the basement of the Fondren Library for Student Center facilities including a co-operative store, a snack bar called the Roost, student organizations and publications offices and a student lounge.

ORGANIZATIONS AND STUDENT PUBLICATIONS

ALL STUDENTS, upon matriculation, become members of the Student Association, which organizes and directs the various activities named below and through its officers, who form the Student Council, represents the students to the faculty, administration, and other institutions. The special problems of the women stu-

dents on the campus are the concern of the Women's Council.

Each of the five classes, Freshman, Sophomore, Junior, Senior, and Class B Graduate,[1] has an organization for its government and for the solution of special problems.

The various activities, covering cultural, professional, and avocational needs, comprise publications: *The Campanile* (annual), *The Rice Engineer* (quarterly), and *The Thresher* (weekly); the Elizabeth Baldwin, Owen Wister, Pallas Athene, Sarah Lane, Chaille Rice, Mary Ellen Lovett, Olga Keith, and Virginia Cleveland Literary Societies; musical groups: the Band and several choral groups; foreign-language clubs; the Architectural Society, the Engineering Society, the Student Affiliates of the American Chemical Society, and the student branches of the American Institute of Chemical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, and the Institute of Radio Engineers, and the American Society of Mechanical Engineers; and other specialized organizations including the Rally Club, the Premedical Society, the Forum Committee, A.P.O., the Rice Sextant, the Radio Club, R and Quill, the Film Society, and an informally organized dramatic club under the sponsorship of the Department of English. There are also several religious clubs, organized under a Student Religious Council.

Through the generosity of the late Mrs. James L. Autry, as a memorial to her husband, the late James L. Autry, of Houston, the Diocese of Texas of the Protestant Episcopal Church is maintaining Autry House in the immediate vicinity of the Rice Institute, as a social and religious center. The cornerstone of Autry House was laid during the commencement ceremonies of the Class of 1921. To this community group of the Episcopal Church, the late Mrs. E. L. Neville, of Houston, in memory of her brother, Edward Albert Palmer, contributed the beautiful Edward Albert Palmer Memorial Chapel, which was dedicated November 27, 1927. All the opportunities of these establishments are available to the students of the Rice Institute irrespective of religious affiliation. Other religious bodies have intimated that they are con-

[1] Composed of students of architecture and engineering working toward a professional degree, following award of the B.A. degree.

sidering future provision for similar undertakings in the neighborhood of the Rice Institute.

In the Fondren Library an area is furnished to provide students an opportunity for relaxation. Adjacent to this Student Lounge are the offices of the Student Association and of the student publications, forming the campus hub of extracurricular activities.

SERVICE AWARD

In memory of Hugh Scott Cameron, first Dean of Students at the Rice Institute, the Student Association annually presents the Rice Institute Service Award, in the form of a bronze medallion, to those currently enrolled or former students who have been most exemplary in rendering distinguished service to the school and to the student body. This coveted honor is sparingly bestowed after careful consideration of possible recipients by a committee of faculty and students appointed by the Association.

HONOR SYSTEM

Examinations are conducted under a student honor system, which is administered by an Honor Council whose members are elected annually from and by the student body. This council is responsible to the faculty, through the Associate Dean for Students, for the validity of all examinations and for the investigation and prosecution of cases of violation of the system.

HONOR SOCIETIES

PHI LAMBDA UPSILON

Phi Lambda Upsilon, an honorary chemical society, has as its purpose "the promotion of high scholarship and original investigation in all branches of pure and applied chemistry." The Alpha Alpha chapter was installed at the Rice Institute in 1927.

THE PHI BETA KAPPA SOCIETY

The Senate of the United Chapters of Phi Beta Kappa at its meeting in December, 1927, voted to recommend the establishment of a chapter at the Rice Institute, and at a meeting of the National Council held in September, 1928, the institution of the

Rice, or Beta of Texas, chapter was duly authorized. The chapter was formally installed on March 1, 1929, by the secretary of the United Chapters.

THE PI DELTA PHI SOCIETY

The Pi Delta Phi Society, organized to interest students of French in competing for high standing in scholarship, authorized in May, 1930, the formation of a chapter of the Society at the Rice Institute. The Theta chapter was formally installed in that year by a delegate of the national organization.

THE SOCIETY OF THE SIGMA XI

The Society of the Sigma Xi, for the promotion of research in science, on the occasion of its thirty-eighth annual convention in December, 1937, acting upon the recommendation of the Executive Committee, duly authorized the establishment of a chapter of the Society at the Rice Institute. The formal installation of the Rice chapter by the president of the national organization took place on March 23, 1938.

THE TAU BETA PI ASSOCIATION

The Tau Beta Pi Association, organized to interest engineering students in competing for high standing in scholarship, authorized at its annual convention in October, 1940, the establishment of a chapter of the Association at the Rice Institute. The Rice chapter, the Gamma of Texas, was formally installed on December 18, 1940, by the national secretary of the Association.

DELTA PHI ALPHA

Delta Phi Alpha, German national honorary society, was founded to promote among university students an interest in the German language and literature. The National Council in April, 1949, authorized the organization of the Gamma Xi chapter at the Rice Institute.

THE SIGMA DELTA PI FRATERNITY

The Sigma Delta Pi, Spanish national honorary society, was founded to promote among university students an interest in the Spanish language and literature. The chapter at the Rice Institute was installed on May 14, 1953.

THE SIGMA TAU FRATERNITY

The Alpha Zeta chapter of Sigma Tau, an engineering society devoted to scholarship, practicality, and sociability, was installed at the Rice Institute on May 20, 1953.

PUBLICATIONS OF THE RICE INSTITUTE

Among the publications of the Rice Institute are a General Catalogue, a Graduate Catalogue, a book of Freshman Announcements, and a Liberal Arts brochure. The Rice Institute Pamphlet, a quarterly, contains articles and monographs by members of the Institute faculty as well as lectures and monographs by visiting scholars.

LIBRARY AND LABORATORIES

The Fondren Library

THE new Fondren Library houses all of the Institute's library materials, except those working tools which must be maintained adjacent to laboratories.

It has been the policy of the Institute in building up the library, first, to supply such books as are necessary to supplement the courses of instruction; second, to acquire material as it is needed to support the research work of the faculty and graduate student. The additional facilities of the new building now make it possible for the library to provide also books for general reading and a collection of phonograph records. Besides nearly two thousand current literary and scientific journals, the library contains about seventy-five thousand back files of important serial publications, the fields of science and technology being very completely represented among these holdings. The book collection at present, including bound periodicals, contains about 260,000 volumes.

LABORATORIES

Architecture

The department of architecture is located on the second floor of Anderson Hall. It consists of two large general drafting rooms for undergraduate students and a large studio well equipped for advanced work in freehand drawing and painting. The drafting rooms for fifth-year graduate students and for construction work are located in a large, air-conditioned area in the basement of the main library building. The construction area consists of a drafting room, a model room, a materials museum with files, and adjacent offices for members of the faculty.

In each drafting room throughout the department, every student has a large individual drafting table. At the fifth- and sixth-year levels the student is provided with two drafting tables.

Biology

Laboratory work is available in all the biology courses offered. Modern and fully-equipped microscopes are provided. Included also is a fully equipped radiation laboratory for training in and experimental use of radioisotopes. This laboratory includes special "hot" chemical rooms, a cold room, a counting room, an animal room, an operating room, and individual research rooms. Special apparatus includes an R.C.A. table-model electron microscope, a Warburg apparatus, a spectrophotometer, a Van Slyke apparatus, a Beckman flame photometer, a photo-colorimeter, a lyophilizer, Geiger counters, and other radiation instruments, as well as refrigerators, centrifuges, fine balances, ovens for dehydrating and ashing, incubators, P^h meters, autoclaves, etc. Facilities are available for advanced research work in such subjects as parasitology, medical entomology, physiology, endocrinology, genetics, and radiobiology.

Chemical Engineering

Laboratory facilities for undergraduate instruction in chemical engineering are housed in the Chemistry Laboratory. They include not only the usual equipment associated with fuels and combustion and with unit-operations courses, but also such special items of undergraduate instructional equipment as an engine-driven vapor-compression evaporator (Kleinschmidt) and a full-size water cooling tower.

Facilities for graduate instruction and research in chemical engineering are housed in the Abercrombie Laboratory. There are well-equipped shops, an open two-story laboratory, bench-scale research laboratories, and a P-V-T-X laboratory. There is also specialized research equipment such as fluid and fixed-bed catalytic converters, vapor-liquid equilibrium apparatus, apparatus for condensation heat transfer, equipment for gas chromatography, and equipment for interphase mass transfer.

A feature of the central wing of the Abercrombie Laboratory is an expanse of unallocated laboratory space to be assigned to engineering research problems as the need arises in various fields.

Chemistry

The chemistry laboratories are well-equipped for research and teaching in both physical and organic fields. Some of the more special equipment consists of several X-ray diffraction units, electron diffraction equipment, polarographic instruments, an electron microscope, automatically controlled equipment for the determination of adsorption isotherms including facilities for simultaneous magnetic susceptibility measurements on the adsorbent, Beckman and Cary recording spectrophotometers, a recording microphotometer, a low-temperature laboratory for calorimetric work on entropy measurements, a micro-wave spectroscopy laboratory, and Perkin-Elmer infrared equipment. In addition, the department it well-equipped with machine and glass blowing shops with the approprite staff for the construction of special research apparatus.

Civil Engineering

The civil engineering laboratory is equipped with the usual surveying instruments: transits, levels, compasses, and plane tables of a wide variety of standard American makes. The drafting room is fully equipped with instruments not required by each individual student, such a planimeters, protractors, special slide rules, railroad curves and irregular curves consisting of splines and weights, and calculating machines. The materials-testing laboratory of the department is equipped with one 50,000-pound Riehlé universal machine, one 60,000-pound Riehlé hydraulic testing machine, one Olsen 15,000-pound universal machine, one 100,000-pound Olsen universal machine, one 200,000-pound Olsen universal machine and one 60,000 inch-pound Riehlé torsion machine. Two R. R. Moore endurance-testing and a Riehlé universal impact machine have been added recently. Further recent additions include a soil-mechanics laboratory equipped for instruction and research, a departmental machine shop for maintenance and construction of research equipment and equipment for making and testing pre-stressed reinforced concrete. The hydraulics laboratory is equipped with a 200-gallon-per-minute, 100-foot head volute centrifugal pump with a directly connected slip-ring motor; a simplex Venturi meter; trapezoidal, triangular, and

rectangular weirs; a Pelton-Doble impulse wheel; and necessary gages and other usual equipment.

Complete electric strain-measuring facilities are available in the form of Baldwin-Southwork and Young strain indicators, a Du Mont Oscilloscope, Schaevitz linear variable differential transformers, and attendant switching equipment.

Electrical Engineering

The equipment of the electrical engineering laboratories is ample for a thorough study of direct and alternating current circuits, machines, and controls, as well as for investigations in the electronics and communications fields. In the power laboratories, examples of a wide variety of rotating machinery, transformers, control devices, industrial electronic devices (including mercury-arc power rectifiers and X-ray equipment), servomechanisms, and instruments are available. The electronics laboratory is equipped for investigations in voice recording, wire communication, radio, and microwave fields, and for basic studies of electronic tubes and their circuits. Instruments, other measuring apparatus, and standards are sufficient to make any measurements likely to be needed, and are maintained on the level of current practices and advancements in the fields to which they apply.

In addition to being a part of the communications laboratory equipment, a 1-kilowatt short-wave transmitter, with several of the latest communications and broadcast receivers, affords opportunity for electrical engineering students to become proficient in the operation of these facilities as an extracurricular activity.

Engineering Drawing

The drafting room for instruction in engineering drawing is located in the mechanical laboratory annex. Equipment is available to acquaint the student with industrial practice.

Mechanical Engineering

The mechanical engineering laboratories are well-equipped with standard apparatus for undergraduate instruction in thermodynamics and heat power, internal combustion engines, manufac-

turing processes, physical metallurgy, and engineering mechanics. A drafting room is also available for laboratory instruction in machine design.

In addition to the above, there are laboratory facilities for graduate study and research in thermodynamics, fluid dynamics, engineering mechanics, and physical metallurgy. Of particular interest are: a 5 × 10-foot "water table" for analogue studies of supersonic gas flow, a stress-analysis laboratory equipped for three-dimensional photoelastic studies, and a vacuum melting furnace for production of high purity alloys for metallurgical research.

An integral part of the laboratories is the machinists' shop, which is equipped for the construction of apparatus for undergraduate instruction and graduate research.

Physics

The physics laboratories include three teaching laboratories used in connection with undergraduate work. For graduate and research work there are laboratory facilities in three major fields.

For work in nuclear physics there are a 200,000-volt Cockroft-Walton high voltage source, a 2,000,000-volt and a 6,000,000-volt Van de Graaff accelerator. The latter is housed in the new nuclear research laboratory. For work at these energies a wide variety of auxiliary equipment is available.

For work in low temperature physics a late model Collins liquifier provides an ample supply of liquid helium.

For work on the magnetic properties of materials, expecially at low temperatures, a source of direct current up to 300 kilowatts is available for the production of large magnetic fields.

Psychology

The psychology department is situated in the Fondren Library. Its facilities include a large experimental classroom, four small individual experimental laboratories, a seminar room, a shop, and the departmental offices. Here, also, are located the standard laboratory instruments, equipment, and materials for construction of apparatus for demonstration purposes and research.

CHAIRS AND LECTURES

THE HARRY CAROTHERS WIESS CHAIR OF GEOLOGY

In 1952, Mrs. Olga Keith Wiess in memory of her husband, late Vice Chairman of the Board of Governors of the Rice Institute, gave a substantial endowment to the Institute for the establishment of a chair of geology to be named for Mr. Wiess in recognition of his profession and of his distinguished service to the university. Work in this department was inaugurated at both graduate and undergraduate level in 1954.

THE SHEPHERD SCHOOL OF MUSIC

Mrs. Sally Shepherd Perkins, of Richmond, Virginia, in 1950 provided for the establishment of a school of music at the Institute. It is contemplated that when the income from this endowment is of sufficient size, appropriate buildings and other facilities will be provided for outstanding instruction in musical theory and appreciation. At present, income from the gift maintains a lectureship and a number of courses and activities in music.

THE J. NEWTON RAYZOR CHAIR IN PHILOSOPHY AND RELIGIOUS THOUGHT

This chair was established in 1953 by Mr. J. Newton Rayzor, a trustee of the Rice Institute. Its purpose is to provide in the Rice curriculum for distinguished instruction in those broad areas of religious and philosophical ideas which have so powerfully influenced the history of civilization.

THE HARRIS MASTERSON, JR., CHAIR IN HISTORY

The late Reverend Harris Masterson, Jr., was deeply interested in the Rice Institute through his activities as Director of Autry House and his close personal association with Rice students through many years. His will provided a bequest to the Institute with which the Board of Governors established a memorial to him in this chair.

THE M. D. ANDERSON VISITING PROFESSORSHIP

The M. D. Anderson Foundation has for several years made possible the yearly appointment of a visiting professor in the humanities. In addition to academic instruction, the M. D. Anderson Visiting Professor each year delivers a series of lectures which are open to the public as well as to the faculty and students of the Institute. Such lectures have been delivered by Dr. Merle K. Bennett of Stanford University, Dr. Theodore Greene of Yale University, and Dr. Willard Thorpe of Princeton University.

THE FACULTY LECTURES

A series of afternoon lectures by members of the faculty is regularly scheduled during the fall months. Announcement of the subjects and dates is made to the public a few weeks before the lectures are delivered. The series usually begins in October and continues until December.

THE ROCKWELL LECTURES

These lectures are made possible by the Rockwell Fund, Inc. They were inaugurated by Sir Robert Alexander Falconer in April, 1938. Later lectures have been delivered by Dr. Harris Elliot Kirk, by Dean Roscoe Pound, by Dr. Joseph Richard Sizoo, by Professor William Ernest Hocking, by Dr. Robert Russell Wicks, by Dr. Ralph W. Sockman, by Dr. George A. Buttrick, by Professor Charles W. Hendel, by Professor Kenneth S. Latourette, by Mr. Charles P. Taft, by Dr. Henry P. Van Dusen, by Professor George Finger Thomas, by Dr. Conyers Read, and by Professor Theodore Greene.

THE RICE INSTITUTE LECTURES

From time to time the Rice Institute invites scholars of distinction to lecture for varying periods. In most cases these lectures are open to the public as well as to the faculty and student body. Recent lectures have been delivered by Sir John T. Sheppard, Dr. William B. Hesseltine, Dr. Felix Bloch, Dr. Edwin G. Nourse, and Dr. Arne Tiselius.

STIPENDS AND FUNDS

FELLOWSHIPS

PROVISION is made for a variety of fellowships available to graduates of this and other institutions. There are several memorial fellowships that have been founded and endowed by gift or bequest on the part of friends of the Rice Institute. These provide a stipend designed to enable the holder to devote his time to study and research in his chosen field. There are also several industrial fellowships maintained by companies interested in the development of technical fields and the training of competent scientists and engineers.

Persons desiring to be considered for appointment as fellows should consult with the department in which they desire to work and should make application to the Office of the Registrar as early as possible.

THE WALTER B. SHARP MEMORIAL FUND FOR RESEARCH IN PURE AND APPLIED SCIENCE

The income from this fund is to be used for the maintenance of resident or traveling fellowships in scientific research, preference to be given to geological research, with special reference to petroleum and allied products. A requisite for eligibility to these fellowships is the degree of Doctor of Philosophy.

THE SAMUEL FAIN CARTER FELLOWSHIP

The annual income of this trust fund is to be awarded to a graduate student of the Rice Institute, or a graduate of an approved institution of learning, for the purpose of enabling the student to continue in postgraduate work, preferably at the Rice Institute; and when the appropriate graduate schools shall have been organized, precedence is to be given to candidates in banking, business administration, and forestry. In the meantime, the award is to be made for the prosecution of postgraduate work in history and allied subjects, in science or engineering, or in other branches of liberal and technical learning.

THE ORA N. ARNOLD FELLOWSHIP FUND

To finance traveling fellowships. Either graduates of the Rice Institute, of outstanding ability and character, or graduates of the University of Mexico, of equal distinction, may be appointed. An incumbent from Rice may study in Mexico, the South American states, the West Indies, or the Philippine Islands; an incumbent from the University of Mexico is expected to study at the Rice Institute.

THE WILLIAM WARD WATKIN MEMORIAL TRAVELING FELLOWSHIP IN ARCHITECTURE

Provision for a Rice Institute Traveling Fellowship in Architecture has been made by the Alumni of the Department of Architecture and the Architectural Society of the Rice Institute. The selection of the holder of the Traveling Fellowship is made annually by the faculty by means of a formal competition.

THE JAMES A. BAKER AND ALICE GRAHAM BAKER BEQUEST

THE CATHERINE WITHERS ROPER AND BENJAMIN E. ROPER MEMORIAL FUND

THE DOW CHEMICAL COMPANY FELLOWSHIPS

On a year-to-year basis, to be awarded to a Rice student in chemical engineering or mechanical engineering.

The Dow Chemical Company has also provided two fellowships in the amount of $1500 each, one to be awarded to a graduate student of mechanical engineering and one to a graduate student of chemical engineering.

THE HUMBLE OIL AND REFINING COMPANY FELLOWSHIPS

For X-ray diffraction research. The Humble Company also established one fellowship in chemistry and one in physics. No limitation is placed on the nature of the research carried on by these two fellows.

THE MAGNOLIA PETROLEUM COMPANY FELLOWSHIP

A fellowship for research work in the general field of physics of the liquid and solid state. Awarded to a student who has completed one or more years of graduate work in physics.

THE AIR PRODUCTS FELLOWSHIP IN CHEMICAL ENGINEERING

THE SHELL FELLOWSHIP IN PHYSICS

THE PAN AMERICAN FELLOWSHIP IN CHEMICAL ENGINEERING

THE FLUOR CORPORATION FELLOWSHIP IN CHEMICAL ENGINEERING

This may also be awarded in the other three branches of engineering.

THE M. N. DAVIDSON FELLOWSHIP IN ARCHITECTURE

The fellowship is to be awarded by the faculty of architecture to a student completing his five years of study for the professional degree of Bachelor of Science in Architecture, and having the highest academic record of the students to reach graduation in that year. The award shall be used by the student for the purpose of travel and study within the United States, beginning not later than six months after the award is made.

THE SCHLUMBERGER FOUNDATION FELLOWSHIP IN MATHEMATICS

THE STANOLIND OIL AND GAS COMPANY FELLOWSHIP IN CHEMICAL ENGINEERING

THE ATLANTIC REFINING COMPANY FELLOWSHIP IN CHEMICAL ENGINEERING

THE CELANESE CORPORATION OF AMERICA FELLOWSHIP IN CHEMICAL ENGINEERING

NON-INSTITUTIONAL FELLOWSHIPS

In addition to the above fellowships, students may pursue advanced research through Atomic Energy Commission Fellowships.

The Committee on Graduate Instruction processes applications for fellowships submitted by graduate students of the Rice Institute for research in other institutions and in other countries. Among available fellowships of this nature are the Rotary International Fellowship, the Rhodes Scholarships, the Charles A. Cof-

fin and Gerard Swope Fellowships awarded by the General Electric Educational Fund, and the Frank B. Jewett Fellowships awarded by the Bell Telephone Laboratories. Applicants for predoctoral fellowships under the Fulbright Act administered by the Institute of International Education, and for postdoctoral research and teaching exchanges under the same act administered by the Committee on International Exchange of Persons, should also file with the Committee on Graduate Instruction.

Rice is one of the sponsoring universities of the Oak Ridge Institute of Nuclear Studies. The Oak Ridge Institute provides a number of fellowships to doctoral candidates who have completed their residence requirements and who want to work on a thesis problem at Oak Ridge because of the special facilities which are available.

THE RALPH BUDD AWARD

A medal available for the best thesis in engineering submitted each year.

THE H. A. WILSON MEMORIAL AWARD

A substantial prize is being provided for the best research in physics done by a graduate student each year.

GRADUATE ASSISTANTSHIPS-FELLOWSHIPS

Graduate students with high academic records and outstanding qualifications may receive assistance through awards of graduate assistantships-fellowships in the various departments of the Rice Institute. Inasmuch as these awards are of equal value, the minimum stipend for such dual appointments is $1300 with exemption from fees. A student holding a graduate assistantship must be a candidate for an advanced degree; he will be expected to devote a substantial part of his program to study and research, and at the same time to teach one section in an elementary course or to do an equivalent amount of other departmental work. He will thus get a certain amount of valuable practical training in preparation for an academic career. Appointments carrying larger stipends, with a schedule equivalent to a teaching load of two sections, are occasionally available; such appointments depend

on the interests and attainments of the student and on the requirements of the department.

GRADUATE SCHOLARSHIPS

STUDENTS whose previous records show marked promise but for whom no graduate assistantships are available may, especially in their first year of graduate study at the Rice Institute, be awarded graduate scholarships with exemption from all fees but without stipend. Graduate scholars may carry a full schedule of graduate work, and are not required to render any service to the Institute.

UNDERGRADUATE SCHOLARSHIPS AND AWARDS

WHILE seeking to develop its students in culture, in character, and in citizenship, the Rice Institute will reserve its highest rewards for scholarship, and in particular for evidences of creative capacity in productive scholarship. To encourage this devotion to learning, there have been established through the donations of friends of the Institute a number of undergraduate scholarships to be awarded principally to students who have been in residence at the Institute for at least one year. Moreover, honorary scholarships without stipend may be granted to students whose scholastic standing shows marked ability. Certain funds, as noted below, are for the benefit of holders of a bachelor's degree. (See also the sections on graduate awards, immediately above.)

THE GRAHAM BAKER STUDENTSHIP

The first undergraduate scholarship at the Institute, the Graham Baker Studentship, was founded by the late Captain and Mrs. James A. Baker, of Houston, in memory of their eldest son, Frank Graham Baker. This studentship is awarded annually to that student in the three lower classes of the Rice Institute who earns the highest scholastic standing for the academic year, and the holder is known as the Graham Baker Student for the year.

THE HOHENTHAL SCHOLARSHIPS

These scholarships are awarded annually to students of high standing in scholarship who are earning a substantial part of their college expenses.

THE D.A.R. SCHOLARSHIP

The John McKnitt Alexander Chapter of the Daughters of the American Revolution has provided an endowed undergraduate scholarship at the Rice Institute. It is awarded to a young woman student of the Institute.

THE ELLEN AXSON WILSON SCHOLARSHIP

The scholarship is awarded from year to year to a young woman student of the Institute of Junior or Senior standing.

THE ELIZABETH BALDWIN LITERARY SOCIETY SCHOLARSHIP

This scholarship is available to a student of the Rice Institute, either a young man or a young woman.

THE VAL T. BILLUPS SCHOLARSHIP

Open to engineering students above Freshman standing.

THE PALLAS ATHENE LITERARY SOCIETY SCHOLARSHIP

This scholarship is open to a young woman student of the Rice Institute.

THE DANIEL RIPLEY SCHOLARSHIP

The annual income of this trust fund is to be awarded to that self-supporting young man or woman student completing the Freshman year at the Rice Institute who receives the highest grades. The first award of the Daniel Ripley Scholarship was made for the academic year 1927-28.

DOW CHEMICAL COMPANY CHEMISTRY AND CHEMICAL ENGINEERING FRESHMAN SCHOLARSHIP AWARDS

One award in each of these two fields to the highest ranking students.

THE EDITH RIPLEY SCHOLARSHIPS

The income of which is to be distributed equally and annually to three young women students of the Institute to be selected by the faculty.

THE MARY PARKER GIESEKE SCHOLARSHIP

This memorial scholarship is to be awarded annually for high standing in scholarship to a student of the Rice Institute who has been in residence at least one year.

THE THOMAS AUBREY DICKSON AND PAULINE MARTIN DICKSON SCHOLARSHIPS

Awarded by the faculty to self-supporting students of the Institute, young men or young women, on the basis of scholarship. The first awards of these scholarships were made for the academic year 1932-33.

THE CHAPMAN-BRYAN MEMORIAL SCHOLARSHIP

The scholar on this foundation, a student of the Institute, is to be selected by the faculty on the basis of high standing, personality, and physical fitness.

THE LADY WASHINGTON TEXAS CENTENNIAL AWARD

This award is to be made yearly for scholarship to a young woman student of the Rice Institute, preference to be given to Houston students of Sophomore standing.

THE KATIE B. HOWARD SCHOLARSHIP

The income of this fund is awarded from year to year to a young woman student of the Institute.

THE SAMUEL S. ASHE SCHOLARSHIP

This scholarship is to be awarded annually to a deserving but necessitous young man or young woman of the Freshman class of the Institute on completing the work of that year with highest grades. The first award of the Samuel S. Ashe Scholarship was made for the academic year 1939-40.

THE ENGINEERING ALUMNI SCHOLARSHIP

For an engineering student, entering his fifth year, at the Rice Institute.

THE THOMAS RICHARD FRANKLIN AND JULIA HADLEY FRANKLIN SCHOLARSHIPS

The income of this fund is to be devoted to the awarding of annual scholarships to properly qualified students of the Institute. Both male and female students are eligible to Franklin Scholarships, and in awarding them, the Institute is to take into consideration not only the scholarly standing but also the financial necessities of the candidates.

THE WALSH SCHOLARSHIP IN ARCHITECTURE

To be awarded by the faculty by means of a formal competition, to a student completing his fourth year in architecture, for the purpose of assisting him to carry on through his fifth year.

THE MAX AUTREY MEMORIAL SCHOLARSHIPS

These scholarships are to be awarded, on such terms as the authorities of the Institute may determine, as a memorial to the donor's son, Max Autrey, in service in the first world war and since deceased.

THE JOHN B. COFFEE SCHOLARSHIPS

One of these scholarships is open to Freshmen, the other only to Junior or Senior students of Geology.

THE COLLEGE WOMEN'S CLUB FUND OF THE RICE INSTITUTE

From the income of this fund an award is to be made annually to some woman Senior at Rice whom the President of the Institute and his committee may select as an outstanding student, to be used by her in working on her master's degree, either at Rice or at some university of the same rank.

THE SCHOLARSHIP OF THE HOUSTON CHAPTER OF THE AMERICAN PETROLEUM INSTITUTE

An engineering scholarship available to a Junior student of Rice, conditioned on class standing, extracurricular activities, and his continuing his Senior year at Rice.

THE JESSE H. JONES NAVAL SCHOLARSHIPS

For the award of scholarships honoring Fleet Admiral William F. Halsey, Jr., and General Alexander Archer Vandegrift. Members of the N.R.O.T.C. unit, including entering students, are eligible. Selections are made under the direction of the R.O.T.C. Committee on a basis of need and outstanding ability.

THE SARAH LANE LITERARY SOCIETY SCHOLARSHIP

This scholarship is available to a woman student of the Rice Institute who has successfully completed her Freshman year.

THE BLANCHE WHITE SCHOLARSHIP

For men or women students who have been in residence at least one year.

THE WILL HOGG MEMORIAL SCHOLARSHIP

The Students' Memorial Loan Fund was established in 1936 by a gift from Mr. W. C. Hogg under the terms of his will. In 1948 the charter of the loan fund was amended to arrange for the awarding of scholarships in addition to the making of loans to students. The first scholarship was awarded for the academic year 1948–49.

THE THETA PSI OMEGA SCHOLARSHIP

The Theta Psi Omega Fraternity, an organization of businessmen, has established a scholarship known as the Theta Psi Omega Scholarship, to be awarded annually to an American male student of the Rice Institute.

THE ELOISE SZABÓ WITTE STUDENTSHIP IN HISTORY

The award should go to that young man or young woman of the Freshman Class who, in that year, has indicated a desire for further study in any branch of history, preferably Biblical or ancient history, and who in the opinion of the department of history has demonstrated the greatest promise in the study of that subject. The studentship is to be granted upon the recommendation of the chairman of the department of history.

THE CIVIL ENGINEERING SCHOLARSHIP

To foster interest in civil engineering education at the Rice Institute and to provide recognition for work well done, an anonymous donor is contributing to the Rice Institute the sum of $175 annually as a stipend for the Civil Engineering Scholarship. The Scholarship is to be awarded at the end of his fourth year to a male student planning to continue through the fifth year of the civil engineering course, who has high scholastic standing. The Scholarship is awarded on recommendation of the members of the civil engineering faculty without reference to the financial circumstances of the student.

THE HOUSTON ENGINEERS' CLUB SCHOLARSHIP

To a candidate for the Bachelor of Science degree in engineering. This award is not necessarily made annually. The holder must be a resident of Harris County but may be other than a student of the Rice Institute.

THE HUGHES TOOL COMPANY AWARD

A scholarship award to a student entering the fifth year of the curriculum in mechanical engineering.

THE SCHLUMBERGER FOUNDATION SCHOLARSHIP

Open to Junior or Senior students in Electrical or Mechanical Engineering, Physics, or Geology who have completed twelve semester hours of study in Electricity, prior to graduation.

THE MAGNOLIA PETROLEUM COMPANY PRODUCTION DIVISION SCHOLARSHIP

Open to candidates for the degree of Bachelor of Science in Mechanical Engineering.

THE UNIVERSITY WOMEN'S ALLIANCE SCHOLARSHIP

The Institute will submit a list of three outstanding women students of Junior standing as applicants. Each woman should submit a written application to the chairman of the Scholarship Committee of the Alliance, and after each applicant has appeared

before the Committee for an interview, the Alliance will select the recipient of the award. Need is the main consideration for this scholarship. Other bases are citizenship, scholarship, and personality. The holder should be a native Texan preferably.

THE REBECCA AND LILY G. NUSSBAUM SCHOLARSHIP

This scholarship was founded by bequest of Ida R. Nussbaum in memory of her mother and sister.

THE IDA R. AND HANNA E. NUSSBAUM SCHOLARSHIPS

These scholarships were founded by bequest of Ida R. Nussbaum.

THE EMANUEL AND MOSE RAPHAEL SCHOLARSHIPS

These scholarships were founded by bequest of Ida R. Nussbaum in memory of her uncles.

THE MILLIE TUTT COOK SCHOLARSHIP

For the benefit of a Junior or Senior student preparing for a career in teaching. The conditions of the award are to be determined by the Rice Institute.

THE ACHILLE AND MALLINE MEYER MEMORIAL FUND

The income is to be awarded annually to a fully or partially self-sustained student of the Rice Institute who is successfully pursuing his course of studies toward a degree.

THE MONSANTO CHEMICAL COMPANY UNDERGRADUATE SCHOLARSHIP IN THE DEPARTMENT OF MECHANICAL ENGINEERING

THE LADY GEDDES PRIZE IN WRITING

The Right Hon. Sir Auckland Geddes, British Ambassador to the United States, Godwin Lecturer at the Rice Institute in 1921, has endowed at Rice a prize in writing, which is to bear the name of Lady Geddes and is to be awarded annually. Competition for this award is open to Freshmen and Sophomores of the Rice Institute.

THE RICHARDSON FUND FOR RICE STUDENTS

Mrs. Libbie A. Richardson, widow of Alfred S. Richardson, who was a charter member of the Board of Trustees of the Rice Institute, bequeathed in trust to the Houston Bank and Trust Company, as trustee, a fund amounting at present to approximately $50,000, the income therefrom to be used in educating necessitous young men and women at the Rice Institute.

THE GRANT WILLIAM JORDAN AND CORA JORDAN MEMORIAL FUND

Under the will of Mrs. Cora Jordan, a resident of Houston, the bulk of her estate was left in trust with the Houston Bank and Trust Company, as trustee, the income therefrom to be used in assisting worthy young men and women in obtaining an education at the Rice Institute. The Jordan Memorial Fund amounts at present to approximately $51,000.

THE SARA STRATFORD FUND

The Sara Stratford Fund for Women Students of the Rice Institute, in memory of the late Mrs. Sara Stratford, first Adviser to Women.

THE WESTINGHOUSE ACHIEVEMENT SCHOLARSHIP

Open to students who have completed four years of undergraduate study in Electrical or Mechanical Engineering.

THE MARY ALICE ELLIOT LOAN FUND

A loan of $500 from this fund is to be available each year, on recommendation of the faculty, to an architectural graduate who has received honorable mention in the annual competition for the regular William Ward Watkin Memorial Fellowship.

THE ROBERT PILCHER QUIN AWARD

By a group of student friends of the late Robert Pilcher Quin, a member of the Class of 1933, provision has been made for an annual "Bob Quin Award," in the form of a medal, for qualities in athletics, leadership, scholarship, and sportsmanship in which he himself excelled.

THE ALICE THIELEN READER PRIZE AND INTERNSHIP IN PUBLIC ACCOUNTING

Providing annually a prize in the sum of $200 and the opportunity for part-time internship with W. W. Reader & Co., Certified Public Accountants, during the Senior year of the recipient. The award is made to a Junior student of business administration who intends to enter professional accounting practice, on the basis of personality, aptitude, scholarship, and financial need, contingent upon continuation of the Senior year at Rice.

SCHOLARSHIPS FOR ENTERING STUDENTS

A limited amount of scholarship aid can be made available from certain funds to selected new students, with exceptional school records, who face difficulty in financing their education. Certain awards of this type, available without respect to the home city or state of applicants, are designated as the Distinguished Student Scholarships and the Rice Institute Liberal Arts Scholarship. Further information may be obtained from the Director of Admissions. Information concerning several scholarships and fellowships not controlled by the Rice Institute, but open to its students, may also be obtained from the Director of Admissions. In view of these numerous forms of aid, no prospective student of outstanding previous record should hesitate, for financial reasons, to apply for admission.

THE LIBERAL ARTS SCHOLARSHIPS

Fifteen scholarships amounting to $300 each will be awarded to outstanding entering Freshmen who major in the Liberal Arts. Information relating to these awards may be obtained from the Director of Admissions.

LOANS AND SELF-HELP

Besides the stipends of graduate and undergraduate awards, there are, on the campus and in the city, opportunities in considerable variety for worthy and deserving students to earn a part of their living expenses while attending the Institute. Information concerning such openings may be obtained from the Placement Service.

Thanks to the generosity of a number of persons, there are available several student loan funds. Among them is the Frank McFaden Caldwell Student Loan Fund, established by Mr. and Mrs. L. C. Caldwell in memory of their son, who was one of ten Rice students who died in an airplane accident in July, 1953. Inquiries concerning the administration of these funds should be addressed to the Assistant to the President.

CURRICULA AND DEGREES

The Rice Institute offers baccalaureate degrees in arts and sciences, physical education, engineering, and architecture. Within the curricula of arts and science the essential premedical and prelegal subjects can be elected.

To students of exceptionally high scholastic standing at the end of the fourth year, the Bachelor of Arts degree may be awarded either "with distinction," or "with honors in [the field of major study]." To obtain the degree "with honors" the student must signify his preference to the Committee on Examinations and Standing at the beginning of his fourth year. With the approval of the department of specialization the Committee may recommend the applicant to the faculty for that degree.

All programs except that in physical education are so arranged that the degree of Bachelor of Arts is taken at the end of four years. During the first two years, the student is registered in one of the four basic curricula (academic, science-engineering, architecture, physical education), in which a considerable part of the work is prescribed. During the second two years, wider choice of majors and individual courses is given. Throughout the entire four-year period, however, each student pursues a broad program of the fundamental sciences and humanities, rather than a narrow course of specialization.

Students completing the four-year course in physical education receive the degree of Bachelor of Science in Physical Education.

Fifth-year programs are offered in architecture and engineering, leading to the Bachelor of Science degree in the department of specialization (B.S. in Arch., B.S. in Ch.E., B.S. in C.E., B.S. in E.E., B.S. in M.E.). Admission to fifth-year programs is accomplished through application to the Committee on Examinations and Standing. To be eligible for admission the candidate must have completed the equivalent of the Rice Institute requirements for the Bachelor of Arts degree in his major field. An applicant is accepted or rejected on the basis of his past academic performance and the recommendation of the department concerned.

Graduate study is offered in the arts and sciences, architecture and engineering. In the arts and sciences, programs leading to the M.A. and Ph.D.[1] degrees are offered. In engineering, programs may lead to the M.S. in [major field of study] and Ph.D.[1] The graduate program in architecture may lead to the degree of Master in Architecture. Application for admission to graduate work is made through the office of the Registrar to the Committee on Graduate Instruction. Applicants will be passed upon by the department concerned and by the Committee, and will be required to submit evidence of suitable preparation and of ability to do work of the quality expected.

For further information about graduate courses and for detailed descriptions of the requirements for advanced degrees see the Graduate Announcements.

Undergraduate Courses are divided into three groups:

Group A—languages, literature, and music

Group B—history, social studies, philosophy, and education

Group C—biology, chemistry, geology, mathematics, physics and psychology

In the majority of courses, the formal instruction offered consists of three lectures a week throughout the academic year, together with concurrent laboratory work in certain subjects.

The schedules shown below are subject to modification. The schedule of every student must be approved by his department of specialization in each of the last two years. Special arrangements may be made for certain modifications of any curriculum leading to a bachelor's degree, in order that the required courses in naval or military science may be taken.

Students working toward bachelor's degrees will be registered in the following programs:

Academic

First Year

(1) Mathematics 100

(2) Physics 100, Chemistry 100 or 120, or Biology 100

[1] At present, graduate courses of study are not offered in all departments of instruction. Refer to the Graduate Announcements for further information.

(3) English 100
(4) French or German
(5) History 100 or 110
(6) Physical Training 100

Second Year

(1) Mathematics 200 or 210, or a laboratory science
(2) English or general literature elective
(3) French or German (continuation of language elected in first year)
(4) Elective in Group B
(5) Free elective

Third and Fourth Years

Academic majors are offered in biology, economics and business administration, English, German, history, mathematics, philosophy, psychology and Romance languages. A major in biology or mathematics may be taken in either an academic or a science program.

Ten courses are required, including two in Group A, two in Group B, and one in Group C. At least seven of the ten courses must be advanced (numbered 300 or higher). Not less than three nor more than five of the third and fourth year courses and not more than six of the total courses offered in fulfillment of the requirements for the degree may fall within a student's major field.

Science-Engineering

First Year

(1) Mathematics 100
(2) Physics 100
(3) Chemistry 120
(4) English 100
(5) History 100 or 110
(6) Physical Training 100

Second Year

(1) Mathematics 200 or 210
(2) Physics 200

(3) Elective
(4) English elective
(5) German
(6) Engineering 203

Students entering the Junior year to major in Chemistry, Chemical Engineering, or Physics must have credit for Chemistry 220; those entering the Junior year to major in Biology must have credit for Biology 100. Students entering the Junior year in Geology must have credit for Geology 200a and 201b.

Special permission may be obtained to substitute Biology 100 for Engineering 203. Chemistry 220 may then be elected for course 3 in the Sophomore year.

Biology, Chemistry, Geology, Mathematics, and Physics

Third Year

(1) Science in major field
(2) Science in major field
(3) Science outside major field
(4) French or German
(5) Humanity elective

Fourth Year

(1) Science in major field
(2) Science in major field
(3) Free elective outside major field
(4) Biology
(5) Humanity elective

Chemical Engineering

Third Year

(1) Chemistry 310
(2) Mathematics 300 or 310
(3) Chemical Engineering 303
(4) German 205
(5) Chemistry 300A

Fourth Year

(1) Elective
(2) Chemical Engineering 403
(3) Engineering 431 (first half-year)
Engineering 432 (second half-year)
(4) Electrical Engineering 433
(5) Humanity elective
(6) Chemical Engineering 443
Chemical Engineering 421 (first half-year)

Fifth Year

(1) Chemistry 410a (first half-year)
Advanced course in chemical engineering (second half-year)
(2) Economics 363
(3) Advanced course in chemical engineering (first half-year)
Chemical Engineering 522 (second half-year)
(4) Chemical Engineering 512 (first half-year)
(5) Chemical Engineering 561 (first half-year)
Chemical Engineering 562 (second half-year)
(6) Chemical Engineering 543

Civil, Electrical and Mechanical Engineering

Third Year (uniform)

(1) Mathematics 300 or 310
(2) Engineering 360 (one semester)
Electrical Engineering 340 (one semester)
(3) Engineering 303
(4) Economics 363
(5) Mechanical Engineering 350 (one semester)
Engineering 350 (one semester)
(6) Humanity elective

Fourth Year—Civil Engineering

(1) Electrical Engineering 403
(2) Mechanical Engineering 403
(3) Civil Engineering 401 and Civil Engineering 402

(4) Civil Engineering 421 and Civil Engineering 422
(5) Elective

Fourth Year—Electrical Engineering

(1) Electrical Engineering 403
(2) Mechanical Engineering 403
(3) Civil Engineering 401
Civil Engineering 402
(4) Electrical Engineering 443
(5) Electrical Engineering 473
(6) Elective (one semester)

Fourth Year—Mechanical Engineering

(1) Electrical Engineering 403
(2) Mechanical Engineering 403
(3) Civil Engineering 401
Civil Engineering 402
(4) Mechanical Engineering 423
(5) Mechanical Engineering 483
(6) Elective

Civil Engineering

Fifth Year (B.S. in C.E.)

(1) Civil Engineering 523
(2) Civil Engineering 543
(3) Civil Engineering 563
(4) Civil Engineering 581
Civil Engineering 582
(5) Civil Engineering 503
(6) Engineering 505

Electrical Engineering

Fifth Year (B.S. in E.E.)

(1) Electrical Engineering 503
(2) Electrical Engineering 513
(3) Electrical Engineering 523

Electrical Engineering 543
(4) Electrical Engineering 553
(5) Electrical Engineering 573
(6) Engineering 505

Mechanical Engineering

Fifth Year (B.S. in M.E.)

(1) Mechanical Engineering 513
(2) Mechanical Engineering 523
(3) Mechanical Engineering 541
Mechanical Engineering 542 or Mechanical Engineering 532
(4) Mechanical Engineering 570
Mechanical Engineering 590
(5) Engineering 515

Architecture

First Year

(1) Mathematics 100
(2) Physics 100
(3) English 100
(4) French
(5) History 100 or 110
(6) Architecture 100
(7) Physical Training 100

Second Year

(1) Mathematics 200 or 210
(2) English or general literature elective
(3) French
(4) Architecture 200
(5) History of Art 215
(6) Drawing 225
(7) Architecture 200b

Third Year

(1) Elective (other than architecture)
(2) Architecture 300

(3) History of Art 315
(4) Architecture 320a
Architecture 320b
(5) Drawing 325
(6) Architecture 330
(7) Civil Engineering 332

Fourth Year

(1) Elective (other than architecture)
(2) Architecture 400
(3) History of Art 415
(4) Drawing 425
(5) Architecture 430a
Architecture 430b
(6) Architecture 440

Fifth Year (B.S. in Architecture)

(1) Elective (other than architecture)
(2) Architecture 500a
Architecture 510b
(3) Architecture 520a
Architecture 540b
(4) Architecture 530
(5) Architecture 550

Physical Education

First Year

(1) English 100
(2) Biology 100
(3) Physical Education 100
Physical Education 125
(4) French, German, or Spanish
(5) Economics 100, or elective

Second Year

(1) English 200, 210, or 220
(2) Chemistry 100 or 120

(3) Physical Education 200
Physical Education 225
(4) French, German, or Spanish (continuation of language elected in first year)
(5) Elective

Third Year

(1) Biology 390
(2) Psychology 300
(3) Physical Education 300
Physical Education 325
(4–5) Two other subjects[1]

Fourth Year

(1) Physical Education 400
Physical Education 425
(2) Physical Education 350
(3–5) Three other subjects[1]

[1] Students planning to enter public school work should elect education in the third and fourth years and Political Science 210 in the third or fourth year.

RULES OF EXAMINATIONS AND STANDING FOR UNDERGRADUATE AND PROFESSIONAL STUDENTS

STUDENTS working toward any bachelor's degree, or not working toward a degree, are under the jurisdiction of the Committee on Examinations and Standing. Students working toward a master's or doctor's degree are under the jurisdiction of the Committee on Graduate Instruction.

Grade symbols have the following meanings; 1, very high standing; 2, high standing; 3, satisfactory standing; 4, poor standing; 5, failure. In the evaluation of year grades, the grades of one-semester courses in *both* semesters are taken into account.

Registration. All undergraduate students, except those entering for the first time, register in May for the following academic year. Transfer students entering with advanced credit register on the dates shown on the calendar (p. vii). Entering freshmen are sent registration materials by mail during the latter half of the summer.

The registration card of each student must be signed by an adviser. The Registrar approves registrations of all entering students; the members of the Committee on Examinations and Standing approve registrations of sophomore students; others are approved by an adviser appointed by the head of the department of the students' major field of study. After completing registration, any student may change his choice of an elective by notifying the Registrar of the change desired. However, changes in registration may not be made after the beginning of classes in the Fall.

Schedules. The regular schedule for all undergraduate students is at least five full courses each year. Irregular schedules are arranged at the time of registration, and must be approved by the Committee on Examinations and Standing. A student of the Institute who has had four full years of college is permitted to complete a first baccalaureate degree by registering for only

those courses actually needed for graduation, provided he is not on probation.

No student shall reduce the program for which he is registered without permission of the Committee on Examinations and Standing.

Examinations. Written three-hour examinations are given to all students at midyear, and at the close of the academic year in May. Late examinations are given only by permission of the Committee on Examinations and Standing; they carry a fee of $10.00 each, which may be waived when an excuse of illness is accepted. Other tests and examinations are given from time to time at periods decided by the instructors. Tests and examinations are conducted under a student honor system. (See page 39). In determining the standing of a student in each class, both his work during the term and the record of his examinations are taken into account.

Probation. Every student at the Rice Institute is expected to do academic work of high quality at all times. A student shall be placed on probation:

(1) If he fails to earn passing grades in 75 per cent of his full schedule in any semester or any academic year.

(2) If he does not earn grades of 3 or higher in at least 40 per cent of his full schedule in any semester or any academic year.

The period of probation is the next semester in which the student is enrolled in the Institute. *A student is not placed on probation more than twice during his residence, but instead of a third probation is required to withdraw from the Institute.*

A student on probation is not permitted to be a candidate for or to hold any elective or appointive office; or to serve as editor, assistant editor, business manager, or assistant business manager of any college publication.

Special Probation. At its discretion, the Committee on Examinations and Standing may grant the privilege of special probation to an individual student who otherwise would not be permitted to continue at the Rice Institute in his desired program.

Special probation requires that a student shall refrain from the extracurricular activities closed to other students on probation (see immediately above) and shall have no grade less than 3 during the period of his special probation, and, further, that he must remain off probation thereafter, or he shall be permanently dropped.

Enforced Withdrawal. A student shall be required to withdraw from the Institute:

(1) If he fails to earn passing grades in at least 50 per cent of his full schedule in any semester. This clause does not apply to an undergraduate student at the end of his first semester at the Institute.

(2) If he fails to earn passing year grades in at least 50 per cent of his full schedule in any academic year.

(3) If he has already been placed on probation twice and his semester or year grades, at any subsequent time, are such as would result in a third probation.

(4) If he fails to fulfill all the terms of special probation, as outlined just above.

Voluntary Withdrawal and Readmission. Any student desiring to withdraw voluntarily from the Institute must do so in person or by letter at the Registrar's Office. A student who withdraws voluntarily while not on probation or special probation will ordinarily be readmitted within three years. However, if the withdrawal occurs within five weeks of the beginning of any semester examination period, his grades as of the date of withdrawal may be used to determine his eligibility for readmission.

Removal of Deficiencies. With the approval, *in advance,* of the Committee on Examinations and Standing, deficiencies may be removed by work of high quality in an approved summer school, but *future courses of a student's schedule may not be anticipated* by work done in summer school.

Change of Curriculum. Following the completion of a student's work in each of his first two years, the Committee on Examinations and Standing, at its discretion, may require a change of curriculum if, in the judgment of the Committee, the student's work

in essential basic courses is such as to render him unsuited for further training in his originally chosen field of study.

Any proposed change of curriculum, whether or not the result of Committee action as mentioned above, is subject to the approval of the Committee on Examinations and Standing.

Approval of Major. In the second semester of the Sophomore year, each student is required to submit to the Committee on Examinations and Standing his choice of major. In determining whether this choice can be approved, the Committee will be guided by (1) aptitude shown in the individual record during the first two years of the curriculum which the applicant has been pursuing, and (2) limitations of departmental facilities for receiving students in the various major programs. Until a student's choice of major has been approved by the Committee on Examinations and Standing, he can not enter the Junior courses of that curriculum.

Graduation. To be recommended for any bachelor's or professional degree, a student must have earned year grades of 3 or better in at least 50 per cent of work prescribed for that degree, and also, year grades of 3 or better in at least 50 per cent of the work undertaken in his major field in the Junior and Senior years. He must not go on probation at the end of the year in which he is a candidate. A student who goes on probation at the end of this year but who is eligible to reregister may obtain his degree by earning grades, in a program of at least four additional courses, that remove him from probation.

COURSES OF INSTRUCTION

COURSE numbers below 200 designate beginning courses. Courses numbered from 200 to 299 are considered second-year courses, and are not normally open to freshmen. Courses numbered from 300 to 499 are advanced courses, not open to freshmen or sophomores except by permission. Courses numbered 500 and above are graduate level courses, open to undergraduates only on special recommendation of the department concerned.

The letters "a" and "b" after course numbers indicate first-semester and second-semester courses respectively. *Engineering* courses with numbers ending in 1 are first-semester courses; with 2, second-semester courses; with 3, two-semester (year) courses. If the number of an *engineering* course ends in zero, it is a one-semester course but may be available in both the fall and spring semesters.

Figures entered in parentheses at the left below the description of each course signify the number of class hours per week, the number of laboratory hours per week, and the semester-hours credit for the completed course, in that order. Thus, the entry (3–3–8) below Physics 100 means that the course meets three hours per week, has three hours of laboratory work per week and is evaluated at eight-semester-hours credit upon completion of the full year's work.

Architecture

Architecture 100. *Drawing and Composition,* including shades and shadows and perspective, with instruction in basic composition and sketching.
(1–5–5) *Messrs. Lent and Morehead*

Architecture 200. *Design.* Problems embracing the design and construction of small buildings, with drafting room practice and working drawings pertinent to small structures.
(1–12–10) *Messrs. Chillman, Leifeste and Dunaway*

History of Art 215. See page 128.
(3–0–6) *Mr. Chillman*

Architecture 220b. *Theoretical Mechanics.*
(3–0–3) *Mr. Leifeste*

Drawing 225. *Freehand Drawing and Painting.* Open to all students.
(0–4–2) *Mr. Parsons*

Architecture 300. *Design.* Buildings of moderate requirements and dimensions. Problems averaging five weeks in duration, with sketch problems between major problems. Visiting critics take part in criticizing at least one project each year.
(0–14–9) *Messrs. Dunaway and Chillman*

History of Art 315. See page 128
(3–0–6) *Mr. Todd*

Architecture 320. (a) *Materials and Methods of Construction,* with assigned construction details.
Mr. Morehead

(b) *Organization and Preparation of Architectural Specifications.*
Mr. Leifeste

Laboratory hours devoted to problems in architectural details.
(3–4–8) *Mr. Leifeste*

Drawing 325. *Freehand Drawing and Painting.* Open to all students.
(0–4–2) *Mr. Parsons*

Architecture 330. *Strength and Properties of Materials.* Theory of beams, columns, and other structural elements. Students taking this course must take Civil Engineering 332 concurrently.
(3–0–6) *Mr. Morehead*

Architecture 400. *Design.* Problems averaging six weeks in duration of commercial and public buildings or groups of buildings, with sketch problems between major problems. Visiting

critics take part in criticizing at least one project each year.
(0–16–10) *Messrs. DeZurko and Lent*

History of Art 415. See page 129.
(3–0–6) *Mr. DeZurko*

Drawing 425. *Life Drawing and Painting.* Open to all students.
(0–4–2) *Mr. Parsons*

Architecture 430. (a) *Practical Construction Design in Steel,* covering beams, connections, plates, girders, columns, trusses, steel joists. A study of steel structural systems, including a major problem to be solved by use of steel, with appropriate construction drawings.

(b) *Practical Construction Design in Reinforced Concrete* of beams, slabs, columns, footings. A study of reinforced concrete systems, including a major problem to be solved in reinforced concrete with appropriate construction drawings.
(3–0–6) *Mr. Morehead*

Architecture 440. *Contemporary Principles of City Planning.* Open to all students.
(3–3–8) *Mr. Dunaway*

Architecture 450. *Great works of Architecture and Its Related Arts.* A history of art from 500 B.C. to modern times. Masterpieces of architectural composition which combine sculpture and painting. Examples: the Acropolis at Athens and the cathedral at Chartres. Lectures, discussions, and papers. Open to Juniors, Seniors, and graduate students. (Alternates with History of Art 455.)
(3–0–6) *Mr. Chillman*

History of Art 455. See page 129.
Mr. Chillman

Architecture 500a. *Advanced Design.* Problems of major proportions of five to eight weeks' duration. Visiting critics and other

staff members take part in at least one project each year.
(0–15–5) *Mr. Lent*

Architecture 510b. *Thesis Design.* The problem for the architectural thesis shall be chosen by the student with the approval of the faculty. Presentation shall consist of a written program and complete presentation drawing with written analysis of the solution, accompanied by explanatory working drawings of important construction details.
(0–12–4) *Mr. Todd*

Architecture 520a. *Contemporary Housing,* including problems with study of appropriate sites and types.
(3–6–5) *Mr. Dunaway*

Architecture 530. *Mechanical and Electrical Equipment.* Plumbing, heating, electric work, and acoustics, with laboratory hours in preparation of complete working drawings.
(3–4–8) *Mr. Leifeste*

Architecture 540b. *Contracts and Professional Practice.* Legal and ethical phases of architecture.
(3–0–3) *Messrs. Dyess and Morehead*

Architecture 550. A course devoted to training architects in collecting and presenting formal papers with particular attention paid to contemporary reading and contemporary philosophy on topics of architectural interest or on the writings of leading architects and thinkers.

Architecture 600. *Postgraduate Design.* A course for students who have received the degree of Bachelor of Science in Architecture. Advanced study and research in architectural design or city planning. The subject of study for the thesis shall be chosen with the approval of the faculty, and a written thesis presenting the results of the study will be required. Three hours of conference, fifteen hours of drawing and research.
(3–15–16) *Messrs. DeZurko, Dunaway, Lent, and Morehead*

Architecture 610. *Postgraduate Architectural History.* A course for students who have received the degree of Bachelor of Science in Architecture. An advanced course of study and research in the field of architectural history. Three hours of conference, six hours of research.
(3–6–10) *Messrs. Chillman and DeZurko*

Architecture 630. *Postgraduate Construction.* A course for students who have received the degree of Bachelor of Science in Architecture. An advanced course of study in the field of architectural construction. Three hours of conference, nine hours of drawing and research.
(3–9–12) *Messrs. Leifeste and Morehead*

Biology

Biology 100. *General Biology.* An introductory course in biology on the general principles underlying living things. A general vertebrate type is considered first, and this is used as a basis for an introduction to physiology, immunology, embryology, cytology, genetics, ecology, and classification. Structure and function are, when possible, considered together; emphasis is placed on the former in the laboratory, and the more dynamic aspects are presented in lecture with the aid of demonstrations and motion pictures. Plants are briefly considered in comparison with animals. The latter part of the course deals with various animal forms and their evolution, with emphasis on progressive differentiation of structure and adaptation to environment.
(3–3–8) *Mr. Davies*

Biology 300. *Comparative Zoology and Anatomy.* The first semester is devoted to a concentrated survey of the animal kingdom designed to acquaint the student with all the major phyla and primary groups within these phyla. Emphasis is placed on taxonomy, natural history, life cycles, and economic significance. In the second semester the structural and functional aspects of vertibrate evolution are discussed to provide a background for a better understanding of human anatomy. In the laboratory (two afternoons per week) dissections are made of the shark, Necturus

and the cat. This is supplemented by demonstrations and examinations of other vertebrate types. Prerequisite: Biology 100.
(3–3–4) (first semester)
(3–6–5) (second semester) *Messrs. Talmage and Daugherty*

Biology 310a. *Genetics and Eugenics.* This course is devoted to a study of heredity, with frequent references to human material. Prerequisites: Biology 100 and Junior standing.
(3–3–4) *Mr. Altenburg*

Biology 320. *Parasitology and the Biology of Public Health.* The first part of the year is devoted to a study of the relations of insects and their allies to the spread of human and animal diseases. Following this the parasitic worms and Protozoa are studied. Particular attention is given to the biology of the parasites as it affects epidemiology, diagnostic methods, and control. Open to any Junior or Senior students who have had one year of biology, and recommended for premedical students and biology majors.
(3–3–8) *Mr. Chandler*

Biology 340a. *Comparative Physiology.* The functions of the several organ systems are considered in relation to the morphology and ecology of the various animal groups. Vertebrate physiology is studied in detail and is correlated with the evolutionary attainments of the different animal types. In the laboratory physiological methods and materials are studied and demonstrated. Prerequisites: Biology 100 and Chemistry 120.
(3–3–4) *Mr. Daugherty*

Biology 350b. *Embryology.* Early developmental stages from fertilization to germ layer formation are studied. Reference is made to determination, differentiation, organizers, and other ontogenetic phenomena. Implantation, placentation, and organogenesis of mammals are studied. The laboratory work is primarily concerned with the development of organs and systems of vertebrates. Prerequisite: Biology 300 (can be taken concurrently)
(3–3–4) *Mr. Enders*

Biology 360a. *Evolution.* The evidence for evolution and the genetic basis for it are first considered. The study of evolution itself is then taken up, with chief emphasis on paleontology. The course includes a consideration of cosmic and geological evolution and of the succession of animal and plant forms in time, including man's place in this process and his present and possible future evolution. Prerequisites: Biology 100 and Junior standing.
(3–3–4) *Mr. Altenburg*

Biology 370a. *Histology.* Cells, tissues, and organs are studied microscopically. Much of the material studied is mammalian, but whenever desirable and feasible, comparable materials from other animals are presented. Laboratory work includes observation, drawings, and an introduction to histological technique. Prerequisite: Biology 100.
(3–3–4) *Mr. Enders*

Biology 380b. *Vertebrate Zoology.* Natural history, ecological problems, and taxonomy of animals are discussed. Primary emphasis will be placed on the vertebrates though invertebrate relationships will be included. Laboratory work includes field trips, and the collection, identification, and preparation of specimens. Prerequisite: Biology 300.
(3–3–4) *Mr. Enders*

Biology 390. *Anatomy and Public Health.* A course of lectures and laboratory work for students of physical education. The first term is devoted to the study of human anatomy and physiology and the physiology of exercise. The second term covers health legislation, social problems, vital statistics, epidemiology, care of water, milk, and other foods, sewage disposal, housing, and ventilation, including trips to study the health practices and conditions of public utilities.
(3–3–8) *Dr. Welsh*

Biology 400 (a and b). *Special problems.* Open only to Senior biology majors, and with special permission of the instructor.
(2–6–4) or (2–6–8) *Staff*

Biology 420b. *Advanced Genetics.* Reading, conferences, and laboratory work.
(2–6–4) *Mr. Altenburg*

Biology 430a. *Instrumentation in Biological Research.* Required of all graduate students and open to seniors by permission of the instructor. The purpose of the course is to acquaint the student with the theory and practice of instruments and techniques valuable in biological research.
(3–4–4) *Mr. Talmage*

Biology 440b. *Cellular Physiology.* Consideration is given to the physical and chemical characteristics of protoplasm in relation to the microscopic and submicroscopic organization of cells, and to the roles of colloids, O-R potentials, membrane phenomena, *p*H, and buffers in the physiology of cells and tissues. Intermediary metabolism, cellular respiration, and the kinetics of cell function are dealt with in detail. In the laboratory one afternoon a week is devoted to general experiments involving the use of recently developed techniques in chromatography, bioelectric potentials, electrophoresis, photometry, and manometry. Prerequisites: Biology 340a, Chemistry 220, and Chemistry 300. (can be taken concurrently)
(3–3–4) *Mr. Daugherty*

Biology 470. *General Bacteriology and Immunology.* Sterilization, microscopy, preparation of media, and methods of cultivation; disinfection; nature and relationships of various types of micro-organisms; introduction to bacteriology of air, soil, water, sewage, dairy products and other foods, and important human, animal, and plant diseases; the principles of immunology and their application to preventive and therapeutic medicine, and to diagnostic procedures. Special emphasis on public health and hygienic aspects of the subject. Prerequisites: one course in biology and Chemistry 120. Given in odd-numbered years only.
(3–3–8) *Mr. Chandler*

Biology 480a. *Endocrinology.* A study of the function, morphology, and comparative anatomy of the glands of internal secretion.

Only the well-organized endocrine glands of mammals are considered in detail, and emphasis is placed on the physiology of reproduction. Laboratory work is restricted primarily to demonstrations of hormonal effects and meets on the average of every other week. Prerequisite: Biology 300, Biology 340a (can be taken concurrently)
(3–2–3) *Mr. Talmage*

Biology 490b. *Radioisotopes in Biology.* An introductory study of the applications of nuclear radiations to biological problems. The purpose of the lectures and laboratory is to acquaint the student with characteristics of nuclear emissions, problems of health physics, an introduction to radiochemistry, study of radiation effects, and the use of isotopes as biological tracers. Prerequisites: at least one previous course in biology, chemistry, mathematics, and physics. Size of class limited by facilities to twelve students.
(3–4–4) *Mr. Talmage*

Biology 500b. *Same as Biology 380b,* but including a post-semester field trip. For graduate students who have not had Biology 380b or its equivalent.
(3–3–4) *Mr. Enders*

Biology 520. *Cytology.* The course consists of student reports and discussions concerning the anatomical and chemical properties of the cell, its formed constituents, and inclusions. Morphological and cytochemical indications of specific activity are emphasized. Prerequisites: Biology 300 and 370. Open to senior majors by permission of instructor.
(2–6–4) *Mr. Enders*

Biology 530. *Advanced Endocrinology A.* The thyroid, pancreas, adrenals, and the relationships of hormones to carbohydrate metabolism are studied. Reading, seminar on current literature in endocrinology.
(3–4–8) *Mr. Talmage*

Biology 540. *Advanced Endocrinology B.* The Parathyroids, the Pituitary, and the phsyiology of reproduction. Readings,

conferences, and laboratory work. Includes also a weekly seminar on current literature in endocrinology.
(3–4–8) *Mr. Talmage*

Biology 550. *Advanced Cellular Physiology.* Reading, conferences, and laboratory work.
(2–6–8) *Mr. Daugherty*

Biology 560. *Medical Entomology.* Classification, taxonomy, identification, life cycles, and control of arthropod parasites, disease vectors, and poisonous species. For students specializing in parasitology. Reading, conferences, and laboratory work. To be offered in 1956–57.
(2–6–8) *Mr. Chandler*

Biology 570. *Helminthology.* Classification, taxonomy, identification, and life cycles of parasitic worms, and a study of economic importance, treatment, and control of helminthic diseases of man and animals. For students specializing in parasitology. Reading, conferences, and laboratory work. To be offered in 1957–58.
(2–6–8) *Mr. Chandler*

Biology 580. *Protozoology.* Classification, taxonomy, identification, life cycles, and technical methods in the study of Protozoa, with special reference to parasitic forms. For students specializing in parasitology. Reading, conferences, and laboratory work. To be offered in 1958–59.
(2–6–8) *Mr. Chandler*

Biology 590. *Research in Genetics.*
Mr. Altenburg

Biology 591. *Research in Embryology.*
Mr. Davies

Biology 592. *Research in Histology and Histochemistry.*
Mr. Davies

Biology 593. *Research in Physiology.*
Mr. Daugherty

Biology 595. *Research in Endocrinology.*

Mr. Talmage

Biology 596. *Research in Parasitology or Microbiology.*

Mr. Chandler

Biology 597. *Research in Medical Entomology.*

Mr. Chandler

Biology 599. *Biology Seminar.* The staff and graduate students meet once a week for papers and discussions on special topics or on current research. Each candidate for an advanced degree will be expected to attend and to give at least one paper each semester.
(1–0–2)

Biology 700. *Summer Graduate Research.* Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Business Administration: *see* **Economics, Business Administration and Sociology**

Chemical Engineering

Chemical Engineering 303. *Chemical Engineering Fundamentals.* A first course in the application of the principles of mathematics, chemistry and physics to the more important chemical processes. Subjects considered are: stoichiometric and equilibrium concepts, material balances, energy relationships for both chemical and physical changes and mechanical equipment, and the thermodynamic properties of fluids and energy.
(3–0–6) *Mr. McBride*

Chemical Engineering 403. *Unit Operations.* This course deals with the principles upon which the mechanical operations involved in the chemical manufacturing industries depend, and with the types of equipment available for such operations and the kind of work for which each is best adapted. The application of

the principles is illustrated both by discussion in the classroom and by the solution of typical problems. Among the subjects considered are: evaporation, humidification and dehumidification, air conditioning, drying, distillation and fractionation, filtration, absorption and adsorption, extraction, crystallization, crushing, grinding, separation, agitation, and transportation of solids, liquids, and gases. Prerequisite: Chemical Engineering 303.
(3–0–6) *Mr. Hartsook*

Chemical Engineering 421. *Plant Inspection.* The work consists of: (1) a critical examination, in conference, of processes, equipment, and problems of each industrial plant to be visited: (2) the inspection of the plant supplemented by discussions by plant officials; (3) a comprehensive report, by squads, consisting of flowsheets, individual unit descriptions, and general specifications of interest. Types of industries inspected are: sewage, sugar, petroleum refining, cement, brewing and malting, steel pouring, plastics, heavy chemicals, fertilizers, etc. Prerequisite: Chemical Engineering 403 or registration in 403.
(1–3–2) *Mr. Akers*

Chemical Engineering 443. *Fuels and Combustion Laboratory.* The work consists of the testing and analysis of gas, oil, coal, and water, and the measurement of fundamental physical quantities; and the application of these methods in developing stoichiometric relations and energy balances. Prerequisites: Chemical Engineering 303 and full fourth-year standing.
(0–3–2) *Mr. Leland*

Chemical Engineering 501. *Rate Processes I.* An advanced study of the important rate processes in chemical engineering with particular emphasis on the rate of transfer of heat, momentum and mass, and on chemical kinetics.
(3–0–3) *Mr. Akers*

Chemical Engineering 502. *Rate Processes II.* A continuation of Chemical Engineering 501.
(3–0–3) *Mr. Akers*

Chemical Engineering 511. *Chemical Engineering Thermodynamics.* A course in theoretical and applied thermodynamics. Prerequisite: Chemistry 310.
(3–0–3) *Mr. Leland*

Chemical Engineering 512. *Chemical Engineering Thermodynamics.* A continuation of theoretical and applied thermodynamics. Prerequisite: Chemical Engineering 511.
(3–0–3) *Mr. Leland*

Chemical Engineering 522. *Plant Design.* The lectures consider the development of chemical manufacturing processes and the design of chemical manufacturing plants from the point of view of location, building, equipment, economics, and organization. The laboratory work consists of calculating and drawing up fundamental data, qualitative and quantitative flowsheets, specifications, plant layout, and cost estimates for typical processes. Prerequisite: Chemical Engineering 403.
(2–3–3) *Mr. Akers*

Chemical Engineering 543. *Unit Operations Laboratory.* Laboratory work in unit operations as follows: crushing, grinding and screening, hydraulic separation, thickening, flotation, filtration, flow of gases, flow of liquids, flow of heat, humidification, water cooling, adsorption, absorption, liquid-liquid extraction, evaporation, drying, distillation, and rectification. Prerequisite: Chemical Engineering 403.
(0–6–4) *Mr. Hartsook*

Chemical Engineering 551. *Distillation.* A study of the rectification of binary and multicomponent mixtures and of the methods of computing the performance of both plate and packed towers.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 561. *Chemical Literature.* The course is devoted to study of the arrangement of chemical literature and its use in industrial and research work. A topic will be assigned to each student every week for a thorough library investigation.
(1–0–1) *Mr. Jensen*

Chemical Engineering 562. *General Seminar.* A course for training chemical engineering students in the preparation and oral presentation of formal papers and discussions on topics of engineering interest. The papers and discussions are given by the students, using acceptable material secured from technical publications. This course is required of all fifth-year chemical engineers.
(1–0–1) *Mr. Leland*

Chemical Engineering 620. *Chemical Process Design.* The application of thermodynamics and unit operations to the design of chemical equipment and plants. Prerequisites: Chemical Engineering 403, 411, and 512.
(3–0–3) *Mr. Akers*

Chemical Engineering 633. *Nuclear Engineering.* An introductory course from the engineering viewpoint. Nuclear fuels and their processing. The fission process, reactor design and control, shielding, heat transfer problems, materials of construction, waste disposal problems and health physics.
(3–0–6) *Mr. Leland*

Chemical Engineering 650. *Petroleum Production Problems.* Physical properties of hydrocarbons at elevated pressures and temperatures, flow of fluids through porous media, estimating size of petroleum reservoirs, and optimum production procedures.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 660. *Physical Equilibrium in Fluid Systems.* A development, from thermodynamic principles, of the volume and phase equilibrium behavior of binary and multicomponent systems, including both ideal and nonideal systems and behavior at both low and high pressures.
(3–0–3) *Mr. Kobayashi*

Chemical Engineering 662. *Graduate Seminar.* Similar to Chemical Engineering 562 except that the course applies to graduate students above the fifth year.
(1–0–1) *Mr. Akers*

Chemical Engineering 670. *Chemical Engineering Mathematics.* Applications of mathematical principles to problems in fluid dynamics, heat transfer, mass transfer, and thermodynamics. (3–0–3) *Mr. Kobayashi*

Chemical Engineering 680. *Summer Graduate Research.* Open to students already admitted as candidates for the degree of Master of Science. At least forty hours of laboratory work per week.

Chemical Engineering 683. *M.S. Research and Thesis.* At least nine hours of work weekly under the direction of a member of the staff on a problem of chemical engineering importance. Four copies of the accepted report will be required: two for deposit in the Institute library and two for the chemical engineering department.

Chemical Engineering 690. *Chemical Reaction Kinetics.* A study of the principal facts and theories relating to the rates at which chemical reactions take place, including a study both of elementary reactions and of the way in which over-all rates of complex reactions are related to the rates of the individual steps. (3–0–3) *Mr. Akers*

Chemical Engineering 720. *Advanced Topics in Chemical Engineering (III).* A theoretical treatment of advanced phases of chemical engineering with special emphasis upon the development of individual abilities. Prerequisite: full graduate standing and consent of department.

Chemical Engineering 780. *Summer Graduate Research.* Open to students already admitted as candidates for the degree of Doctor of Philosophy. At least forty hours of laboratory work per week.

Chemical Engineering 783. *Ph.D. Research and Thesis.* At least twenty hours of work weekly under the direction of a member of the staff on a problem of chemical engineering importance. Four copies of the accepted report will be required: two for

deposit in the Institute library and two for the chemical engineering department.

Chemistry

Chemistry 100. *Introductory Chemistry.* Laboratory fortnightly. This is a course in general chemistry planned for the needs of students of physical education, and academic students who expect to take no more than one or two courses in chemistry. It satisfies the preparatory requirements for Chemistry 200. Not offered after 1956–57.
(3–2–7) *Mr. Nicholas*

Chemistry 120. *General Inorganic Chemistry and Qualitative Analysis.* A general introductory course dealing with the fundamental phenomena and principles of the science. During the first half-year the laboratory exercises are arranged to verify and illustrate the principles and facts which are discussed in the lectures. During the last half-year the laboratory work deals with the general principles and methods of qualitative analysis. This course is required of science-engineering students, and is also open to academic students who may wish to proceed beyond the Sophomore year in chemistry. Chemistry 120 is one of the prerequisites for Chemistry 220. Prerequisite: High School Chemistry
(3–4–8) *Messrs. Nicholas and Waser*

Chemistry 200. *Introductory Physical and Physiological Chemistry.* This course is open to academic students who wish to elect a second course in chemistry, and to premedical students desiring another chemistry course in addition to those specifically recommended. The lectures and laboratory work of the first half-year deal with the physical properties of gases, liquids, and solids; solutions; etc. The lectures and laboratory work of the second half-year are devoted to a study of the physiological processes of the animal body, such as digestion, metabolism, and nutrition, and to blood and urine chemistry. Prerequisite: Chemistry 100 or 120. Not offered after 1956–57.
(3–3–8) *Mr. Nicholas*

Chemistry 220. *Quantitative Analysis.* The course aims to familiarize the student with the fundamental principles of analytical chemistry and, by laboratory and problem work, with the application of these principles to a variety of representative analytical processes. Special emphasis is placed on chemical mathematics and stoichiometry, and throughout the work attention is given to general analytical technique. Prerequisites: Chemistry 120 and Physics 100.
(3–4–8) *Mr. Bird*

Chemistry 230. *Analytical Chemistry.* A laboratory course required of and open only to Junior chemistry majors. This course is designed to supplement and extend the previous work in analytical chemistry in order to meet certain professional requirements. During the first semester four hours of laboratory work each week will be devoted to qualitative analysis. The second semester will require two four-hour laboratory periods weekly directed to the study of quantitative analysis.
(0–6–4) *Mr. Nicholas (first semester) and Mr. Bird (second semester)*

Chemistry 300A. *Organic Chemistry.* The course is designed to give a thorough survey of aliphatic and aromatic chemistry with an introduction to the heterocyclic compounds, and to present the theories relating to their structure and reactions. Prerequisite: Chemistry 220.
(3–4–8) *Mr. Richter*

Chemistry 300B. *Organic Chemistry.* A course arranged primarily for premedical students and academic students not specializing in chemistry. This course differs from Chemistry 300A only in the type of laboratory preparations. The laboratory work is devoted chiefly to the synthesis of typical examples of general and local anesthetics, disinfectants, analgesics, biological preparations, alkaloids, and dyes. Prerequisite: Chemistry 220 or special permission from the department of chemistry.
(3–4–8) *Mr. Richter*

Chemistry 310. *Physical Chemistry.* A quantitative study of theoretical and physical chemistry dealing with the forms of matter, changes of state and energy kinetics equilibria, electrochemistry, photochemistry, and atomic structure. Prerequisites: Chemistry 220 and Physics 200.
(3–4–8) *Mr. Salsburg*

Chemistry 400a. *Advanced Organic Chemistry.* Introduction to theoretical organic chemistry with emphasis on reactions of general synthetic importance.
(3–0–3) *Mr. Ettlinger*

Chemistry 410a. *Colloid Chemistry.* An introductory course dealing with the theories of colloid chemistry and their applications. Prerequisites: Chemistry 300 and 310.
(3–4–4) *Mr. Milligan*

Chemistry 420b. *Structural Chemistry.* Modern concepts of structural chemistry based on the principles of quantum mechanics, including a discussion of current methods of structure determination.
(3–0–3) *Mr. Waser*

Chemistry 430a. *Special Topics in Physical Chemistry.* The course is designed to give a more thorough treatment to selected phases of the subjects introduced in Chemistry 310.
(3–0–3) *Mr. Salsburg*

Chemistry 440b. *Advanced Organic Chemistry and Qualitative Analysis.* This course embodies a systematic procedure for the separation and identification of pure organic compounds. It aims to review, by actual laboratory contact, many important reactions of the main series of organic substances. (Owing to limitations of space, enrollment will be limited to thirty-five students.)
(2–6–4) *Mr. Lewis*

Chemistry 450a. *Thermodynamics.* Relation of heat and work to chemical and physical systems. A consideration of free energy,

entropy, and fugacity as applied to equilibria. Especial attention to the treatment of solutions.
(3–0–3) *Mr. Kilpatrick*

Chemistry 480b. *Chemistry of Natural Products.* A study of important types of natural products of current interest to biology and chemistry.
(3–0–3) *Mr. Turner*

Chemistry 500. *M.A. Thesis.* Graduate students who are working toward the M.A. degree in chemistry are expected to elect at least nine hours a week in research under the direction of some member of the staff of instruction.
Staff

Chemistry 510. *Chemistry of the Steroids.* A theoretical consideration of the reactions and stereochemistry of the steroids, including a discussion of the physiological importance of these compounds.
(3–0–6) *Mr. Turner*

Chemistry 520b. *Theory of Adsorption of Gases.* An advanced treatment of modern theories of adsorption of gases on solids.
(3–0–3) *Mr. Milligan*

Chemistry 540b. *Special Topics in Organic Chemistry.*
(3–0–3) *Mr. Ettlinger*

Chemistry 545a. *Physical-organic Chemistry.* The application of physical methods to the determination of the structure of organic compounds.
(3–0–3) *Mr. Lewis*

Chemistry 545b. *Physical-organic Chemistry.* A study of the mechanisms of various important organic reactions.
(3–0–3) *Mr. Lewis*

Chemistry 550a. *Reaction Kinetics.* A consideration of the rates of reactions with emphasis on homogeneous kinetics as a tool in the study of reaction mechanisms. Prerequisite: Chemistry 400a.
(3–0–3) *Mr. Lewis*

Chemistry 560b. *Electrochemistry.* The application of thermodynamics to the study of electrolytic cells. Prerequisite: Chemistry 450a.
(3–0–3) *Mr. Kilpatrick*

Chemistry 570b. *Absorption Spectra of Organic Compounds.* The application of ultraviolet and infrared absorption spectra to the study of molecular structure.
(3–0–3) *Mr. Ettlinger*

Chemistry 580a. *Special Topics in Organic Chemistry.* A consideration of the chemistry of selected groups of natural products.
(3–0–3) *Mr. Turner*

Chemistry 600. *Ph.D. Thesis.* Graduate students who are working toward the Ph.D. degree in chemistry are expected to elect at least twelve hours a week in research under the direction of some member of the staff of instruction.
Staff

Chemistry 610. *Application of X-ray Diffraction Methods.* Application of X-ray diffraction methods to inorganic and physical chemistry. Identification of solid phases, determination of crystal size, X-ray analysis of simple types of structures. Electron diffraction. Principles and operation of modern X-ray apparatus. This course alternates with Chemistry 660.
(3–0–6) *Mr. Milligan*

Chemistry 620. *Molecular Structure Determination.* Theory and practice of various physical methods of molecular structure determination. Theory of the chemical bond.
(3–0–6) *Mr. Waser*

Chemistry 630b. *Statistical Thermodynamics.* A development of the principles of thermodynamics from the standpoint of statistical mechanics. The relation of the structure of molecules to their thermodynamic properties. Prerequisites: Chemistry 450a and Mathematics 300 or 310.
(3–0–3) *Mr. Kilpatrick*

Chemistry 650. *Quantum Mechanics.* A study of simple mechanical systems from the point of view of wave mechanics. The application of these concepts to the chemical bond. The energy states of polyatomic molecules. Prerequisite: Mathematics 300 or 310.
(3–0–6) *Mr. Kilpatrick*

Chemistry 660. *X-ray Crystal Structure Analysis.* Crystals, X-rays, and their interaction. Experimental methods. Symmetry and space groups. Fourier methods. Dynamic theory of X-ray diffraction. This course alternates with Chemistry 610.
(3–0–6) *Mr. Waser*

Chemistry 680. *Modern Methods in Crystal Structure.* Fourier and Patterson methods, modification functions, inequalities, and order-disorder phenomena.
(3–0–6) *Mr. Waser*

Chemistry 700. *Summer Graduate Research.* Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Civil Engineering

Civil Engineering 332. *Materials Testing for Architects.* A series of standard tests of common building materials for architectural students registered in Architecture 330. Laboratory fortnightly.

Civil Engineering 401. *Strength of Materials.* Stresses and deformations due to tensile, compressive, and shearing forces; distribution of shears, bending moments, deflections, torsional stresses, and combined stresses. Theory of beams, columns, and shafts. Laboratory physical tests of cast iron, steel, wood, cement, bricks, and concrete. Prerequisites: Physics 100, Mathematics 300 or 310, Engineering 303, and full fourth-year standing. Laboratory fortnightly.
(3–1½–3) *Mr. Ryon*

Civil Engineering 402. *Mechanics of Liquids.* Principles of hydrostatics and hydrodynamics; the flow of liquids through orifices

pipes, and nozzles, in open channels, and over weirs. Laboratory tests of weirs. Venturi meters, and simple hydraulic machinery. Prerequisite: Civil Engineering 401. Laboratory fortnightly.
(3–1½–3) *Mr. Ryon*

Civil Engineering 421. *Advanced Surveying.* Determination of meridian; stadia; plane table. Topography. Simple, compound, reversed, and vertical and horizontal easement curves for railway and highway use. Mass diagrams and earthwork. Prerequisite: Engineering 350 and full fourth-year standing.
(2–6–4)

Civil Engineering 422. *Graphic Statics and Stresses in Framed Structures.* Algebraic and graphic statics applied to beams and trusses. Fixed and moving loads. Load systems. Influence diagrams. Portals; transverse bents; determination of design load stresses in roof and bridge trusses. Prerequisites: Engineering 303, Civil Engineering 401, and full fourth-year standing.
(3–6–5)

Civil Engineering 431. *Basic Sanitation—Municipal and Rural.* A presentation of the principles and techniques fundamental to basic sanitation. Study of communicable disease, water supply, sewerage, refuse collection and disposal, pest and rodent control, milk and food sanitation, swimming pool and housing problems. Prerequisite: Fourth year standing.
(2–0–2) *Mr. Busch*

Civil Engineering 503. *Experimental Problems in Civil Engineering.* Methods of extending and applying basic physical laws to the measurement of stresses or deformations that are of significance in the engineering design of load resisting members. Among the topics studied are: electrical, mechanical, and optical strain gages; accuracy vs. sensitivity of measurement; measurement of dynamic strains; brittle coating strain indication; models and analogies; photoelasticity; and fatique studies. Tests performed on large size specimens of steel, aluminum, wood and concrete.
(0–3–2) *Mr. Sims*

Civil Engineering 523. *Municipal Engineering.* (a) Water supply hydrology: reservoirs, pipe lines, pumps, distribution systems. (b) Sewerage: storm and sanitary systems. Design, construction, and maintenance of sewers and sewage disposal systems. (c) Highways, road systems, city streets: pavement types and subgrade studies. Demand studies and methods of financing. Prerequisites: Civil Engineering 401 and 402, and full fifth-year standing.
(3–3–8) *Mr. Busch*

Civil Engineering 543. *Concrete Structures.* A study of concrete and concrete aggregates. Theory and design of reinforced concrete slabs, beams, and columns. A study of current building codes. Design of typical parts of buildings. Prerequisites: Civil Engineering 401, registration in Civil Engineering 563 and 581, and full fifth-year standing.
(3–3–8) *Mr. Sims*

Civil Engineering 563. *Steel and Timber Structures.* Design of tension and compression members and of riveted and welded connections. Design of roof trusses, simple bridge trusses, plate girders, and mill building frames. Detailed drawings and estimates of cost and weight. Prerequisites: Civil Engineering 401, 402, and 422, and registration in Civil Engineering 543 and 581.
(3–6–10) *Mr. Ryon*

Civil Engineering 581. *Introduction to Statically Indeterminate Structures.* A study of the stresses and deflections of such structures as continuous spans and rigid frames, by the methods of angle changes and moment distribution. Analysis of trussed structures with redundant members; analysis of secondary stresses in trusses. Williot-Mohr diagrams. Three lectures and one three-hour computation period per week. Prerequisites: Civil Engineering 422 and registration in Civil Engineering 543 and 563.
(3–3–4) *Mr. Sims*

Civil Engineering 582. *Elementary Soil Mechanics and Foundations.* A study of the physical characteristic of soils and of the mechanics of soil masses subjected to loads. Earth pressures and

stability. Design of foundations for buildings, bridges, and other major structures. Prerequisites: registration in Civil Engineering 523 and 543.
(3–3–4) *Mr. Sims*

Civil Engineering 603. *Statically Indeterminate Structures and Advanced Structural Design.* A study of stresses and deflections in indeterminate structures such as continuous spans, rigid frames, and arches by the classical and modern methods of analysis. Design of a rigid-frame structure. Theory of design and methods of construction of masonry structures. Special problems in bending, torsion, and buckling of bars and thin plates and shells. Three lectures and one design period a week. Prerequisites: Civil Engineering 563 and 581, or their equivalents.
(3–3–8)

Civil Engineering 605. *Graduate Seminar.*
(1–0–2)

Civil Engineering 613. *Advanced Problems in Soil Mechanics and Foundations.* Stress conditions for failure in soils; plastic equilibrium; arching in ideal soils. Application to retaining wall problems and stability of slopes. Earth pressure on supports in cuts, tunnels, and shafts; anchored bulkheads. Theory of consolidation; mechanics of drainage. Problems involving subgrade soil or pile reaction. Vibration problems. A study of foundation design and construction procedures. Site investigation; methods of soil exploration. Footing, raft, and pile foundations. Settlement due to exceptional causes. Cofferdams and other aids for open excavations; caissons. Bridge piers and abutments. Underpinning.
(3–3–8)

Civil Engineering 623. *Numerical and Approximate Methods of Structural Analysis.* Methods of successive approximations. Numerical procedures for the solution of complex problems with applications to bridges, buildings, and aircraft structures. Method of successive relaxation of constraints; energy methods; difference equations; numerical integration procedures. Vibrations of struc-

tures including earthquake effects. Action of simple structural elements and of more complex structures subjected to dynamic loads. Elastic and inelastic instability of bars, plates, and stiffened plates.
(3–0–6)

Civil Engineering 633. *Research and Thesis.* This will consist of an original investigation along some approved line of civil engineering work, an original design, or a critical review of existing work. In every case three complete typewritten or printed reports will be required: two for deposit in the Institute library and one for the civil enginee ing department.

Civil Engineering 643. *Introduction to the Mathematical Theory of Elasticity.* Fundamental concepts of the theory of elasticity. The differential equations of equilibrium and the equations of strain compatibility. Solution of two-dimensional problems in rectangular and polar coördinates. Strain energy methods. Analysis of stress and strain in three dimensions. Torsion and bending of prismatic bars. Analogies: the photo-elastic analogy, the membrane analogy, the electric analogy. Propagation of waves in elastic mediums. Bending of laterally loaded plates with various boundary conditions. Elastic stability of plates. Membrane theory of shells. General theory of shells. Prerequisites: Mathematics 300 or the equivalent, Civil Engineering 603 or current registration in that course, and full graduate standing.
(3–0–6)

Civil Engineering 653. *Analytical Study of Experimental Work in Reinforced Concrete.* Critical reviews of experimental and analytical investigations. Behavior of reinforced concrete structural members: beams and columns subjected to flexure, axial compression, combined axial compression and flexure, and combined flexure and shear. Behavior of reinforced concrete structures: frames, floor slabs, column footing, and highway bridge floors. Prerequisites: Bachelor of Science in Civil Engineering with undergraduate courses in structures and reinforced concrete design.
(3–0–6)

Civil Engineering 661. *Steel Design.* Design of steel members; codes and specifications for buildings; riveted and welded construction; evolution of bridge specifications; loads and working stresses; economic proportions.
(3–3–4)

Civil Engineering 662. *Design of Lightweight Structures.* Analysis and design of structures and structural members of minimum weight. Prerequisites: Civil Engineering 563 and 581, or their equivalents.
(3–3–4)

Civil Engineering 663. *Elementary Structural Design.*
(3–3–8)

Economics, Business Administration, and Sociology

Economics 100. *Introduction to Business and Economics.* A survey course designed to introduce the student to the social setting and the economic bases of modern industry. Planned for students of physical education.
(3–0–6) *Mr. Young*

Economics 210. *History of Political Economy.* This course is designed to acquaint the student with the functions of an economic system, with the characteristics of the several types of economic systems which have been of importance in the past two centuries, and with the nature of the principal economic issues which have existed since the advent of the Industrial Revolution. The issues which are studied include depressions, monopoly, international economic relations, over-population, the concept of value, the appropriate distribution of goods and services, and trade unionism. The economic systems which are investigated are Mercantilism, Socialism, Communism, and Capitalism (in all its forms). A large part of the course is devoted to an examination of the views of the great economists—including Smith, Ricardo, Malthus, Mill, Marx, Menger and the Austrian School, Walras, Marshall and the neoclassicists, Schumpeter, and

Keynes—on economic issues and forms of economic organization.
(3–0–6)

Economics 350a. *Elements of Statistical Method.* Collection, classification, and presentation of data; use of graphic methods; analysis of frequency distributions; introduction to the theory of sampling and statistical inference; analysis of time series; index numbers; correlation.
(3–2–3) *Mr. J. Hodges*

Economics 355b. *Financial Institutions.* A survey of the nature and functions of money and credit; the role of commercial banks and the Federal Reserve System in regulating the supply of credit. Sources of capital for private enterprise; corporate securities and their distribution; the role of investment banks and the securities exchanges; the regulation of the sale of new security issues. The determination of income; the problem of reserves; surplus and dividend policy.
(3–0–3) *Mr. J. Hodges*

Economics 363. *Elements of Economics.* Introduction to economic theory and an analysis of the operation and problems of our modern economic system; business organization and finance; labor and industrial relations; money, banking, and the Federal Reserve System; national income and its fluctuations; behavior of costs and prices.
(3–0–6) *Staff*

Economics 370a. *Economic Analysis I.* The first of two one-semester courses in economic analysis which are designed to acquaint the student with the workings of an advanced capitalist economy. The first semester is devoted to the economics of the firm and household. The theory of the price mechanism and the theory of demand are developed.
(3–0–3) *Mr. Cookenboo*

Economics 375b. *Economic Analysis II.* The second course in economic analysis is concerned with the study of economic fluctuations at the national and regional level. The historical pattern

of business cycles in the United States economy and the theory of fluctuations are studied as a background for the appraisal of current stabilization policies.
(3–0–3) *Mr. Auten*

Economics 410a. *The Economics of Labor Relations.* A survey of the history and current status of the labor movement in the United States; organization and structure of labor unions; trends in labor legislation; collective bargaining and the settlement of labor disputes; wage and employment theory; social insurance; current labor problems and issues.
(3–0–3) *Mr. Giles*

Economics 420b. *International Economics.* A study of the economic relationships between separate countries in the international economy and between separate regions within the national economy. Collateral readings are available for students who have particular interests in the field of foreign commerce. Prerequisite: Economics 370 and 375 or approval of the instructor.
(3–0–3) *Mr. Auten*

Economics 430. *Government Regulation of Industry.* A study of the origins and economic consequences of government regulation of industry in the United States since the Civil War, with particular emphasis on the control of monopoly and competition by the Federal government.
(3–0–6) *Mr. Cookenboo*

Economics 460a. *Management I.* Introduction to personnel management and employee relations; personnel policies; job analysis; wage and salary administration; employee services; labor legislation.
(3–0–3) *Mr. J. Hodges*

Economics 465b. *Management II.* Financial structure of enterprise; principles of internal organization; plant location; control of production and sales; managerial uses of accounting data.
(3–0–3) *Mr. J. Hodges*

Economics 475a. *Taxation and Fiscal Policy.* An analysis of the financial operations of governmental units at the national, state, and local level. Theoretical analysis of monetary and fiscal policies to promote economic stability is combined with an economic appraisal of the United States tax structure. Special attention is given to the incentive effects of taxation and the prospects for long-run economic growth and development. Prerequisites: Economics 370 and 375.
(3–0–3) *Mr. Auten*

Economics 490b. *The Development of Economic Institutions.* A seminar devoted to the analysis of the impact of technological change and political and social developments upon the evolution of economic institutions. Investigation will be made of economic forces which lie beyond supply-and-demand factors in the market economy. The course will survey the works of leading institutional economists and social anthropologists as a point of departure for research and discussion.
(3–0–3) *Mr. Giles*

Business Administration 200. *Principles of Accounting—Introductory.* The course follows the widely accepted view that the study of accounting principles furnishes a desirable approach to the study of business. A study is made of the financial record-keeping and financial-reporting systems of the modern economy. While the course is basically accounting, the organization and procedures of modern business are emphasized throughout.
(3–0–6) *Messrs. Simons and Mackey*

Business Administration 390a. *Principles of Accounting—Intermediate.* Further development of accounting principles. Construction of financial and operating statements; interpretation of financial and operating statements; corporations; valuation of assets and liabilities; funds and reserves; application of funds. While the course is basically accounting, the organization and procedures of the modern business world are emphasized throughout. Prerequisite: Business Administration 200.
(3–0–3) *Mr. Simons*

Business Administration 395b. *Cost Accounting.* The methods of accounting for the various elements of manufacturing costs are treated with special emphasis on the use of cost information in administration and control. Job order, process, and standard cost procedures. Prerequisite: Business Administration 200 or approval of the instructor.
(3–0–3) *Mr. Mackey*

Business Administration 421a. *Auditing and Federal Taxation.* Financial examination theory and procedure as practiced by the independent certified public accountant; internal control; working papers and reports. Largely based on integrated case study. Laboratory hours devoted to a study of federal taxation of the income of individuals, fiduciaries, partnerships, and corporations. Prerequisite: Business Administration 390a.
(3–3–4) *Mr. Mackey*

Business Administration 426b. *Advanced Accounting and Federal Taxation.* Partnership; consignment and installment sales; insurance; statement of affairs; receiverships; actuarial science; estates and trust; home office and branch accounting; parent and subsidiary accounting; consolidations, mergers, and financing; foreign exchange. Laboratory hours devoted to a study of federal taxation of the income of individuals, fiduciaries, partnerships, and corporations. Prerequisite: Business Administration 390a.
(3–3–4) *Mr. Simons*

Sociology 200. *An Introduction to Sociology.* The course includes an analysis of the geographical and biological factors in social evolution, social psychology, and a study of the functions of citizenship. The subject matter involves a survey of modern social problems and their relation to a changing technological and institutional framework.
(3–0–6) *Mr. Giles*

Sociology 400a. *Sociological Analysis.* A survey of principles and tools for sociological analysis. Open to Juniors and Seniors who do not have credit for Sociology 200.
(3–0–3) *Mr. Giles*

Sociology 400b. *Seminar on the Foundations of Social Thinking.* A study of the development of sociological thought through the integration of contributions from the fields of biology, anthropology, philosophy, and the social sciences. Special emphasis is given to the culture concept, the origins and development of social values and social institutions, analyses of the social process in relation to problems of social disorganization and adjustment. Prerequisite: Sociology 200 or Sociology 400a.
(3–0–3) *Mr. Giles*

Education

Education 310. *The History of Education.* A survey of educational thought and practice from ancient times to the present. Recommended: Philosophy 300 or one course in history.
(3–0–6) *Messrs. Black and Young*

Education 410. *Basic Principles of Secondary Education.* First Semester: an intensive examination of the principles of secondary education, teaching, and the profession of teaching, the organization and administration of schools, methods of instruction, curriculum, educational psychology, and current trends in education. Second semester: an examination of the theory, philosophy, principles, methods, and practice in American education since 1900. Recommended: Psychology 210a and 210b, Psychology 300, or Philosophy 300. Prerequisite: Education 310.
(3–0–6) *Mr. Black*

Education 420. *Methods, Observation, and Student Teaching: Grades 7–12.* Designed for students who plan to teach in senior or junior high schools. First semester: three hours per week on the campus devoted to instruction in methods of teaching and preparation for actual teaching. Second semester: observation and supervised student teaching in the public schools for a period of twelve weeks of half-day placement. Open only to Senior students who have the approval of the instructor, as an additional course not to be counted in the degree program. Recommended: Education 310 and Education 410.
(Credit: 9 semester hours) *Mr. Young*

Education 430. *Methods, Observation, and Student Teaching: Elementary Grades.* Designed for students who plan to teach in the elementary school grades. First semester: three hours per week on the campus devoted to instruction in methods of teaching and preparation for actual teaching. Second semester: observation and supervised student teaching in the public schools for a period of twelve weeks of half-day placement. Open only to Senior students who have the approval of the instructor, as an additional course not to be counted in the degree program. Recommended: Education 310 and Education 410.
(Credit: 9 semester hours) *Mr. Young*

Electrical Engineering

Electrical Engineering 340. *Elementary Electronics.* The fundamental principles of transistors, vacuum tubes, gaseous conduction tubes and their circuits. Applications. General circuit theory. Prerequisites: full third year standing, Physics 200 and Mathematics 200 or 210.
(4–3–5) *Mr. Baker*

Electrical Engineering 403. *Direct and Alternating Current Machinery and Circuits.* The fundamental principles of electrical engineering for electrical, civil, and mechanical engineering students. Prerequisites: full fourth-year standing, Engineering 303, Electrical Engineering 340, and Mathematics 300 or 310. Laboratory fortnightly.
(3–1½–7)

Electrical Engineering 433. *Introduction to Direct and Alternating Current Machinery and Circuits and Elementary Electronics.* Fundamental principles of electrical engineering for chemical engineering students only. Prerequisites: full fourth year standing. Physics 200 and Mathematics 300 or 310. Laboratory fortnightly.
(3–1½–7)

Electrical Engineering 443. *Electrical Engineering Components.* An introduction to the principles of design of the basic com-

ponents of electrical machinery and electronic devices and circuits. Must be accompanied or preceded by Electrical Engineering 403.
(2–3–6) *Mr. Cowles*

Electrical Engineering 473. *Electrical Engineering Analysis I.* Application of certain mathematical techniques useful in the solution of many electrical engineering and allied problems. Mathematical formulation and physical interpretation of solutions. Prerequisite: Mathematics 300 or 310.
(3–0–6) *Mr. Pfeiffer*

Electrical Engineering 503. *Advanced Electric Circuit Theory.* Symmetrical components. Lumped and distributed constant circuits; the generalized four terminal network; transient analysis. Transmission lines, filter circuits and wave guides. Maxwell field equations. Prerequisites: full fifth year standing and Electrical Engineering 403 and 473.
(3–0–6) *Mr. McEnany*

Electrical Engineering 513. *Advanced Electrical Machinery.* Theory of electrical machinery and controls; calculation of characteristics; application of electronic and magnetic controls and circuits; the machine as a circuit; servomechanisms; power rectifiers. Must be accompanied or preceded by Electrical Engineering 503 or 533, and accompanied by Electrical Engineering 553 and 573.
(3–0–6) *Mr. Waters*

Electrical Engineering 523. *Electrical Design.* The application of magnetic, electrostatic, and heat transmission theory to the design and calculation of characteristics of electrical apparatus. Illumination. Must be accompanied or preceded by Electrical Engineering 503 or 533, and 513.
(3–4–8)

Electrical Engineering 533. *Advanced Electrical Circuits and Transmission Lines.* A more complete mathematical treatment of the electrical phenomena than is given in Electrical Engineering

503, and open to students who show capacity in mathematics and electrical theory. Prerequisites: full fifth-year standing. Electrical Engineering 403, and Mathematics 310. Must be accompanied or preceded by Electrical Engineering 573.
(3–0–6)

Electrical Engineering 543. *Electronics and Communications Engineering.* The theory and application of electronic devices. circuits and apparatus in wire and radio communication and related fields. Antennae, radiation, wave guides and measurements. Must be accompanied or preceded by Electrical Engineering 503 or 533, and 513.
(3–4–8) *Mr. Wischmeyer*

Electrical Engineering 553. *Advanced Laboratory Measurements.* Laboratory studies of electrical machinery and circuits, power rectifiers, electronic and magnetic control devices and circuits, and servomechanisms; electrical measurements. Must be accompanied by Electrical Engineering 513.
(1–8–7)

Electrical Engineering 573. *Electrical Engineering Analysis II.* Continuation of Electrical Engineering 473. Application of mathematical techniques to the solution of electrical engineering, vibration, and heat flow problems. Prerequisite: Electrical Engineering 473.
(3–0–6) *Mr. Pfeiffer*

Electrical Engineering 593. *Electrical Engineering Problems.* Under certain favorable conditions, an electrical engineering major with at least full fifth-year standing may elect an approved investigation of some electrical engineering problem under the direction of a member of the electrical engineering staff.
(1–9–8) *Staff*

Electrical Engineering 603. *Advanced Circuit Analysis.* Dynamic behavior of linear, lumped constant systems; use of transform and other mathematical methods; general network and transmission

systems theorems; phase and amplitude relations; frequency response and transient behavior. Prerequisite: Electrical Engineering 573.
(3–4–8) *Mr. Pfeiffer*

Electrical Engineering 605. *Graduate Seminar.*
(1–0–2) *Staff*

Electrical Engineering 613. *Advanced Servomechanisms.* Mathematical formulation of the control problem; linear servo analysis and synthesis; design criteria and optimum synthesis; sampled data systems; non-linear systems. Prerequisite: registration in or completion of Electrical Engineering 603.
(3–4–8) *Mr. Pfeiffer*

Electrical Engineering 623. *Advanced Electrical Power Engineering.* Power plants and substations. Relaying transmission, and distribution systems. Prerequisite: Registration in or completion of Electrical Engineering 603.
(3–4–8)

Electrical Engineering 633. *Research and Thesis.* A thorough investigation and report on an electrical engineering problem selected by the student and approved by the head of the department. A member of the electrical engineering staff will be designated as adviser.

Electrical Engineering 643. *Advanced Electronics and Communications Engineering.* Electromagnetic theory and wave propagation. Modulation; frequency analysis; electro-acoustical systems. Prerequisite: Registration in or completion of Electrical Engineering 603.
(3–4–8) *Mr. Wischmeyer*

Electrical Engineering 653. *Theory of Electrical Machinery.* Treatment of electrical machinery from concepts of generalized circuit theory and energy flow. Prerequisite: Registration in or completion of Electrical Engineering 603.
(3–4–8) *Mr. Waters*

Electrical Engineering 663. *Feedback Control Systems.* Designed for engineering graduates who are not necessarily electrical engineers. Introduction to feedback systems; rapid review of background topics as needed; physical interpretation and mathematical formulation of systems behavior; systems analysis and design. Laboratory work includes study of available systems, basic measurements, and solution of numerical problems. Prerequisite: approval of the head of the electrical engineering department. (3–4–8)

Engineering

Courses listed as *Engineering,* are basic courses required of students majoring in the several branches of engineering. With the exception of Engineering 203 they are taught by members of the departmental staffs. More advanced courses are described under the names of the four engineering departments—chemical, civil, electrical and mechanical.

Engineering 203. *Engineering Drawing.* An engineering course which develops drawing as a method of solving technical problems and of exchanging ideas. Emphasis is on "engineering graphics." Included are graphical arithmetic, graphical calculus, nomography, orthographic projection, sketching, pictorial projection, lettering, dimensioning, A.S.A. and S.A.E. standards, intersections and developments, and relationship of algebraic and graphical solutions of problems in space. Staff approval of all drawing instruments is required. Students taking Engineering 203 must have completed or be taking Mathematics 200 or 210. (1–6–6) *Mr. McDonald*

Engineering 303. *Engineering Mechanics.* Statics and dynamics. Coplanar and noncoplanar static force system by algebraic and graphical methods. Centroids and moments of inertia of areas and bodies. Friction. Application of Newton's second law to problems of translation, rotation, and plane motion of rigid bodies. Work and energy methods. Impulse and momentum. Prerequisites: Engineering 203, Physics 100, Mathematics 200 or 210, and registration in Engineering 360 and Mathematics 300 or 310. (3–0–6)

Engineering 350. *Plane Surveying.* The development and study of the principles and theory fundamental to engineering measurements. Field and office work to familiarize the student with tape, compass, level, transit and plane table. Comprehensive studies of directional measurements, linear observations, engineering leveling and topographic operations. Prerequisites: Engineering 203 and Mathematics 100.
(3–6–5)

Engineering 360. *Kinematics of Machines.* The study of relative motion of parts of machines, instant centers, velocities, and gearing and wrapping connectors. Prerequisites: Engineering 203, Physics 100, Mathematics 200 or 210, and registration in Engineering 303.
(3–3–4)

Engineering 431. *Applied Mechanics.* The same subject material as in Engineering 303 through statics. For chemical engineers only. Prerequisites: Physics 100, Engineering 203, and Mathematics 300 or 310.
(3–0–3)

Engineering 432. *Strength of Materials.* Theory of beams, columns, and shafts. Stresses and deformations due to tensile, compressive, and shearing forces; distribution of shears and bending moments; deflection; torsion. Physical tests of metals and concrete in the laboratory. For chemical engineers only. Laboratory fortnightly. Prerequisites: Physics 100, Engineering 203, and Mathematics 300 or 310.
(3–1½–3)

Engineering 505. *Seminar.* A course devoted to the purpose of training engineering students in collecting and presenting orally formal papers and discussions on topics of general engineering interest. The papers and discussions are given by the students, using acceptable material secured from technical periodicals. The course meets weekly and is conducted in the form of an engineering society meeting. Required of all civil and electrical engi-

neering students in the year they are candidates for a bachelor's degree in engineering.
(1–0–2)

Mechanical Engineering 515. *Seminar.* A course similar to Engineering 505, for mechanical engineering students.
(1–0–2)

English

English 100. *English Composition; Study of Fundamental Literary Forms.* The primary purpose of the course is to give students the command of written English which is necessary for later work in college. A secondary but still important purpose is to examine the chief types of prose and poetry, as a foundation for further courses in literature or for private reading. Required of Freshmen.
(3–0–6) *Messrs. Camden, Dowden, Gallegly, Parish, Whiting, Williams, and others*

English 200. *Outlines of the History of English Literature.* Collateral reading of major authors representative of the various periods.
(3–0–6) *Messrs. Camden, Williams, and others*

English 210. *Argumentation and Public Speaking.* Practical training in the fundamentals of effective speech, written argument, and debate. Designed to prepare the student for the ordinary demands of business life. Platform speaking, themes, conferences. This course is planned for students of physical education.
(3–0–6) *Mr. Gallegly*

English 220. *Composition and Expression.* Primarily for science-engineering students. Letters, reports, and argumentation. Study and discussion of selected prose readings.
(3–0–6) *Messrs. Thomas, and others*

English 230. *Selected Great Books of European Literature.* Readings, lectures, discussions, and reports.
(3–0–6) *Mr. McKillop*

English 300. *English Drama from Its Beginnings to 1642.* The development of the drama will be traced from the miracle plays and the moralities through the plays of Shakespeare and his contemporaries to the closing of the theaters. Some emphasis will be placed upon the development of Shakespeare as a dramatist, and upon the indebtedness of Shakespeare to the earlier drama.
(3–0–6) *Mr. Camden*

English 310. *Modern British and American Poetry.* A survey of poetic development in Great Britain and America from 1890 to date: the revolt of the 1890's, the Irish Renaissance, the Georgians, the poetry of the two World Wars, the "new" American poetry.
(3–0–6) *Mr. Williams*

English 320. *Modern Drama.* Special study of Ibsen, Strindberg, Shaw, Barrie, Galsworthy, O'Neill, and Anderson; reading of representative recent English, American, and Continental plays, lectures upon theatrical history, acting, and dramatic tendencies.
(3–0–6) *Mr. Whiting*

English 330. *Advanced Writing.* The writing of essays, stories, plays, and novels. Time is given also to problems of marketing manuscripts. Stories will be read and analyzed, and critical theories discussed. Frequent conferences.
(3–0–6) *Mr. Williams*

English 340. *The English Novel.* Major novelists of the nineteenth, and early twentieth centuries.
(3–0–6) *Mr. McKillop*

English 350. *Poetry and Prose of the Romantic Period.* Study of the poetry from Blake to Keats; reading of selected prose from Lamb to Carlyle.
(3–0–6) *Mr. Dowden*

English 355. *Victorian Literature.* The main procedure is close reading and class discussion of assigned texts from the major

writers of poetry and nonfictional prose. Connections with other literature of the period, and with the social and political background, will be made through lectures, collateral reading, and reports.
(3–0–6) *Mr. Thomas*

English 360. *English Drama from 1660 to 1900.* This course begins with the opening of the theaters after the Puritan Revolution and covers the drama of the Restoration, the eighteenth century, and the nineteenth century.
(3–0–6) *Mr. Camden*

English 370. *Milton and His Contemporaries.* Special study of Milton and some of the minor writers of the seventeenth century, including Donne, Herbert, Cowley, Bunyan, Pepys, and Dryden.
(3–0–6) *Mr. Whiting*

English 380. *Seventeenth Century Survey.* A survey of the major poets and prose writers of the seventeenth century, other than Milton, and of their relation to the political, religious, and scientific issues of the period.
(3–0–6) *Mr. Parish*

English 390. *Major American Writers.* A number of American books of the nineteenth and twentieth centuries are studied in relation to the background of American thought. The novel is the form to which most attention is given, and the primary emphasis is placed on literary qualities.
(3–0–6)

English 395. *Life and Literature of the West and Southwest.*
(3–0–6) *Mr. Gallegly*

English 400. *Shakespeare.* A close study of certain of the comedies, histories, and tragedies, with lectures on the interpretation of these plays in the light of the Elizabethan mind.
(3–0–6) *Mr. Camden*

English 420. *Victorian Literature.* Poetry, nonfictional prose, precursors of modern drama.
(3–0–6) *Mr. Whiting*

English 430. *Eighteenth Century Prose and Poetry.*
(3–0–6) *Mr. McKillop*

English 460. *Sixteenth Century Literature.* A survey of non-dramatic literature from Malory to the death of Elizabeth, with special emphasis upon *The Faerie Queene* and *Arcadia.*
(3–0–6) *Mr. Marsh*

English 480b. *Shakespeare Seminar.*
(3–0–3) *Mr. Camden*

English 500. *Chaucer.* Extensive reading in the *Canterbury Tales* and *Troilus and Criseyde.*
(3–0–6) *Mr. Conner*

English 510. *Old English: "Beowulf."*
(3–0–6) *Mr. Conner*

English 530a. *Bibliography and Methodology.* This course is designed to acquaint students with the bibliographical guides and aids to literary research. Attention will also be given to methods of preparing papers, theses, and dissertations.
(3–0–3) *Mr. Thomas*

English 530b. *Literary Criticism.* A study of the principles of classical, romantic, and realistic literature as formulated by the major critics from Plato to the present day.
(3–0–3) *Mr. Dowden*

English 540. *Topics in English Literary History.* Graduate research.

French: *see* **Romance Languages**

Geology

Geology 200a. *Physical Geology.* An introduction to the study of the physical, chemical and geological processes that produce rocks, economic deposits, and landforms. The laboratory includes map and structure interpretation in addition to the identification of hand specimens of rocks and minerals. Prerequisite: Consent of the Department. Prospective majors in geology are expected to have had Chemistry 120, Physics 100, and Mathematics 100.
(3–3–4) *Messrs. Adams and Rogers*

Geology 201b. *Historical Geology.* An introduction to the study of the physical events of the ancient past from the birth of the earth through the most recent ice age, together with a synopsis of the concurrent changing patterns of life. The laboratory includes the analysis of geological maps with emphasis on the structure of the stratified rocks and their organic remains. Prerequisite: Geology 200a or consent of the Department.
(3–3–4) *Messrs. Croneis and Rogers*

Geology 310a. *Mineralogy.* A systematic study of minerals with hand specimen, X-ray, and microscope techniques. Prerequisites: Geology 200a, Mathematics 200, Physics 200, and consent of the Department.
(3–4–4) *Mr. Adams*

Geology 311b. *Petrography.* An introduction to the detailed study of igneous, sedimentary, and metamorphic rocks. The methods of describing both hand specimens and thin sections are considered, and the characteristics of various rocks are discussed in relation to problems of petrogenesis. Prerequisite: Geology 310a or consent of the Department.
(3–6–5) *Mr. Rogers*

Geology 320. *Geochemistry.* A study of the geological and chemical processes that produced the observed distribution and abundances of the elements. The age, formation, and heat balance of the earth are some of the topics discussed from a geochemical

viewpoint. Prerequisites: Geology 310a and consent of the Department.
(3–4–8) *Mr. Adams*

Geology 330b. *Structural Geology.* Mechanical principles; description, classification, and mechanics of folds and faults; salt dome and igneous tectonics; description and discussion of the major crystal structures of the earth. Prerequisites: Geology 200a, Geology 201b (may be taken concurrently), and Geology 310a.
(3–3–4) *Mr. Officer*

Geology 390. *Field Geology.* In addition to the various shorter field trips conducted in connection with a number of the geology courses taken in residence, a summer field trip of not less than six weeks (ordinarily eight weeks) is required of all majors. The work may be taken at any one of several approved university field stations during the summer prior to the senior year.

Geology 400a. *Geobiology.* The morphology, geological record and geographic distribution of the major invertebrate groups characterized by significant fossil representation. Prerequisites: Geology 201b and consent of the Department.
(3–4–4) *Mr. Croneis*

Geology 401b. *Stratigraphy and Index Fossils.* The principles of stratigraphy and stratigraphic analysis. Problems of correlation, standard sections and paleogeography. Prerequisite: Geology 400a.
(3–4–4) *Mr. Croneis*

Geology 405a. *Micropaleontology.* A microscopic study of the plant and animal remains commonly recoverable from drill cuttings. Principles underlying the use of such fossils in local and worldwide correlations. Prerequisite: Geology 401b or consent of the Department.
(2–6–4) *Mr. Croneis*

Geology 410a. *Sedimentary Petrology.* The study of sediments and sedimentary rocks. Topics considered include weathering,

erosion, transportation, deposition, lithification, and the petrographic characteristics of certain types of sedimentary rocks. Laboratory work is adjusted to the interests of the individual student and may involve mechanical analysis of sediments, descriptions of land specimens and thin sections, and special research projects. Prerequisite: Geology 311b or consent of the Department.
(3–4–4) *Mr. Rogers*

Geology 411b. *Igneous and Metamorphic Petrology.* The study of igneous and metamorphic rocks. Emphasis is placed on problems concerning the origin of igneous and metamorphic rocks. Laboratory work involves various methods of studying rocks, and opportunity is given for research. Prerequisite: Geology 311b or consent of the Department.
(3–4–4) *Mr. Rogers*

Geology 420a. *Ore Deposits.* An introduction to the study of the metallic ores. The characteristics of various types of deposits are studied, and emphasis is placed on problems concerning the origin of hydrothermal ores. Prerequisite: Geology 311b or consent of the Department.
(3–0–3) *Mr. Rogers*

Geology 421b. *Economic Geology of the Non-Metals.* A study of the geology, origin, and general economics of the non-metal deposits, with emphasis on petroleum. Topics for study include analysis of significant occurrences and methods of exploration. Prerequisites; Geology 310a, 311b, and consent of the Department.
(3–0–3) *Mr. Adams*

Geology 440b. *Current Research Problems.* Lectures and seminars on major research problems by members of the Rice Institute laboratories. Ordinarily organized as a formal course in alternate years. Geology majors are expected to attend. Under certain circumstances seniors, and advanced students whose undergraduate training was obtained at other schools, or in other departments, may register for credit.
(2–0–2)

Geology 450a. *Geomorphology.* Mechanics of weathering and sedimentation; streams and glaciers; mountains, plains, and plateaus; volcanoes; atolls and reefs; submarine geomorphology. Prerequisites: Geology 200, 330b, and Physics 200.
(3–0–3) *Mr. Officer*

Geology 460. *Geophysics.* Theory of wave propagation, rays, and wave guides; earthquake and explosion seismology; potential theory; gravity and terrestrial magnetism; heat flow; present knowledge of the earth through geophysics; tectonophysics; contribution of physics to theories of the origin and development of the earth through geologic time. Prerequisite: consent of the Department.
(3–3–8) *Mr. Officer*

Geology 500. *Special Studies.* Advanced work in certain phases of geology, adapted to the needs of individual graduate students. Registration permitted only with consent of the instructor.

Geology 510-517. *Seminars in Geology.* Courses covering the subjects listed in sequence under Research Courses numbered 590-597.

Geology 590. *Research in Physical and Structural Geology.*
Mr. Rogers

Geology 591. *Research in Mineralogy.*
Mr. Adams

Geology 592. *Research in Petrography and Petrology.*
Mr. Rogers

Geology 593. *Research in Geochemistry.*
Mr. Adams

Geology 594. *Research in Geophysics and Oceanography.*
Mr. Officer

Geology 595. *Research in Geobiology and Stratigraphy.*
Mr. Croneis

Geology 596. *Research in Economic and Petroleum Geology.*
Staff

Geology 597. *Research in Regional Geology.*
Staff

Geology 700. *Summer and Off-Campus Graduate Research.* Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week, or full time field investigations.

German

German 100. *Elementary German.* Grammar, conversation, and extensive reading.
(3–0–6)

German 200. *Intermediate German:* Literary. Reading of several works of literary excellence. Outside reading.
(3–0–6)

German 201. *Intermediate German:* Scientific. The work of the first semester is identical with that in German 200. May be offered as prerequisite for advanced courses.
(3–0–6)

German 205. *Intermediate German:* Literary and scientific. The work of the first semester is identical with that in German 200. May be offered as prerequisite for advanced courses. Outside reading second semester in field of major study.
(3–0–6)

German 305. *Writing, Speaking, Translation.*
(3–0–6)

German 330. *Nineteenth Century Literature.* Given in alternate years.
(3–0–6)

German 360. *Lessing and Schiller.* Given in alternate years.
(3–0–6)

German 370. *Philosophical Ideas in German Literature.* Readings in the original will be required. Given in alternate years.
(3–0–6)

German 380. *German Literature since 1880.* Given in alternate years.
(3–0–6)

German 390. *Goethe.* Including the study of *Faust.* Given in alternate years.
(3–0–6)

German 460. *German Literature from 1500–1800.* Given in alternate years.
(3–0–6)

German 505. *Graduate Research.*
(3–0–6)

German 520. *Germanic Philology.* An introduction to the study of Gothic, Old Norse, Old Saxon, Old High German, and the history of the German language. For advanced students in English and German. Given in alternate years.
(3–0–6)

German 530. *Middle High German.* Given in alternate years.
(3–0–6)

History, History of Art, and Political Science

History 100. *Foundations of Western Civilization.* This course is intended to provide an historical background for the various humanistic branches of study. It includes a survey of human achievement from the prehistoric times through antiquity and the Middle Ages to the eighteenth century. The main emphasis is placed upon those formative influences which constitute the basis of the modern world structure. Much attention is given to historical geography.
(3–0–6) *Mrs. Drew*

History 110. *American History.* A survey of the growth of the American nation, with considerable attention to its European background. It stresses such major developments as the establishment of the Federal republic, westward expansion and the dominance of frontier attitudes, the growth of democracy, the triumph of nationalism over sectionalism, the transition from agrarianism to industrialism, the emergence of America as a world power, and the present involvement in Europe and Asia. Much attention is given to historical geography. Recommended as fulfilling the requirements of prelegal and premedical students and constituting a basic course in history for Freshmen.
(3–0–6) *Messrs. Masterson and Peckham*

History 115. *American Development.* This course, open only to Army R.O.T.C. students, traces the development of America's leading problems and policies from the Civil War to the present day. Special emphasis is given to the problems, background, and history of World Wars I and II.
(1–0–2) *Mr. E. Phillips*

History 300. *Cultural History of the United States.* This course deals with the primary trends in the social and intellectual life of the American people from colonial times to the present, and seeks to interpret them as expressions of the American national spirit. Prerequisite: History 110.
(3–0–6) *Mr. Lear*

History 310. *The Early National Period.* A study of the society and thought of America from the late colonial period to 1850. The chronological limitation is intended to permit a close study of the personalities and characteristic of the nation in its formative years. Prerequisite: History 110.
(3–0–6) *Mr. Masterson*

History 320. *Trends in European Culture during Antiquity and the Middle Ages.* This course traces selected aspects of European thought from Periclean Athens to the later Middle Ages, with special reference to Greco-Roman influences. Hellenistic, Byzan-

tine, and Mohammedan contributions to the Latin West are considered. Religious, philosophical, and scientific implications are examined in some detail. Prerequisite: History 100.
(3–0–6) *Mr. Lear*

History 330. *The Making of Modern Europe, 1250–1789.* The first semester of this course covers the period usually termed "Late Medieval" and the second semester the period often called "Renaissance and Reformation." A survey of European culture and politics from the decline of feudalism and the rise of the national monarchies to the French Revolution. The purpose of this course is primarily to trace the development of those institutions in Western Europe which have been important in the modern period: the revival of commerce, the development of capitalism, the growth of the national monarchies, the revival of Roman law and the expansion of the power of the state, the break-up of religious unity, the intellectual and cultural ferment and the social changes leading up to the Revolution.
(3–0–6) *Mrs. Drew*

History 350. *Europe since 1789.* A study of Europe's efforts to adapt its social and political institutions to the changes enforced by the Industrial Revolution. Particular attention is given to the failure of nationalism to serve as an adequate social and political ideal, and to the subsequent exhaustion and demoralization of Europe in the two recent great wars.
(3–0–6) *Mr. Nelson*

History 355. *British History Survey.* A survey of British history from pre-Roman times to the present with an attempt to trace the most important political, constitutional, social, and economic developments connected with the history of the British people in England and abroad.
(3–0–6) *Mrs. Drew*

History 360. *Recent British History.* A study of the transformation of Britain since 1700 from a predominantly agricultural to an industrial and urban society. The course is concerned primarily with social and political changes in Britain itself, but also

deals with British expansion overseas, and the decline of British commercial and political pre-eminence since 1870.
(3–0–6) *Mr. Nelson*

History 365. *History of the British Commonwealth Nations.* The history of Canada, Australia, New Zealand, South Africa, and India is presented in this course, with special emphasis given to the study of comparative frontiers. The relations of the dependencies to the mother country and the development of the British Commonwealth of Nations structure are also carefully studied. The course deals with areas which are destined to play enormous roles in the future. Prerequisite: History 100, 110 or 115
(3–0–6) *Mr. E. Phillips*

History 370. *Naval and Military History.* The course includes a survey, from ancient times, of war as an instrument of national policy. Attention is given to the causes of wars, the principles of strategy and tactics, the personalities of great commanders, and Admiral Mahan's doctrine of the influence of sea power upon history.
(3–0–6) *Mr. Craig*

History 375. *The History of Latin America.* A political and economic history of the Latin American republics, with special emphasis on their relations with the United States and the gradual development of a Pan-American system.
(3–0–6) *Mr. Peckham*

History 380. *Economic History of the United States.* This course studies the development of the American industrial system. Special emphasis is given to the social and human background of American industry and to the roles of individual business leaders. The case method is used to study certain leading industries and issues. Prerequisite: History 100, 110 or 115.
(3–0–6) *Mr. E. Phillips*

History 390. *History of the American West.* This course traces the Westward Movement from its beginnings on the east coast to its culmination on the Pacific coast. Most attention is given to the

history, romance, and problems of the Trans-Mississippi West, with special emphasis on Texas and the Great Plains. Prerequisite: History 100, 110 or 115.
(3–0–6) *Mr. E. Phillips*

History 395. *A History of the South.* A study of the life and economy of the Southern people from the colonial period. Attention is given to such topics as the frontier, the plantation, slavery, sectionalism, and agrarian, social, and industrial problems. Primary emphasis is placed on the institutions and history of the ante-bellum period. Prerequisite: History 110.
(3–0–6) *Mr. Vandiver*

History 420. *Medieval Sources.* Survey and translation of typical medieval Latin sources. The selections are studied from the point of view of historical significance and of literary appreciation. Attention is given also to the role of the Latin language in the Middle Ages, the preservation of letters in manuscripts and libraries, and the evolution of the medieval scripts. This course is intended for students of history and the modern languages who desire some familiarity with ordinary medieval Latin texts. Prerequisite: three or four years of high school Latin.
(3–0–6) *Mr. Lear*

History 430. *Topics in Ancient and Medieval Intellectual History.* This course deals with selective phases of classical and medieval thought based on the cultural monuments of antiquity and the Middle Ages. The sources in letters and art are interpreted as historical documents. Intensive reading and reports on special aspects of the field. Prerequisite: History 100.
(3–0–6) *Mr. Lear*

History 440. *Social and Economic History of Europe in the Middle Ages.* The work of this course begins with social and economic conditions in the late Roman Empire, traces their gradual evolution into the "stagnant" conditions of the early Middle Ages, and then considers the important economic changes associated with the eleventh century and their influence on the social and

economic institutions of early modern Europe. Open only to advanced students after consultation with the instructor.
(3–0–6) *Mrs. Drew*

History 450. *Contemporary History.* A survey of current world affairs, with lectures and readings on the background of present-day policies and events.
(3–0–6) *Mr. Craig*

History 460. *English Constitutional History.* A survey of the development of the English constitution with particular attention to the period since 1485.
(3–0–6) *Mr. Nelson*

History 465. *American Colonial History.* A study of American society in the colonial period. Particular attention is given to the social and intellectual background of the Revolution.
(3–0–6) *Mr. Nelson*

History 470. *Foreign Relations of the United States.* This course is primarily a study of American diplomatic history, with some emphasis as well on our political, economic, social, and cultural relations with other nations.
(3–0–6) *Mr. Peckham*

History 490. *Topics in American Constitutional and Political History.* Research in the fields of American political history and constitutional development. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Masterson*

History 495. *Civil War and Reconstruction.* A study of the rise of sectionalism, the abolition crusade, the secession crisis, United States versus Confederate States, aftermath of the war, reconstruction, economic and social consequences of the war, and emergence of a New South. Emphasis is placed on social, economic and military events during the years 1861–1865. Prerequisite: History 110.
(3–0–6) *Mr. Vandiver*

History 500. *Topics in American History.* Graduate research and thesis.

History 510. *Topics in Medieval History.* Graduate research and thesis.

History 520. *Topics in Renaissance History.* Graduate research and thesis.

History 530. *Topics in Modern History.* Graduate research and thesis.

History 545. *Historiography.* Graduate Seminar.
(3–0–6) *Mr. Masterson*

History 570. *The First World War.* A study of the causes of World War I, the course of the war itself, and the peace settlement of Versailles. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Craig*

History 590. *Seminar in Western American History.* This course includes a study of the leading authorities in Western American history, training in the critical examination of source material, and original research in selected topics of Western history. Open to graduate students, and to Seniors who show a proficiency in history, after consultation with the instructor.
(3–0–6) *Mr. E. Phillips*

History of Art 215. *A History of the Architecture, Sculpture, and Painting of the Ancient World.* Emphasis is placed upon the correlation of the arts and their reflection in Renaissance and contemporary developments. Open to all students.
(3–0–6) *Mr. Chillman*

History of Art 315. *A History of the Architecture, Sculpture, and Painting of the Middle Ages.* During the first term the emphasis will be placed upon the architectural monuments of the Middle Ages and the development of their structural systems. The

second term will stress the development of painting, sculpture, and the decorative arts of the same period. Open to all students.
(3–0–6) *Mr. Todd*

History of Art 415. *A History of the Architecture, Sculpture, and Painting of the Renaissance and the Subsequent Developments to the Present Time.* Open to all students.
(3–0–6) *Mr. DeZurko*

History of Art 450. *Great Works of Architecture and Its Related Arts.* A history of art from 500 B.C. to modern times. Masterpieces of architectural composition which combine sculpture and painting. Examples: the Acropolis at Athens and the cathedral at Chartres. Lectures, discussion, and papers. Open to Juniors, Seniors, and graduate students.
(3–0–6) *Mr. Chillman*

History of Art 455. *The Art of the Fourteenth and Fifteenth Centuries in Italy.* Open to Juniors, Seniors, and graduate students. (Alternates with Architecture 450.)
(3–0–6) *Mr. Chillman*

Political Science 210. *American Government.* A study of the history and operation of constitutional government in the United States with special emphasis on the historical background of the Federal government, the structure of the government, the formation of public policy, and the conduct of public business. For additional background and for contrast, reference is made to English constitutional history and to the present structure of the English government. This year course in American government, planned for the general student of government, is also designed to enable prospective lawyers, physicians, and teachers to meet the state requirement of a course in "Constitutions."
(3–0–6) *Messrs. Fornell and Hudspeth*

Political Science 310. *Law and Society.* The study of law as a part of cultural anthropology and the history of organized society. Emphasis is placed upon the sources of legal doctrine, spe-

cifically illustrated by case law and legislation in the field of contracts, torts, commercial transactions, and domestic relations.
(3–0–6) *Mr. Hudspeth*

Political Science 340. *Foundations of National Power.* A study of the basic factors in political geography and international politics, stressing such elements of national power as geographical location, population, resources, technology, ideology, military strategy, and geopolitical theory.
(3–0–6) *Mr. Peckham*

Political Science 410. *Ancient and Medieval Political Theory.* A survey of the main trends in politics and law from antiquity into the later Middle Ages, with special emphasis upon such important conceptions as god-kingship, legalized absolutism, the organic state, natural law, personality of law, custom and feudal contract, majesty and sovereignty, allegiance, and constitutionalism. Open only to advanced students after consultation with the instructor.
(3–0–6) *Mr. Lear*

Political Science 520. *Topics in Legal History and Political Theory.* Much attention is given to methods, materials, and the recent literature in this field. Instruction is based on the translation of several primary sources in Roman and Germanic law, as well as reports on such topics as sovereignty and allegiance. Open to properly qualified students after consultation with the instructor.
(3–0–6) *Mr. Lear*

Italian: *see* **Romance Languages**

Mathematics

Mathematics 100. *Elementary Analysis.* Analytic geometry, and elementary calculus. This course is required for Freshmen because it forms a necessary introduction to work in mathematics and pure and applied science, and assists the students in developing habits of self-criticism in thinking and writing. As one

of the most modern of sciences and, at the same time, one of the most ancient of humanities, mathematics is regarded as an integral part of any general education. Science-engineering sections meet four hours per week.
(3–0–6) or (4–0–8) *Staff*

Mathematics 200. *Differential and Integral Calculus.* Derivatives, differentials, definite integrals, infinite series, and their applications, especially to mechanics. This course continues the work of Mathematics 100 in calculus and analytic geometry, with applications to Newton's laws of motion and calculation of moments of forces and of inertia, centers of gravity, etc. Prescribed for all science-engineering majors who do not take Mathematics 210. Students who have considerable facility in mathematical reasoning should register for Mathematics 210.
(3–0–6) *Staff*

Mathematics 210. *Differential and Integral Calculus.* This course covers the ground of Mathematics 200 but is more complete and goes further. It is open to students who obtain high grades in Mathematics 100, or otherwise satisfy the instructor of their fitness to take the course.
(3–0–6) *Staff*

Mathematics 300. *Advanced Calculus and Differential Equations.* Multiple integrals, infinite series, and partial differentiation, with many applications; the geometry of three dimensions; differential equations. This course, or Mathematics 310, is prescribed for all engineering students. Open also to other students who have passed Mathematics 200 or 210, or otherwise satisfy the instructor of their fitness to take the course.
(3–0–6) *Staff*

Mathematics 310. *Advanced Calculus and Differential Equations.* Students with considerable facility in mathematical reasoning should take this course instead of Mathematics 300, the ground of which it covers. Opportunity to write theses is given.
(3–0–6) *Staff*

Mathematics 320. *Analytical Mechanics.* Vector analysis; reduction of systems of forces and conditions for equilibrium. Dynamics of systems of particles; rigid bodies. Prerequisites: Mathematics 200 and 300. (The latter may be taken concurrently.)
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 330. *Introduction to Higher Algebra.* Properties of determinants and matrices. Theory of linear dependence. Bilinear and quadratic forms. Polynomials. Invariants. Lambda matrices and applications.
(3–0–6) *Staff*

Mathematics 360. *An Introduction to Mathematical Probability and Statistics.* Topics covered will include: conditional probability, Bernoulli's Theorem, law of large numbers, distributions, correlation, large and small sample theory, goodness of fit, testing statistical hypotheses, and the design of experiments. Insofar as possible, the mathematical foundations will be emphasized. Prerequisite: Mathematics 300 (may be taken concurrently). Enrollment with permission of department.
(3–0–6)

Mathematics 400. *Theory of Functions of a Complex Variable.* This course is fundamental in analysis. Besides giving an introduction to basic concepts of analysis, it includes the study of analytic functions of a complex variable, the Cauchy-Riemann equations, Cauchy's Integral Theorem, Taylor's series, calculus of residues, and conformal mapping.
(3–0–6) *Mr. Ulrich*

Mathematics 410. *Differential Equations and an Introduction to the Calculus of Variations.* Geometry of the integral curves and the classification of the singularities of equations of first order. Existence theorems. Theory of integrating factors and integration by elementary means. General theory of second order linear equations. Oscillation and comparison theorems. Fuchsian theory of regular singular points. Eigenvalue problems. General partial differential equation of first order. Boundary value problems for

certain second order linear systems, as much calculus of variations as time permits.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 420. *Differential Geometry.* Theory of curves and surfaces. Geodesics. Mapping of surfaces. The absolute geometry of a surface.
(3–0–6) *Mr. Johnson*

Mathematics 430. *Introduction to Modern Geometry.* Synthetic and algebraic geometry. The group of projective transformations and certain subgroups of the group of projective transformations. The geometries defined by these groups. Projective correspondences. Projective theory of conics.
(3–0–6)

Mathematics 440. *Algebra and Topology.* Groups, rings, fields, vector spaces. Topological spaces, fundamentals of homology theory, homotopy and covering spaces, classification of surfaces. Riemann surfaces.
(3–0–6)

Mathematics 450. *Introduction to the Theory of Numbers.* The fundamental theorem of arithmetic, congruences, quadratic residues, Diophantine equations, quadratic forms, and other topics in the elementary theory of numbers. The second half of the course includes an introduction to the theory of algebraic numbers.
(3–0–6) *Mr. Durst*

Mathematics 500. *Theory of Functions of a Complex Variable.* Entire and meromorphic functions. Distribution of values. Deficiency relation of Nevanlinna. Applications to the theory of Riemann surfaces.
(3–0–6) *Messrs. Mandelbrojt and Ulrich*

Mathematics 501. *Theory of Functions of a Complex Variable.* A study of special analytic functions of importance in mathematical physics. The course is usually given as a seminar.
(3–0–6) *Mr. Ulrich*

Mathematics 505a. *Selected Topics from the Theory of Functions of a Complex Variable.* The subject matter of this course varies from year to year. In past years the following topics have been among those presented: singularities of a function defined by a Taylor series, theory of normal families, theory of kernels, elementary theory of Dirichlet series, approximation theory.
(3–0–3) *Mr. Mandelbrojt*

Mathematics 510. *Theory of Functions of a Real Variable.* Theory of real numbers. Summable functions, Lebesgue and Stieltjes integrals, general integrals, functions of point sets and of plurisegments, Fourier series.
(3–0–6) *Mr. Bray*

Mathematics 520. *Trigonometric Series and Related Topics.* Series expansions in terms of orthogonal systems of functions. Trigonometric series. Fourier transforms and integrals. The course is based upon Mathematics 510.
(3–0–6) *Mr. Bray*

Mathematics 530. *Laplace Transformations.* Theory of the Laplace transformation with particular reference to the properties of the transform as a function of a complex variable. Applications to the solution of difference equations, integral equations of the convolution type, and ordinary differential systems. Boundary value problems. Certain Sturm-Liouville systems. Abelian and Tauberian theorems. Asymptotic representations.
(3–0–6) *Mr. Ulrich*

Mathematics 540. *Topological Linear Algebra.* Vector spaces. The elementary geometric and algebraic properties of Banach and Hilbert spaces. Normed ring. Operators and spectral theory. Applications and topics of related interest. Prerequisite: Mathematics 510.
(3–0–6) *Mr. Brown*

Mathematics 545. *Theory of Algebraic Functions.* Theory of elliptic functions. Properly discontinuous groups of linear trans-

formations. Automorphic functions. Uniformization of algebraic functions.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 550. *Advanced Theory of Riemann Surfaces.* Topological properties, theory of entire and meromorphic functions, problem of type.
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 555. *Recent Developments in the Theory of Riemann Surfaces.*
(3–0–6) *Mr. MacLane or Mr. Ulrich*

Mathematics 570a. *Selected Topics from Advanced Analysis.* The subject matter of this course varies from year to year. In past years the following topics have been among those presented: Fourier transforms in the complex domain, analytic continuation and infinitely differentiable functions, theory of composition, general Tauberian theorems, general problem of moments, closure theorems, general asymptotic representations, zeta-function of Riemann, and analytic theory of numbers and ergodic theory.
(3–0–3) *Mr. Mandelbrojt*

Mathematics 590. *Thesis.*

Mathematical Colloquium. The colloquium usually meets one afternoon every other week in order to allow the exposition of original investigations by its members.

Mechanical Engineering

Mechanical Engineering 350. *Mechanical Processes.* Class and laboratory instruction dealing with welding, heat-treating, foundry and machine shop practice, and their effects on machine design. Practice with a variety of bench and machine tools, carefully selected for their fitness in affording actual contact with machine work and in developing a certain degree of skill and resourcefulness in the student. Plant inspection trips. Prerequisites: full third-year standing in engineering.
(2–6–4) *Mr. Burghard*

Mechanical Engineering 403. *Thermodynamics and Heat Engines.* A general course of lectures, recitations from text, and laboratory covering elementary thermodynamics and the characteristics, fields of usefulness, operation, and test of fuels, steam engines and turbines, boilers, pumps, condensers, and auxiliaries; properties of steam; internal-combustion engines and accessories. Numerous problems illustrate the theory discussed. Prerequisite: full fourth-year standing. Laboratory fortnightly.
(3–1½–7) *Messrs. Chapman and O'Keiff*

Mechanical Engineering 423. *Engineering Analysis.* The analysis of engineering problems, with emphasis on the interpretation of results and analogies among the problems of different fields. Undergraduate and graduate credit.
(3–0–6) *Mr. Wilhoit*

Mechanical Engineering 483. *Introduction to Mechanical Design.* A study of those machine elements that require applied mechanics and elementary stress theory for their design. Attention is directed toward the manufacture of these elements and their assembly into a working machine. Prerequisite: Engineering 303.
(½–3–3) *Mr. Burghard*

Mechanical Engineering 513. *Machine Design.* Recitations from text and references, with the calculations and drafting involved in the complete design of machine parts, including elementary stress and strain at a point of strain gage applications. Considered are both the theory and modifications due to such factors as shop practice and economic considerations. Design of several complete assemblies. Prerequisites: Engineering 303 and 360, Mechanical Engineering 350, and Civil Engineering 401 and 402.
(3–6–10)

Mechanical Engineering 523. *Power Plants; Heating; Ventilation; Air Conditioning.* Fundamental applications of thermodynamics to the design, selection, or operation of modern central power stations, steam turbines, steam generators, gas turbines,

and their auxiliaries; the principles of refrigeration and air conditioning; fundamental applications to heating, ventilating, and cooling systems, and the selection of equipment. Prerequisite: Mechanical Engineering 403.
(3–6–10) *Mr. Plapp*

Mechanical Engineering 532. *Internal-combustion Engines and Fuels.* A study of the theory, characteristics, and operation of gasoline, gas, and oil-burning engines for automotive, stationary, and marine service, including the production and characteristics of the fuels used. Prerequisites: Mechanical Engineering 403.
(3–3–4) *Mr. O'Keiff*

Mechanical Engineering 541. *Physical Metallurgy I.* A study of the fundamentals of alloying and heat treatment. Mechanical and non-mechanical properties of metallic systems. Analysis of various basic types of metal forming processes. An introduction to oxidation and corrosion of metals.
(3–3–4) *Mr. Brotzen*

Mechanical Engineering 542. *Physical Metallurgy II.* Introduction to X-ray metallography. Thermodynamics of alloy systems. Mechanism and kinetics of transformations. A fundamental study of the mechanical behavior of metals and alloys. Prerequisite: Mechanical Engineering 541 or equivalent.
(3–3–4) *Mr. Brotzen*

Mechanical Engineering 570. *Mechanical Vibrations.* Theory of harmonic vibrations with several degrees of freedom. Applications to balancing of rotating machinery, vibration isolation, and the calculation of critical speeds of rotating shafts. Prerequisite: Mechanical Engineering 423.
(3–0–3)

Mechanical Engineering 590. *Heat Transfer.* A general course of lectures and recitations from text covering a basic study of the laws of heat transfer by conduction, convection, and radiation. Prerequisites: Mechanical Engineering 403 and 423.
(3–0–3) *Mr. Chapman*

Mechanical Engineering 593. *Mechanical Engineering Problems.* If conditions are favorable, mechanical engineering students may elect at least nine hours a week in approved investigations or designs under the direction of a member of the staff.

Mechanical Engineering 605. *Graduate Seminar.*
(1–0–2) *Staff*

Mechanical Engineering 615. *Advanced Dynamics.* Dynamics of a particle, dynamics of a system of particles, Hamilton's principle, and LaGrange's equations. Applications to advanced engineering problems including gyroscopic motion and the vibration of elastic bodies. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 623. *Advanced Engineering Analysis I.* An introduction to the theory of the complex variable and to vector analysis with particular emphasis on engineering applications in the fields of fluid dynamics, heat conduction and elasticity.
(3–0–3) *Messrs. Plapp, Wilhoit, Chapman*

Mechanical Engineering 625. *Advanced Engineering Analysis II.* Advanced topics in engineering analysis. The subject matter may vary from year to year depending on the background of those enrolled. Among topics which may be considered are: the calculus of variations, integral equations, matrix methods, tensor analysis, partial differential equations, statistics and probability, numerical methods, and their engineering applications.
(3–0–3) *Staff*

Mechanical Engineering 631. *Plasticity.* Stress, strain and plastic stress-strain relations. Problems of ideally plastic and of strain-hardening materials. Application of the theory of plasticity to metal-forming processes including drawing, extruding, rolling, and forging. One semester.
(3–0–3) *Mr. Brotzen*

Mechanical Engineering 633. *Physics of Alloys.* Principles of thermodynamics and electron theory applied to metals. The kinetics and the mechanism of allotropic transformations, order-disorder, age hardening and martensitic reactions, as well as recrystallization. Diffusion and nucleation studies.
(3–0–6) *Mr. Brotzen*

Mechanical Engineering 643. *Mechanical Metallurgy.* Fundamentals of elastic, plastic, and viscous behavior and their application to metallurgical problems including brittle and ductile failures, distortion, fatigue, creep, and damping.
(3–0–6) *Mr. Brotzen*

Mechanical Engineering 653. *Research and Thesis.* A report on an engineering investigation carried out by the individual student under the direction of a member of the staff in mechanical engineering. Nine hours of research weekly. Three copies of the accepted report will be required: two for deposit in the Institute library and one for the mechanical engineering department.

Mechanical Engineering 661. *Advanced Strength of Materials.* State of stress at a point, stress-strain relations, curved beam theory, strain energy methods, the bending of beams on elastic foundations, and an introduction to the theory of plates, shells, and buckling. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 662. *Theory of Elasticity.* The general equations of three-dimensional elasticity theory. A treatment of the two-dimensional theory including plane stress and plane strain. States of stress in rectangular, circular, and ring-shaped plates. The torsion and flexure of uniform bars of any cross section. One semester.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 665. *Theory of Plates and Shells.* The bending of rectangular and circular flat plates with various edge conditions is discussed. An introduction to plate buckling and vibration is given. The membrane theory of shells and the general theory of cylindrical shells is treated.
(3–0–3) *Mr. Wilhoit*

Mechanical Engineering 670. *Advanced Thermodynamics.* A continuation of the study of the principles of thermodynamics Primarily a thorough course in the fundamental concepts of thermodynamics not usually covered in undergraduate courses. A detailed consideration of energy and its transformations, the laws of thermodynamics, reversibility, entropy, and examples of applications to various fields.
(3–0–3) *Mr. Chapman*

Mechanical Engineering 673. *Advanced Fluid Dynamics.* A course emphasizing topics in classical fluid dynamics. The material consists of fundamentals of frictionless flow, velocity potentials, complex potential functions, and Blasius' theorems. Equal time is devoted to the flow of viscous fluids. The Navier- Strokes equations and the boundary layer equations are applied to problems of boundary layer flow and heat transfer.
(3–0–6) *Messrs. Chapman and Plapp*

Mechanical Engineering 680. *Advanced Heat Conduction.* Advanced work in the field of heat conduction. The course consists of a presentation of the general conduction equation and methods of solution in one-, two-, and three-dimensional problems and in the transient state. An examination is made of the problems of extended surfaces and internal heat sources.
(3–0–3) *Mr. Chapman*

Mechanical Engineering 682. *Theory of Convective Heat Transfer.* A basic examination of the processes of forced and free convection in laminar and turbulent flow. Development of the basic flow equations and a presentation of the more important cases for which they have been solved.
(3–0–3) *Mr. Plapp*

Mechanical Engineering 693. *Advanced Gas Dynamics.* Analysis of the general equations of fluid flow. Properties of compressible fluids. Subsonic and supersonic flow in the steady and non-steady states and in one, two, and three dimensions. Shock waves and other phenomena connected with high-velocity flow. Analysis of the general properties of quasi-linear hyperbolic differential equations.
(3–0–6) *Mr. Chapman*

Mechanical Engineering 695:*Special Topics in Mechanical Engineering.* Individual laboratory or library investigations under the direction of a member of the mechanical engineering department. Directed studies of advanced phases of mechanical engineering. (3–0–3)

Music

(The Shepherd School of Music)

Music 300. *Orientation and Analysis.* An investigation into the technical, psychological, and social aspects of music. Prerequisite: Junior standing.
(3–0–6) *Mr. Hall*

Music 400. *Medieval and Renaissance Music contrasted with Modern Music.* A comparison of the techniques of the periods showing the development and expansion of basic principles of composition. Prerequisite: Music 300 or its equivalent and instructor's permission.
Mr. Hall

Philosophy

Philosophy 100. *An Introduction to Responsible Thinking.* First semester: a study of logical demands and forms of sound thinking, emphasizing scientific ideas and problems of vital human interest. Second semester: an inquiry into the main principles and problems of a reasonable view of life, personal and social, as expressed in philosophical works and in great literature. This course is offered to a selected group of first-year students instead of Mathematics 100 or English 100 as a required course for a degree.
(3–0–6) *Mr. Fulton*

Philosophy 210. *Introduction to Philosophy.* Ethics: an introductory study of the development of moral ideas and of the problems of morality in our civilization. Logic: the principles according to which evidence is weighed and right conclusions are drawn in everyday thought as well as in the systematic thinking of science and philosophy.
(3–0–6) *Mr. Black*

Philosophy 220. *Philosophical Classics.* Reading of philosophical works which have helped to mold the mind of Western man, and discussion of problems in philosophical method, ethics, social and political philosophy, and esthetics.
(3–0–6) *Mr. Kolenda*

Philosophy 300. *History of Philosophy.* An historical survey of the essential features and main currents of philosophical thought, ancient, medieval, and modern.
(3–0–6) *Mr. Fulton*

Philosophy 310. *History of Religions.* An introductory study of the historical development of the principal religions.
(3–0–6) *Mr. Nielsen*

Philosophy 340. *Philosophy of Science and Theory of Knowledge.* First semester: The development of the modern scientific view of the world. The nature and value of scientific knowledge. Second semester: The place of logic and language in the search for knowledge. Problems of meaning, perception, memory, truth, and certainty.
(3–0–6) *Messrs. Fulton and Kolenda*

Philosophy 350. *Philosophical Ideas in Literature.* Reading and discussion of literary works which reflect the movement of thought from the time of the Enlightenment to the present. (In the years 1956–57 and 1957–58 German literature, in original and translation, will be studied. The course is also listed as German 370.)
(3–0–6) *Mr. Kolenda*

Philosophy 410. *Philosophy of Religion.* An examination of the basic ideas and problems of religious thought.
(3–0–6) *Mr. Nielsen*

Philosophy 420. *Types of Philosophical Theory.* First Semester: Reading and discussion of selected writings of Plato and Aristotle in translation. Second semester: Critical study of contemporary developments in ethical theory.
(3–0–6) *Messrs. Fulton and Kolenda*

Philosophy 430. *Modern Philosophical Classics.* Reading and discussion of selected masterpieces of modern philosophy.
(3–0–6) *Messrs. Fulton and Kolenda*

Philosophy 440. *Contemporary Philosophy.* A critical study of the development of philosophical thought during the last hundred years.
(3–0–6) *Messrs. Fulton and Kolenda*

Philosophy 450. *Seminar in Religious Philosophy.* A critical study of the major religious traditions through analysis and discussion of selected theological problems. (Not given in 1956–57.)
(3–0–6) *Mr. Nielsen*

Philosophy 460. *Social and Political Philosophy.* A survey of fundamental problems of social ethics and political theory. (Not given in 1957–58.)
(3–0–6) *Mr. Nielsen*

Philosophy 510. *Graduate Philosophical Research and Thesis.*

Physical Training and Physical Education

THE facilities of the Rice gymnasium make provision for systematic physical training and education on the part of the students of the Rice Institute. These facilities are used by intercollegiate athletic teams, and for faculty and alumni recreation. Facilities in or near the gymnasium are available for swimming, basketball, handball, football, track, volleyball, and many other recreative games and sports.

Physical Training 100. This course is designed to teach the student skill in various forms of recreative and athletic games and contests. Required of Freshmen and of transfers who have not had the equivalent elsewhere. Two two-hour periods each week.
(0–4–0) *Staff*

Physical Education 100. *Introduction to Health, Physical Education, and Recreation.* An introductory course to the professional

study of health, physical education, recreation, and camping. Units include orientation, vocational analysis, educational and scientific background, basic calculation, basic human anatomy, medical examinations and physical diagnosis.
(3–0–6) *Messrs. Hermance, Bland and Miss Garrett*

Physical Education 125. Laboratory periods devoted to intensive instruction and study in the activities of touch football, soccer, speedball, tumbling, swimming, tennis, squash, games, stunts, relays and contests.
(0–6–4) *Mr. Weston*

Physical Education 200. *Fundamentals of Health, Physical Education, and Recreation.* This course deals with units in personal hygiene, first aid, supervision of instruction, survey of current professional literature and sources of materials on objectives, principles, programs, public relations, etc.
(3–0–6) *Mr. Weston*

Physical Education 225. Laboratory periods devoted to intensive instruction and study in the activities of fencing, archery, fishing, volleyball, badminton, handball, and apparatus.
(0–6–4) *Mr. Barker*

Physical Education 300. *Advanced Fundamentals of Health, Physical Education and Recreation.* This course includes units in community recreation, intramural sports, safety education, professional literature, current problems, research, and history of physical education.
(3–0–6) *Messrs. Barker and Weston*

Physical Education 325. Laboratory periods devoted to intensive instruction and study in the activities of golf, life saving and water safety, basic rhythms, wrestling, boxing, basic program, lead up games, horseshoes, quoits, croquet, and softball.
(0–6–4) *Mr. Bearden*

Physical Education 350. *Scientific Foundations of Health, Physical Education and Recreation.* (Emphasis on basic principles.)

This course includes units in testing and measuring, physiology of exercise, kinesiology, body mechanics, and adaptive physical education.
(3–0–6) *Mr. Bearden*

Physical Education 400. *Principles and Methods of Health, Physical Education, and Recreation in Elementary and Secondary Schools.* This course deals with the principles, organization, administration, methods, and materials of the elementary and secondary school programs of health, physical education, and recreation.
(3–0–6) *Messrs. Weston and Hermance*

Physical Education 410. *Health and Physical Education for Teachers of Elementary and Secondary Schools.* This course is designed for prospective teachers who desire to meet the health and physical education requirements for certification by the State of Texas. The course includes a study of the purpose, content, and methods of instruction in a program of health and physical education in the elementary and secondary schools. Offered in case of sufficient demand.
(3–3–8) *Staff*

Physical Education 425. Laboratory periods devoted to intensive instruction in the theory and practice of football, basketball, student teaching and visitation, training room procedures and techniques, baseball and track.
(0–6–4) *Messrs. Bland, Weston and Wojecki*

Physics

Physics 100. *Heat, Light, Mechanics, and Sound.* A course of three experimental lectures and three hours of practical work per week. This course is intended for those who wish to obtain some general knowledge of the principles of natural philosophy on which the modern applications of science to human activities are based. The scientific method of dealing with facts and theories is explained and made familiar by numerous experimental

demonstrations and laboratory exercises. Students taking Physics 100 must have taken or be taking Mathematics 100.
(3–3–8) *Messrs. Heaps and Rorschach*

Physics 200. *Electricity, Magnetism, and Atomic Physics.* A course of three lectures and three hours of practical work per week. This course with Physics 100 makes up a complete course on the principles of physics which is required of science-engineering students. In this second course the fundamental principles of electrical theory are explained and illustrated, including the elementary theory of direct and alternating currents, electronics, and electrical theory of matter. The topics of the last eleven weeks are atomic physics, and solid state, and nuclear physics. In the laboratory the students are taught how to make measurements of all the important electrical quantities such as current, resistance, potential, capacity, inductance, magnetic intensity, magnetic properties of iron and steel, electro-chemical equivalents, characteristics of triodes; other experiments include measurements of radiations from radioactive elements. Students taking Physics 200 must have completed Mathematics 100 and must take Mathematics 200 or 210 at the same time as Physics 200.
(3–3–8) *Messrs. Bonner, Class, Prosser, Schiffer, Sapp, G. Phillips and Risser*

Physics 300. *Intermediate Electricity and Electronics.* Electrostatics. Elements of vector analysis. D.C. and A.C. circuits. Inductance. Capacity. Thermionic vacuum tubes and vacuum tube circuits. Transmission lines. Ultra-highfrequency techniques. Three hours of laboratory weekly during the first semester only.
(3–1½–7) *Mr. Class*

Physics 310. *Atomic and Nuclear Physics.* Outline of the principal experiments upon which the quantum theory is based. Particle-like properties of light and other electromagnetic radiation. Wave-like and particle-like properties of the electron. Optical spectra and energy levels. X-rays. Radioactivity. Properties and spectra of alpha, beta, and gamma rays. Elementary facts of nuclear structure. Three hours of laboratory weekly during the second semester only.
(3–1½–7) *Mr. Risser*

Physics 400. *Introduction to Mathematical Physics.* A systematic review of the principal subjects in mechanics and electrodynamics. Mathematical methods, including differential equations and vector analysis, will be applied to the solution of problems in particle dynamics, vibrating systems, dynamics of rigid bodies, electrostatics, magnetostatics, and the electromagnetic field. Three class hours and two problem hours per week.
(3–2–7) *Mr. Houston*

Physics 410. (a) *Vibration and Sound.* Forced oscillations, resonance, and complex motional impedance. Waves on a string and a membrane. Sound waves. Acoustic impedance. Horns, speakers, microphones.

(b) *Physical Optics.* Electromagnetic waves, boundary conditions at dielectic interface, polarization, refraction, interference, diffraction. Optical instruments. Electromagnetic radiation from a dipole. Heat radiation.
(3–3–8) *Mr. Squire*

Physics 430. *Special Problems.* Especially qualified students can occasionally arrange with a member of the faculty to carry on reading or experimental study of a minor research problem. Credit will depend on the work accomplished.

Physics 440. *Physics Colloquium.* One meeting a week at which present-day researches in physics will be discussed.

Physics 510a. *Advanced Dynamics.* The general equations of analytical dynamics. Orbit theory and the central force problem. The kinematics of rigid bodies. Canonical transformations. Hamilton-Jacobi theory.
(3–0–3) *Mr. Heaps*

Physics 520. *Principles of Quantum Mechanics.* A deductive presentation of the principles of quantum mechanics with applications to various problems in spectroscopy, collisions of atomic particles, molecular binding, etc.
(3–0–6) *Mr. Houston*

Physics 530. *Electromagnetic Theory.* Electrostatics, magnetostatics, boundary value problems, stress-energy relations; electromagnetic wave equations, Lienard-Wiechert potentials, multiple fields, radiation; special relativity, radiation from accelerated charges.
(3–0–6) *Mr. Biedenharn*

Physics 540. *Nuclear Physics.* Radioactivity; alpha, beta, and gamma radiations and their interaction with matter; properties of nuclei; theory of nuclear structure; nuclear magnetic moments and spins; beta disintegrations; artificial disintegration of nuclei; nuclear scattering; mesons; fission; cosmic rays.
(3–0–6) *Mr. Bonner*

Physics 550. *Special and General Theories of Relativity.*
(2–0–4) *Mr. Wilson*

Physics 560. *Structure of Solids.* A review of the structure and vibration of crystals, and the motions of electrons in them, based on quantum mechanics.
(3–0–6) *Mr. Houston*

Physics 570. *Low-temperature Physics.* Production and measurement of extremely low temperatures. Properties of liquid helium. Superconductivity. Magnetism and low temperatures. Specific heats. Recently published research. Laboratory techniques and participation in research problems (Physics 590).
(3–0–6) *Mr. Squire*

Physics 580. *Physics Colloquium.* One meeting a week at which results of researches in physics will be discussed.
(1–0–2) *Staff*

Physics 590. *Research Work.*

Physics 600. *Special Topics in Solid State Physics.*
(2–0–4) *Mr. Houston*

Physics 610. *Neutron and Reactor Physics.* Fundamental properties of the neutron: mass, magnetic moment, interaction with the proton, etc. Interaction with nuclei. Sources and detectors. Interaction with matter in bulk: slowing down and diffusion. Nuclear chain reactions. Magnetic scattering and polarization. Neutron diffraction.
(3–0–6) *Mr. Risser*

Physics 620. *Theoretical Nuclear Physics.* General nuclear properties, two-body problems, scattering, nuclear spectroscopy, nuclear reaction, interaction of nuclei with electro-magnetic and electron-neutrino fields, nuclear shell theory.
(3–0–6) *Mr. Biedenharn*

Physics 700. *Summer Graduate Research.* Open only to students already admitted as candidates for an advanced degree. At least forty hours of laboratory work per week.

Psychology

Psychology 210a. *General Psychology.* Psychological studies of human behavior are examined to show the interdependence of theory, method and data in scientific inquiry in the behavioral sciences. (Note that this is a first semester course; it must be followed by Psychology 210b.)
(3–0–3) *Mr. Walker*

Psychology 210b. *Elementary Statistics.* An introduction to the theories and techniques of the statistical method as applied to problems in psychological research. The course will be concerned with means of describing distribution of scores and measures, the normal curve and probabilities, sampling and statistical inference, and correlation.
(3–0–3) *Mr. Wann*

Psychology 300. (a) *General Psychology.* Psychological studies of human behavior are examined to show the interdependence of theory, method, and data in scientific inquiry in the behavioral sciences.

(b) *Culture and the Individual.* The view of science presented in the first semester is elaborated further in a systematic consideration of several alternative conceptions of the relations between the individual and his cultural environment.
(3–0–6) *Mr. Walker*

Psychology 310a. *Advanced Statistics.* More advanced correlational techniques, frequency comparisons, small sample methods, analysis of variance, and further consideration of sampling and statistical inference. Prerequisite: Psychology 210a and 210b.
(3–0–3) *Mr. Wann*

Psychology 310b. *History and Systems.* This course reviews the history of Western scientific psychology and the development of systems in psychological theory. Prerequisite: Psychology 210a and 210b.
(3–0–3) *Mr. Hudson*

Psychology 320. *Language and Thought.* An examination of language and thought from the perspectives of psychology, linguistics, cultural anthropology, and philosophy. Prerequisite: Psychology 210a and 210b, or 300.
(3–0–6) *Mr. Walker*

Psychology 330. (a) *Differential Psychology.* This course is designed to familiarize the student with the techniques for measuring individual differences. Critical reviews will be made of various theories of individual differences in intelligence and personality.
Mr. Wann

(b) *Personality.* Selections from the literature on personality are analyzed and compared.
Prerequisite: Psychology 210a and 210b.
(3–0–6) *Mr. Walker*

Psychology 400. *Experimental Psychology.* This course is an introduction to experimental methods in psychological research, presented in the context of its historical antecedents and interpreted in terms of modern psychological theory. In lectures, and

in laboratory experiments and demonstrations, psychological concepts and methods will be developed and examined experimentally. Prerequisite: Psychology 210a and 210b.
(2–4–6) *Mr. Hudson*

Psychology 410. (a) *Developmental Psychology.* The year course presents three major topics: adolescence, comparative social psychology, and theories and problems of social psychology. The first semester is designed to acquaint the student, from the point of view of adolescence, with the physical, social, and emotional processes that go into the making of an adult.

Mr. Wann

(b) *Social Psychology.* The second semester is a continuation of the above topics, giving greater emphasis to social processes. These are viewed from the vantage point of comparative social psychology and the wide varieties of behaviors possible for human beings; and from the points of view provided by alternative theories.

Prerequisite: Psychology 210a and 210b, or 300.
(3–0–6) *Mr. Wann*

Psychology 450. *Introduction to Research.* An introduction to research for the well-qualified upper-division student in which, under the direction of a member of the staff, a minor research problem will be undertaken. Prerequisites: Psychology 210a and 210b, 310a and 310b, 320, and 330. Hours and credit to be arranged.

Staff

Romance Languages

French 100. *First-year French.* Oral exercises, dictation, grammar, composition and study of French texts.
(3–0–6)

French 200. *Second-year French.* Oral exercises, dictation, review of grammar, composition, study of representative authors, and supplementary reading under the supervision of the instructor.
(3–0–6)

French 300. *Third-year French.* Composition and study of modern French texts. A considerable amount of outside reading will be required. Reports and essays in French.
(3–0–6)

French 320. *Main Currents in French Literature from the Beginnings to 1685.* The Middle Ages, the Renaissance, the seventeenth century.
(3–0–6)

French 400. *French Civilization.*
(3–0–6)

French 420a. *Eighteenth Century Literature.* Alternates with French 420b.
(3–0–3)

French 420b. *Nineteenth Century Literature.* Alternates with French 420a.
(3–0–3)

French 470. *The French Novel.* Alternates with French 490.
(3–0–6)

French 490. *The Contemporary French Drama.* Alternates with French 470.
(3–0–6)

French 500. *Main Currents in French, Italian, and Spanish Literatures.* Alternates with French 510.
(3–0–6)

French 510. *Methods of Research and French Literary Criticism.* Alternates with French 500.
(3–0–6)

French 520. *French Classicism.*
(3–0–6)

French 530. *The Development of French Thought in the Eighteenth Century.* Alternates with French 540.
(3–0–6)

French 540. *Franco-British Literary Relations from 1700 to 1850.* Alternates with French 530.
(3–0–6)

French 550. *The French Romantic Movement.* Alternates with French 560.
(3–0–6)

French 560. *The Evolution of French Poetry from Baudelaire to Valéry.* Alternates with French 550.
(3–0–6)

French 570. *Studies in the French Drama.* Alternates with French 580.
(3–0–6)

French 580. *The Contemporary French Novel.* Alternates with French 570.
(3–0–6)

French 590. *A Study of the Development of Realism in the French Novel between 1830 and 1900:* Stendhal, Balzac, Flaubert, Maupassant.
(3–0–6)

Italian 100. *Elementary Italian.* Open to students who have had at least two years of French, Spanish, or Latin. Oral exercises, grammar, composition, and reading of representative Italian authors. Alternates with Italian 480.
(3–0–6)

Italian 480. *Masters of Italian Literature.* Alternates with Italian 100.
(3–0–6)

Italian 490. *Dante.*
(3–0–6)

Spanish 100. *First-year Spanish.* Oral exercises, grammar, composition, and study of elementary Spanish texts.
(3–0–6)

Spanish 200. *Second-year Spanish.* Oral exercises, dictation, grammar, composition, translation, and study of modern Spanish texts. Open to students who have had two years of high school Spanish or Spanish 100.
(3–0–6)

Spanish 300. *Third-year Spanish.* Review of grammar, composition, essays, study of representative authors, collateral readings, and reports. Conducted in Spanish.
(3–0–6)

Spanish 320. *A Survey of the History of Spanish Literature.*
(3–0–6)

Spanish 410. *Hispano-American Life and Civilization.* A general survey of the conditions in Spain and in Latin-American countries. Open to students who have already taken Spanish 300 or 320.
(3–0–6)

Spanish 440. *The Spanish Drama of the Golden Age.* Alternates with Spanish 450.
(3–0–6)

Spanish 450. *The Spanish Novel.* Major novelists of the eighteenth, nineteenth, and twentieth centuries. Alternates with Spanish 440.
(3–0–6)

Russian

Russian 100. *Elementary Russian.*
(3–0–6) *Mr. Jitkoff*

Russian 200. *Grammar and Literature.*
(3–0–6) *Mr. Jitkoff*

Sociology: *see* Economics, Business Administration, and Sociology.

Spanish: *see* Romance Languages

COURSES IN NAVAL SCIENCE

The department of naval science at the Rice Institute was established in the fall of 1941 and is an integral part of the organization of the Institute. It is administered by a U. S. Naval Officer designated as the Professor of Naval Science. He is assisted in his administrative and instructional duties by officers and men of the U. S. Navy and Marine Corps.

The mission of the Naval Reserve Officers' Training Corps is to provide, by a permanent system of training and instruction in essential naval subjects at civil educational institutions, a source from which qualified officers may be obtained for the U. S. Navy and the U. S. Marine Corps, and the U. S. Naval Reserve and U. S. Marine Corps Reserve.

The N.R.O.T.C. program provides opportunities for fully qualified and selected young men within prescribed quotas to obtain commissions in either the Navy or Marine Corps for active or inactive duty upon graduation from college. There are two categories of N.R.O.T.C. Students: (1) Regular; (2) Contract.

Regular Students

A regular N.R.O.T.C. Student is appointed a Midshipman, U.S. Naval Reserve, and receives retainer pay at the rate of six hundred dollars per year for a maximum of four years, with all fees, books, and equipment paid for by the government. Required uniforms are furnished. He is required to complete twenty-four semester hours of naval science subjects (one course per term) and other training prescribed during the summer months, and upon graduation with a baccalaureate degree to accept a commission as Ensign in the U. S. Navy or Second Lieutenant in the

U. S. Marine Corps, if offered, and serve on active duty for a period of three years unless sooner released by the Secretary of the Navy. He may remain as a career officer in the Regular Navy or Marine Corps. In the event of termination of such a commission, the N.R.O.T.C. Student must agree to accept a commission in the organized United States Naval Reserve, or Marine Corps Reserve, and not to resign from that Reserve prior to the sixth anniversary of the date of rank stated in his original commission in the U. S. Navy or Marine Corps.

Appointments as Midshipman, U. S. Naval Reserve, are made on a nation-wide competitive basis. Information bulletins and application blanks concerning this part of the N.R.O.T.C. program are distributed in the fall to the deans of all accredited colleges and universities, principals of high schools, professors of naval science, and offices of naval officer procurement throughout the United States. Candidates for selection as Regular N.R.O.T.C. Students are to be notified of their status by the Bureau of Personnel of the Navy Department in the spring.

Students certified by the Navy Department as fulfilling all the requirements for appointment as Midshipman, U. S. Naval Reserve, will be considered for admission to the Rice Institute in accordance with established policies and procedures which are applicable to other students on the same competitive basis. Those admitted will be within quotas of students as may be prescribed for the Rice Institute and the N.R.O.T.C. Units.

Selection by the Navy as a Regular N.R.O.T.C. Student does not give any special rights or privileges to the selectee not common to any other student applying for admission to the institution. It is the responsibility of the selectee to apply for and gain admission to the school of his choice.

Contract Students

A Contract Student is not entitled to the compensation and benefits paid Regular N.R.O.T.C. Students except that necessary uniforms are issued and naval science textbooks are provided. During the final two years of college, commutation of subsistence is furnished, currently at the rate of ninety cents per day.

The Contract Student is required to complete twenty-four semester hours of naval science subjects (one course per term) and to participate in only one summer training period of about six weeks' duration. Upon graduation with a baccalaureate degree and satisfaction of the Naval Training requirements, he is required to accept a commission, if offered, in the U. S. Naval Reserve or Marine Corps Reserve. Contingent upon the needs of the service he is required to accept a commission in the U. S. Naval Reserve or the U. S. Marine Corps Reserve and to serve on active duty for a period of two years unless sooner released by the Secretary of the Navy. However, if he desires, and if his services are needed, he may apply for a commission in the U. S. Navy, and if accepted, be entitled to the same benefits and options of service as a Regular Student.

Applications for enrollment as Contract Students and additional information may be obtained upon request from the Professor of Naval Science at the Rice Institute.

U. S. Marine Corps

N.R.O.T.C. Students, either Regular or Contract, may apply for transfer to the Marine Corps during the second term of the Sophomore year. Those selected will complete twelve semester hours of the Marine Corps Curriculum in lieu of the naval science courses prescribed for Navy officer candidates.

Other Pertinent Information

Students enrolled in the N.R.O.T.C. are required to provide their own board and lodging and may live wherever they choose.

Military control over N.R.O.T.C. Students is limited to the time that the students are under Navy instruction. This is less than one hour per day during the college year.

Any student dropped by the Rice Institute for academic failure or other cause shall be immediately disenrolled from the N.R.O.T.C. Any student performing unsatisfactory work in naval science courses, or lacking satisfactory officer-like qualities, may be disenrolled from N.R.O.T.C. regardless of the quality of his other academic work.

Students taking five-year courses are considered eligible for enrollment at the beginning of either their first or second year. Students enrolling the first year will be placed in a leave status, without compensation, during the fifth year. While in this status they will not take naval science courses. Upon completion of their fifth academic year and the granting of the baccalaureate degree, they will be commissioned at the same time and in the same manner as other N.R.O.T.C. students who have completed a normal four-year course.

Students who have completed one year of college work are eligible, provided that they agree to take subjects that will require four years to complete from date of enrollment in the N.R.O.T.C.

Enrollment in the N.R.O.T.C. program at the Rice Institute is made at the beginning of the fall term only.

Eligibility Requirements

To be eligible for either category of N.R.O.T.C. Students (Regular or Contract), a candidate must:

(a) Be a male citizen of the United States.
(b) Have reached the seventeenth anniversary of his birth for regular students and sixteenth for contract students, and not have passed the twenty-first anniversary of his birth on July 1 following the September of enrollment, unless contemplating undertaking a college course which takes five years to complete, in which case he shall not have passed the twentieth anniversary of his birth on July 1 following the September of enrollment.
(c) Be eligible for admission to the Rice Institute in accordance with its entrance requirements.
(d) If a minor, have the consent of his parents or guardian at the time of his enrollment.
(e) Agree to accept a commission in the United States Navy or Marine Corps or the Reserves thereof, if offered; and if the commission is in the Regular Navy or Marine Corps and is terminated after three years of active duty, to accept a commission in the organized Reserves and thereafter not to resign before the sixth anniversary of the date of rank of his original commission.
(f) Be unmarried, never have been married, and agree to remain unmarried until commissioned.
(g) Be physically qualified:
    (1) Be physically sound and well formed, and have a robust constitution.
    (2) Vision 20/20 each eye uncorrected.

(3) Heart, lungs, hearing normal.
(4) Height 64 to 78 inches.
(5) Weight in proportion to height.
(6) Sixteen vital serviceable teeth with a minimum of 8 in each arch.

Course of Training

The N.R.O.T.C. course of training consists of those courses, practice periods, and exercises prescribed by the Navy Standardized Curriculum currently in effect, together with such training duty or training cruises as may be prescribed. A Midshipman (Regular or Contract N.R.O.T.C. Student) pursuing a normal four-year college course will be required to carry a minimum of one naval science course per semester unless otherwise authorized by the Professor of Naval Science.

Naval science courses as described below will be taken in succession, as listed:

Naval Science 101 (first half-year). *Naval History and Orientation.* History of sea power, with emphasis on the history of the United States Navy. Presents a brief description of the traditions, customs, mission, and organization of the navy.
(3–2–3)

Naval Science 102 (second half-year). *Naval History and Orientation.* Continues History of Sea Power. Basic seamanship. Types and characteristics of naval vessels.
(3–2–3)

Naval Science 201 (first half-year). *Naval Weapons.* Introduction to naval weapons. Ammunition. Gun assemblies. Major and intermediate caliber installations. Antiaircraft and surface fire control systems.
(3–2–3)

Naval Science 202 (second half-year). *Naval Weapons.* Fire control systems. Sonar systems. Basic principles of radar. Combat Information Center. Shore bombardment. Guided missiles. Antisubmarine warfare.
(3–2–3)

Naval Science 301 (first half-year). *Naval Machinery, Diesel Engines, Damage Control and Ship Stability.* Introduction to naval machinery. Feed water systems. Fittings. Fuel oil systems. Distilling plants. Auxiliary machinery. Main propulsion. Diesel engines. Accessories and controls. Hull design and warship construction. Piping systems. Stability characteristics. Effect of weight shifts and flooding. Repair of damage.
(3–2–3)

Naval Science 302 (second half-year). *Navigation.* Magnetic and gyrocompasses. The navigator's work at sea. Motion of celestial bodies. Time. The sextant. Observations for position.
(3–2–3)

Naval Science 401 (first half-year). *Naval Operations.* Fleet organization. Surface and air operations. Anti-submarine warfare. Mine warfare. Amphibious warfare. Logistics. Communications.
(3–2–3)

Naval Science 402 (second half-year). *Naval Administration.* Naval administration and organization. Uniform code of Military Justice. Leadership.
(3–2–3)

N.R.O.T.C. Students who desire to be commissioned as Second Lieutenants in the U. S. Marine Corps or Marine Corps Reserve, and whose applications for transfer are accepted, will substitute the following courses during the final two years:

Naval Science 301M (first half-year). *Evolution of the Art of War.* Significance of military power. Classic principles of war, analyzed as a foundation for further understanding of military operations by a study of famous battles.
(3–2–3)

Naval Science 302M (second half-year). *Modern Basic Strategy and Tactics.* Basic strategic concepts and principles of offensive and defensive tactics through the battalion level.
(3–2–3)

Naval Science 401M (first half-year). *Amphibious Warfare.* History of amphibious warfare. Development of amphibious tactics. Gunfire support. Planning. Logistics. Administration. (3–2–3)

Naval Science 402M *(second half-year). Marine Corps, Leadership, and the Uniform Code of Military Justice.* Development of leadership techniques through a study of the basic psychology of leadership. Uniform Code of Military Justice. (3–2–3)

The Navy Standardized Curriculum presently in effect prescribes additional course requirements for N.R.O.T.C. Students as follows:

1. By the end of the Sophomore year every student must have satisfactorily completed one year of college physics.

2. By the end of the Sophomore year every student must have satisfactorily completed mathematics courses through trigonometry.

3. Every student must achieve proficiency in written and oral expression. The Rice Institute will prescribe standards of proficiency and determine procedures necessary to achieve them.

4. Physical training and swimming requirements also are prescribed.

Special arrangements may be made for certain modifications of any curriculum leading to a bachelor's degree, in order that the required courses in naval science may be taken.

COURSES IN MILITARY SCIENCE

The mission of the Army Reserve Officers' Training Corps is to train college students as junior officers having the attributes essential to their professional development in a component of the United States Army, particularly in the Reserve components, i.e., the Organized Reserve Corps and the National Guard. The R.O.T.C. also provides a major source of procurement of junior officers for the Regular Army through the recurring selection of

a number of distinguished military graduates from senior units for direct Regular Army appointment.

The Army R.O.T.C. offers a four-year program consisting of two main subdivisions: the Basic Course and the Advanced Course. Students electing the R.O.T.C. do so for only two years at a time. The first election is for the two-year Basic Course, after which, if the student is recommended for further training, he may elect the Advanced Course. This training, once entered upon by the student, is, under the terms of his contract, a required part of his course. No contract is executed between the government and student admitted to the Basic Course.

The Basic Course is the course of study normally pursued by the student during his Freshman and Sophomore academic years. The Basic Course consists of a minimum of three hours per week of formal instruction of a general type applicable to the Army as a whole and not specialized by arm or service.

The Advanced Course consists of a minimum of five hours per week of formal military instruction, specializing in Corps of Engineers subjects. Completion of the Basic Course is a prerequisite to admission to the Advanced Course. Advanced Course students are required to attend one summer camp, which normally comes between the Junior and Senior years. This camp consists of practical and theoretical military instruction principally specializing in Corps of Engineers functions.

Students enrolled in the Basic Course are furnished military textbooks and uniforms. Students enrolled in the Advanced Course are furnished military textbooks and uniforms and receive an allowance for commutation of subsistence, currently at the rate of about $27.00 per month.

The Advanced Course student, upon successful completion of the four-year R.O.T.C. program and graduation with a baccalaureate degree, may be given a commission in the Organized Reserve Corps. An active duty period of from six months to two years is currently required to fulfill the requirements of the deferment given to the student under the provision of the Selective Service Act. Distinguished military graduates may be offered commissions in the Regular Army. Those accepting will enter the Regular Army in the grade of Second Lieutenant.

Pertinent Information

Uniforms are worn to each drill period and at such other times as may be prescribed. At all other times civilian clothing is worn.

Military control over A.R.O.T.C. students is limited to the time that the students are under Army instruction.

Any student dropped by the Rice Institute for academic failure or other cause shall be immediately disenrolled from the A.R.O.T.C. Any student performing unsatisfactory work in military science courses, or possessing unsatisfactory officer-like qualities, may be disenrolled from the A.R.O.T.C. regardless of the quality of his academic work.

Students taking five-year courses are considered eligible for enrollment at the beginning of their first or second year.

Enrollment in the A.R.O.T.C. program at the Rice Institute is made at the beginning of the fall term only.

Eligibility Requirements

To be eligible for the A.R.O.T.C., a candidate must:

1. Basic Course
   (a) Be a male citizen of the United States.
   (b) Be not less than 14 or over 23 years of age.
   (c) Be physically qualified:
      (1) Be physically sound and well formed, and have a robust constitution.
      (2) Vision 20/100 each eye corrected to 20/20 in one eye and 20/30 in the other eye. (Waiver may be granted for uncorrected visual defects in excess of this requirement.)
      (3) Heart, lungs, hearing normal.
      (4) Height 60 to 78 inches.
      (5) Weight in proportion to height.
   (d) Be acceptable to the Rice Institute as a regularly enrolled student.
   (e) Be qualified morally.
   (f) If entering the first-year Basic Course have at least three academic years remaining in his course of study.
2. Advanced Course
   (a) Be not over 27 years of age.
   (b) Be physically qualified.
   (c) Be morally qualified.
   (d) Be enrolled in any academic course leading to an engineering, technical, or other scientific degree. However, certain well-qualified students may be selected for the Advanced Course regardless of the course of study.
   (e) Complete such survey and general screening tests as may be prescribed.

(f) Be selected by the Professor of Military Science and Tactics and the head of the Rice Institute.
(g) Have completed the Basic Course or have received credit in lieu thereof.
(h) Must execute a contract agreeing to complete the Advanced Course at the Rice Institute or at any other institution he may transfer to if such a course is offered, to devote five hours a week during the Advanced Course to the military training prescribed, and to pursue the courses of camp training prescribed by the Secretary of the Army.

Course of Instruction

The A.R.O.T.C. course of training consists of those courses, practice periods, and exercises prescribed by the Army Program of Instruction for Military and Civilian Colleges currently in effect, together with such training camps as may be prescribed. Military science courses as described below will be taken in succession, as listed:

Military Science 101 (first half-year). *Orientation.* Military Organization. Introduction to weapons to include marksmanship.

Military Science 102 (second half-year). *Military History.* History of land operations, with emphasis on the history of the United States Army.

Military Science 201 (first half-year). *Military Techniques.* Map and Aerial Photograph Interpretation. Introduction to crew served weapons.

Military Science 202 (second half-year). *Military Tactics.* Gunnery and Small Unit Tactics.

Military Science 301 (first half-year). *Military Engineering Techniques.* Military Leadership. Military Explosives and Mine Warfare. Construction Materials and Elementary Military Construction.

Military Science 302 (second half-year). *Military Engineering Techniques.* Military Teaching Methods. Military Structures. Field Construction Procedures.

Military Science 401 (first half-year). *Military Administration and Logistics.* Military Administration, Personnel Management. Supply, Evacuation, and Utilities.

Military Science 402 (second half-year). *Engineer Operations.* Construction of roads and airfields. Offensive and Denial Operations. River Crossing Operations, etc.

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