



Reprinted by
General Superintendent
1910-11

Academic Calendar 1978-1979

First Semester

<i>Monday, August 14</i>	Last day for payment of fees for continuing students
<i>Monday, August 21-</i> <i>Saturday, August 26</i>	Arrival and orientation week for new students and new transfers
<i>Saturday, August 26 and</i> <i>Sunday, August 27</i>	Arrival of continuing students
<i>Monday, August 28</i>	First day of classes
<i>Monday, September 4</i>	Labor Day holiday
<i>Friday, September 8</i>	Final registration for undergraduates and candidates for B.Arch. and B.F.A. degrees, fall semester, 5 p.m.
<i>Friday, September 22</i>	Deadline for adding courses to schedule and for designating Pass/Fail, 5 p.m.
<i>Friday, September 29</i>	Deadline for removal of Incompletes, 5 p.m.
<i>Wednesday, October 11</i>	Last day to file college course plans with the Dean of Undergraduate Affairs
<i>Thursday, October 12 and</i> <i>Friday, October 13</i>	Midterm recess
<i>Wednesday, November 1</i>	Deadline for Ph.D. candidacy petitions, Office of the Dean of Advanced Studies and Research, 5 p.m.
<i>Friday, November 3</i>	Deadline for dropping courses or converting Pass/Fail options to a number grade, 5 p.m.
<i>Thursday, November 23-</i> <i>Sunday, November 26</i>	Thanksgiving recess
<i>Friday, December 8</i>	Last day of classes
<i>Wednesday, December 13</i>	First day of final examinations
<i>Wednesday, December 20</i>	Last day of final examinations
<i>Wednesday, December 27</i>	All grades due, Registrar's Office, 12 noon

Second Semester

<i>Monday, January 8</i>	First day of classes
<i>Friday, January 19</i>	Final registration for undergraduates and candidates for B.Arch. and B.F.A. degrees, spring semester, 5 p.m.
<i>Friday, February 2</i>	Deadline for adding courses to schedule and designating Pass/Fail, 5 p.m.
<i>Friday, February 9</i>	Deadline for removal of Incompletes, 5 p.m.
<i>Tuesday, February 13</i>	Majors Day for freshmen and sophomores
<i>Friday, February 23</i>	Last day to file college course plans with the Dean of Undergraduate Affairs
<i>Monday, February 26-</i> <i>Sunday, March 4</i>	Midterm recess
<i>Thursday, March 1</i>	Deadline for Master's Degree petitions, Office of the Dean of Advanced Studies and Research, 5 p.m.
<i>Saturday, March 17</i>	Parents Day
<i>Friday, March 23</i>	Deadline for dropping courses and for converting Pass/Fail options to a number grade, 5 p.m.
<i>Thursday, April 12-</i> <i>Sunday, April 15</i>	Easter recess
<i>Friday, April 27</i>	Last day of classes
<i>Saturday, April 28-</i> <i>Thursday, May 3</i>	Final examinations for graduating seniors and 5th year degree candidates
<i>Wednesday, May 2</i>	First day of final examinations for remaining students
<i>Friday, May 4</i>	Deadline for submission of theses for spring graduation, Office of the Dean of Advanced Studies and Research, 12 noon
<i>Monday, May 7</i>	Grades of all degree candidates due in Registrar's Office, 9 a.m.
<i>Wednesday, May 9</i>	Last day of final examinations
<i>Saturday, May 12</i>	Sixty-sixth Commencement
<i>Tuesday, May 15</i>	Deadline for filing undergraduate degree plans
<i>Wednesday, May 16</i>	Remaining grades due, Registrar's Office, 5 p.m.

Summer, 1979

<i>June-July</i>	Rice summer program for college students
<i>June-July</i>	Teaching Apprentice Session

Rice University
General Announcements
Houston, Texas

1978-1979

Offices to contact for additional information:

Mailing Address: Rice University, Post Office Box 1892, Houston, Texas 77001
Location: 6100 South Main, Houston, Texas
Telephone: Area Code 713, 527-8101

Please address all correspondence to the appropriate office or department followed by the university mailing address given above.

Admission, Catalogs, Applications	Office of Admissions 109 Lovett Hall; (713) 527-4036
Business Matters	Office of the Cashier 110 Allen Center; (713) 527-4946
Career Placement, Part-time Employment Off Campus	Placement Office 301 Lovett Hall; (713) 527-4055
Continuing Education	Office of Continuing Studies 315 Lovett Hall; (713) 527-4803
Credits, Transcripts	Office of the Registrar 103 Lovett Hall; (713) 527-4999
Financial Aid, Scholarships, Part-time Employment on Campus	Financial Aid Office 201 Lovett Hall; (713) 527-4958
Graduate Study	Chairman of the Appropriate Department
Housing for Undergraduates	Office of Admissions 109 Lovett Hall; (713) 527-4036
Undergraduate Students, Undergraduate Curricula	Dean of Undergraduate Affairs 101 Lovett Hall; (713) 527-4996

William Marsh Rice University admits students of any race, color, and national or ethnic origin.

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The University and the Campus

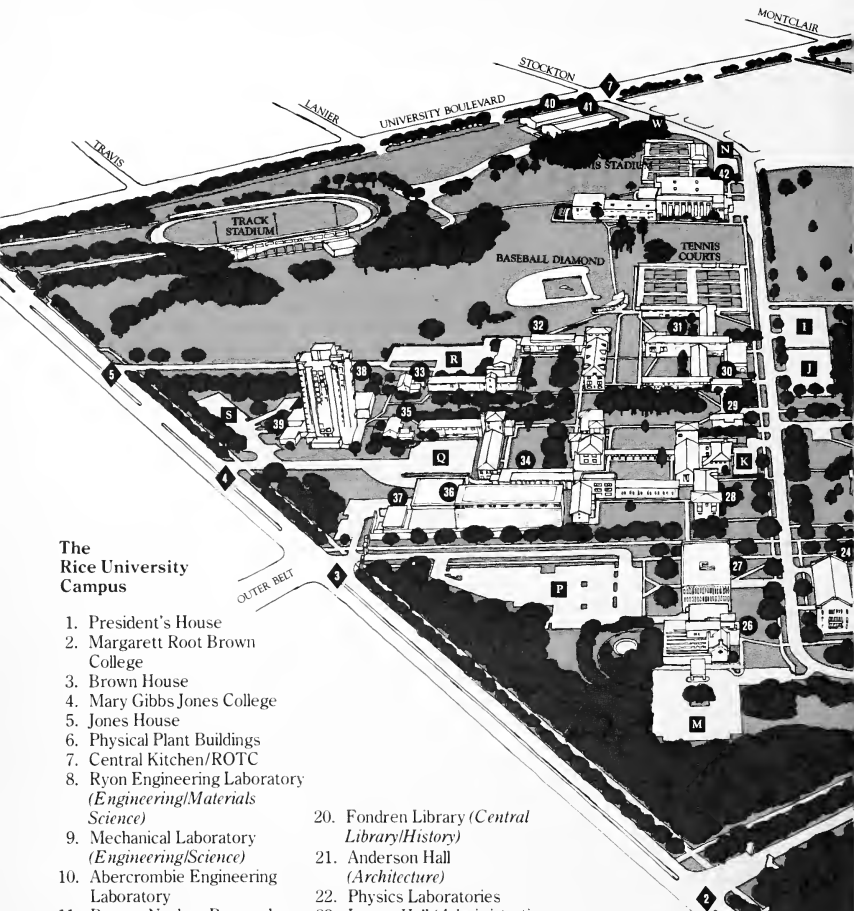
Dedicated to “the advancement of letters, science, and art,” Rice University is private, independent, nonsectarian, and coeducational. It includes among its academic divisions both undergraduate and graduate studies in humanities, social sciences, natural sciences, engineering, architecture, administrative sciences, and music.

Highly talented students with diverse interests are attracted to Rice by the opportunities for creative learning. They encounter rewarding student-faculty relationships, options for individually tailored programs of study, independent research, cooperative activities with other institutions in the nation’s fifth largest city, and the unique experience of residential colleges.

The majority of Rice’s 2700 undergraduate students live on campus in the eight residential colleges. The colleges have independent student governments, plan social functions, field intramural teams, and sponsor innovative academic courses, visiting distinguished speakers, plays, and other functions. In each college the college master and approximately eighteen faculty associates act as advisers and mentors to the students. This system provides students and faculty with a style of living in keeping with the tenets of fine education.

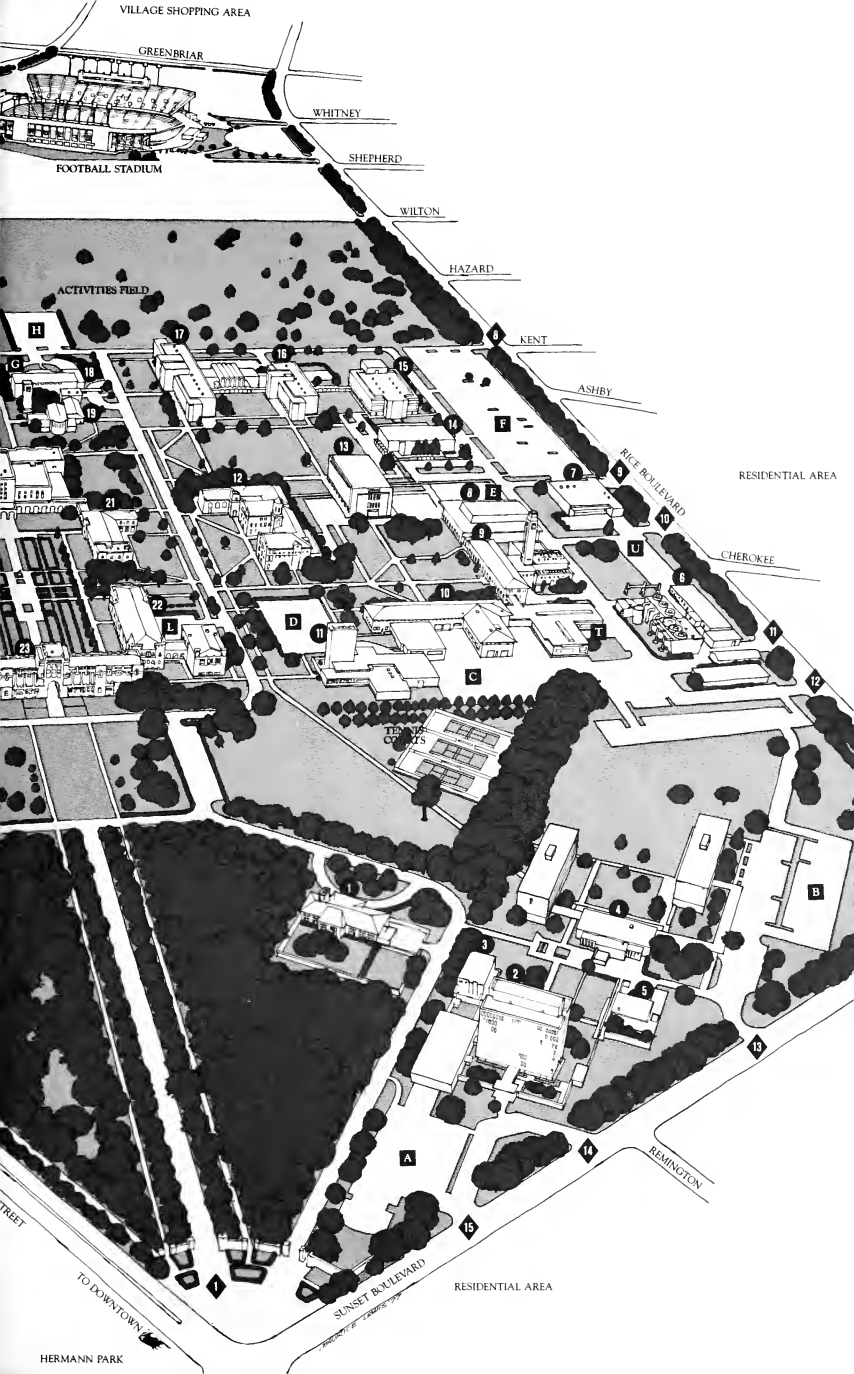
Rice’s approximately 900 graduate students work closely with faculty members who are eminent in their fields and conduct innovative research to extend the horizons of current knowledge. Graduate students live off campus. The Graduate Student Association organizes and funds regular social activities and provides graduate students with a separate organization to represent their interests within the university.

A look through the archway of Lovett Hall shows even the casual visitor why the 300-acre Rice campus is widely acclaimed for its dignified yet casual beauty. Approximately forty permanent buildings are conveniently grouped in quadrangles under graceful live oak trees. The city’s largest stadium, the 972,000-volume Fondren Library, the Media Center, the gymnasium, the computer center, drama and musical presentations make Rice “behind the hedges” a community unto itself. Yet only three miles from downtown Houston, Rice students enjoy all the academic, government, business, shopping, entertainment, and cultural advantages of a major metropolitan center.



The Rice University Campus

1. President's House
2. Margaret Root Brown College
3. Brown House
4. Mary Gibbs Jones College
5. Jones House
6. Physical Plant Buildings
7. Central Kitchen/ROTC
8. Ryon Engineering Laboratory (*Engineering/Materials Science*)
9. Mechanical Laboratory (*Engineering/Science*)
10. Abercrombie Engineering Laboratory
11. Bonner Nuclear Research Laboratory
12. Chemistry Building
13. Herman Brown Hall (*Math/Math Science ICSA Accounting/Administrative Science*)
14. Hamman Hall (*Auditorium*)
15. Space Science Building
16. Keith-Wiess Geological Laboratories
17. Anderson Biological Laboratories
18. Rice Memorial Center (*Student activities/Plub Sammy's/Campus Store and Bookstore/Band Hall*)
19. Rice Chapel
20. Fondren Library (*Central Library/History*)
21. Anderson Hall (*Architecture*)
22. Physics Laboratories
23. Lovett Hall (*Administrative offices/Admissions/Records/Religious Studies/Philosophy*)
24. Sewall Hall (*Art/Music/Social Sciences NROTC Education*)
25. Rayzor Hall (*English/Foreign Languages/Linguistics*)
26. Cohen House (*Faculty Club*)
27. Allen Center for Business Activities
28. James A. Baker College
29. Baker House
30. Wiess House
31. Harry C. Wiess College
32. Harry C. Hanszen College
33. Hanszen House
34. Will Rice College
35. Will Rice House
36. Edgar Odell Lovett College
37. Lovett House
38. Sid W. Richardson College
39. Richardson House
40. Rice Museum
41. Rice Media Center (*Photography*)
42. Gymnasium and Autry Court (*Health & PE/Athletics*)
43. Owl Club Room.



VILLAGE SHOPPING AREA

GREENBRIAR

WHITNEY

FOOTBALL STADIUM

SHEPHERD

WILTON

HAZARD

KENT

ASHBY

RICE BOULEVARD

RESIDENTIAL AREA

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* * *

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Administrative Offices

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Affirmative Action	Eva J. Lee
Alumni Association	Carolyn H. Wallace
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Computer Services	Priscilla Huston
Development Office	Margaret S. Alsobrook
Financial Aid	G. David Hunt
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Food and Housing	Marion O. Hicks
Information Services	David H. Rodwell
Personnel	Mitchell O. Sadler
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Registrar	James C. Morehead, Jr.
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Baker College	David Minter
Brown College	Franz R. Brotzen
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Jones College	Ronald F. Stebbings
Lovett College	John W. Freeman
Richardson College	William C. Martin
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Will Rice College	Constantine Armeniades

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Atlantic Richfield Company
Baker International Corporation
Cameron Iron Works, Inc.
Continental Oil Company
E. I. du Pont de Nemours & Company
Exxon Company, U.S.A.
Gulf Oil Corporation
Halliburton Company
Houston Natural Gas Corporation
International Telephone and Telegraph Corporation
Monsanto Company
Pennzoil Company
Procter & Gamble Company
Schlumberger, Limited
Shell Oil Company
Smith International, Inc.
Tapco International
Texaco Inc.
Texas Eastern Corporation
Transco Companies Inc.

Instructional and Research Staff

As of May 1, 1978

Emeritus Faculty

Bale, Allen M. Athletic Director Emeritus

B.S. (Rice) 1936; M.A. (Columbia) 1939

Battista, Joseph Lloyd. Professor Emeritus of Romance

Languages

Certificat d'Études Française (Bordeaux) 1919; Diplôme d'Études Supérieures (Bordeaux) 1919; B.A. (Michigan) 1920; M.A. (Washington University) 1923; M.A. (Harvard) 1929

Bourgeois, Andre Marie Georges. Favrot Professor of French, Emeritus

Bachelier ès Lettres (Paris) 1921; Bachelier en Droit (Paris) 1923; Certifié d'Études Supérieures de Lettres (Paris) 1930; M.A. (University of Texas) 1934; Docteur de l'Université (Paris) 1945; Commandeur de l'Ordre des Palmes Académiques, 1971

Bray, Hubert Evelyn. Professor Emeritus Of Mathematics and Honorary

Associate Emeritus of Jones College

B.A. (Tufts) 1910; M.A. (Harvard) 1916; Ph.D. (Rice) 1918

Bryan, Andrew Bonnell. Lecturer Emeritus in Physics

B.A. (Rice) 1918; M.A. (Rice) 1920; Ph.D (Rice) 1922

Camden, Carroll. Professor Emeritus of English and Honorary Charter

Associate of Hanszen College

A.B. (Centre) 1925; Ph.D. (Iowa) 1930

Cason, Carolyn. Lecturer Emeritus in Dietetics

B.S. (University of Texas) 1934; M.A. (Columbia) 1939

Franklin, Joe L., Jr. Robert A. Welch Professor of Chemistry, Emeritus

B.S. (University of Texas) 1929; M.S. (University of Texas) 1930; Ph.D. (University of Texas) 1934

Freund, (Friedrich Ernst) Max. Professor Emeritus of Germanics

Ph.D. (Leipzig) 1902

Fulton, James Street. Professor Emeritus of Philosophy and Honorary

Master of Will Rice College

B.A. (Vanderbilt) 1925; M.A. (Vanderbilt) 1929; Ph.D. (Cornell) 1934

Gallegly, Joseph S. Professor Emeritus of English

B.A. (Rice) 1925; M.A. (Rice) 1926

Hake, Evelyn. Lecturer Emeritus in Biology

B.A. (Rice) 1930; M.A. (Rice) 1932

Harsook, Arthur J. Professor Emeritus of Chemical Engineering

A.B. (Nebraska Wesleyan) 1911; B.S.Ch.E. (M.I.T.) 1920; M.S. (M.I.T.) 1921

Hermance, Gilbert Leslie. Professor Emeritus of Health and Physical Education

B.S. (Oregon) 1927; M.A. (Columbia) 1930

Hodges, Lee. Professor Emeritus of French

B.S. (Harvard) 1930; M.A. (Rice) 1934

Hudson, Bradford Benedict. Professor Emeritus of Psychology

A.B. (Stanford) 1930; Ph.D. (California) 1947

Jitkoff, Andrew N. Professor Emeritus of Russian

Bachelor (Prague Inst. of Tech.) 1928; Master (Prague Inst. of Tech.) 1931

Russian

- McDonald, A. P.** Professor Emeritus of Engineering Graphics
B.S. (Texas A&M) 1943
- McEnany, Michael Vincent.** Professor Emeritus of Electrical Engineering and Honorary Associate of Will Rice College
B.S.E.E. (Colorado College) 1929; M.A. (Dartmouth) 1931
- Neely, Jess Claiborne.** Athletic Director Emeritus
LL.B. (Vanderbilt) 1924
- Nettleton, Lewis L.** Lecturer Emeritus in Geology
B.S. (Idaho) 1918; M.S. (Wisconsin) 1923; Ph.D. (Wisconsin) 1923
- Richter, George Holmes.** Professor Emeritus of Chemistry
B.A. (Rice) 1926; M.A. (Rice) 1927; Ph.D. (Rice) 1929
- Rossini, Frederick D.** Professor Emeritus of Chemistry
B.S. (Carnegie Inst.) 1925; M.S. (Carnegie Inst.) 1926; Ph.D. (California) 1928
- Shelton, Fred Vernon.** Professor Emeritus of French and Honorary Charter Associate of Hanszen College
B.A. (Rice) 1926; M.A. (Rice) 1928; M.A. (Mexico) 1942; Docteur de l'Universite (Paris) 1963
- Simons, Verne Franklin.** Professor Emeritus of Accounting
A.B. (Kansas) 1923; A.M. (Kansas) 1925
- Thomas, Joe David.** Professor Emeritus of English
Ph.B. (Chicago) 1929; A.M. (Chicago) 1930
- Wadsworth, Philip A.** Professor Emeritus of French
A.B. (Yale) 1935; Ph.D. (Yale) 1939
- Williams, George Guion.** Professor Emeritus of English
B.A. (Rice) 1923; M.A. (Rice) 1925
- Welsh, Hugh Clayton.** Lecturer Emeritus in Biology and Medical Adviser
M.D. (University of Texas) 1923

Faculty

- Adams, John Allan Stewart.** Professor of Geology
Ph.B. (Chicago) 1946; B.S. (Chicago) 1948; M.S. (Chicago) 1949, Ph.D. (Chicago) 1951
- Adams, Thomas M.** Captain, U.S. Army, and Assistant Professor of Military Science
B.S. (Brigham Young University) 1970
- Akers, William Walter.** Professor of Chemical and Environmental Engineering and Vice President for External Affairs
B.S.Ch.E. (Texas Tech) 1943; M.S.Ch.E. (University of Texas) 1944; Ph.D. (Michigan) 1950
- Alcover, Madeleine.** Associate Professor of French
Licence de Lettres Modernes (Bordeaux) 1962; Diplome d'Etudes Superieures (Bordeaux) 1963; Doctorat de Litterature Francaise (Bordeaux) 1965
- Alfrey, Clarence P., Jr.** Adjunct Professor of Biomedical Engineering
B.A. (Rice) 1951; M.D. (Baylor) 1955; Ph.D. (Minnesota) 1966
- Ambler, John S.** Professor of Political Science and Associate of Brown College
B.A. (Willamette) 1953; A.M. (Stanford) 1954; Certificat d'Etudes Politiques (Bordeaux) 1955; Ph.D. (California) 1964
- Anderson, Hugh R.** Professor of Space Physics and Astronomy and Associate of Wiess College
B.A. (Iowa) 1954; M.A. (Iowa) 1958; Ph.D. (California Inst. of Tech.) 1961

- Anderson, John B.** Assistant Professor of Geology and Associate of Hanszen College
B.S. (South Alabama) 1968; M.S. (New Mexico) 1970; Ph.D. (Florida State) 1972
- Ansevin, Krystyna D.** Associate Professor of Biology
B.S. (Jagellonian) 1950; M.S. (Jagellonian) 1950; Ph.D. (Pittsburgh) 1961
- Apple, Max I.** Associate Professor of English
B.A. (Michigan) 1963; M.A. (Stanford) 1965, Ph.D. (Michigan) 1970
- Arbiter, Eric.** Lecturer in Music
B.A. (Oberlin Conservatory) 1972; M.A. (Cleveland Institute of Music) 1973
- Aresu, Bernard.** Assistant Professor of French and Italian and Associate of Baker College
Licence ès Lettres (Université de Montpellier) 1967; Ph.D. (Washington) 1975
- Armeniades, Constantine D.** Professor of Chemical Engineering and Master of Will Rice College
B.S. (Northeastern) 1961; M.S. (Case) 1967; Ph.D. (Case) 1969
- Austin, Walter James.** Professor of Civil Engineering
B.S.C.E. (Rice) 1941; M.S.C.E. (Illinois) 1946; Ph.D. (Illinois) 1949
- Avé Lallemant, Hans Gerhard.** Associate Professor of Geology and Associate of Will Rice College
B.Sc. (Leiden) 1960; M.Sc. (Leiden) 1964; Ph.D. (Leiden) 1967
- Awapara, Jorge.** Professor of Biochemistry
B.S. (Michigan State) 1941; M.S. (Michigan State) 1942; Ph.D. (Southern California) 1947
- Bacon, Thomas.** Lecturer in Music
B.A. (Oakland) 1975
- Badner, Carol Luce.** Lecturer in Art
B.F.A. (Ohio Wesleyan) 1963; M.F.A. (Columbia) 1967
- Baker, Donald Roy.** Professor of Geology and Honorary Associate of Brown College
B.S. (California Inst. of Tech.) 1950; Ph.D. (Princeton) 1955
- Baker, Stephen Denio.** Professor of Physics
B.S. (Duke) 1957; M.S. (Yale) 1959; Ph.D. (Yale) 1963
- Baker, Stewart A.** Associate Professor of English and Master of Wiess College
B.A. (Columbia College) 1960; M.A. (Yale) 1961; Ph.D. (Yale) 1964
- Barker, J. R.** Associate Professor of Health and Physical Education and Associate of Hanszen College
B.S.P.E. (Rice) 1949; M.Ed. (Texas) 1965
- Bartlett, John.** Adjunct Associate Professor of Health Facilities Planning
LL.B. (Iowa) 1961; M.A. (Iowa) 1963; Ph.D. (Iowa) 1970
- Baum, Ernest Roy.** Lecturer in Education
B.A. (Trinity) 1956; M.A. (University of Texas) 1964
- Bavinger, Bill Allen.** Instructor in Architecture
B.A. (Rice) 1973; M.Arch. (Rice) 1976
- Bayazitoglu, Yildiz.** Assistant Professor of Mechanical Engineering
B.S. (Middle East Tech. Univ.) 1967; M.S. (Michigan) 1969; Ph.D. (Michigan) 1974
- Bearden Frank W.** Professor of Health and Physical Education
B.S. (Texas Tech) 1947; M.A. (Columbia) 1949; Ed.D. (Columbia) 1954

- Beatrous, Frank H., Jr.** G.C. Evans Instructor in Mathematics
B.S. (Tulane) 1972; M.S. (Tulane) 1975; Ph.D. (Tulane) 1978
- Beckmann, Herbert W. K.** Professor of Mechanical Engineering
Dipl. Ing. (Hannover) 1944; Dr. Ing. (Hannover) 1957
- Bedient, Philip B.** Assistant Professor of Environmental Engineering and Associate of Lovett College
B.S. (Florida) 1969; M.S. (Florida) 1972; Ph.D. (Florida) 1975
- Bell, Philip W.** Professor of Administrative Science and Associate of Lovett College
B.A. (Princeton) 1947; M.A. (California, Berkeley) 1949; Ph.D. (Princeton) 1954
- Bell, Robert L., Jr.** Adjunct Professor of Psychology
B.A. (Texas Southern) 1953; M.A. (University of Texas) 1955; Ph.D. (University of Texas) 1961
- Bencivenga, Ermanno.** Andrew W. Mellon Instructor in Philosophy
B.A. (University of Milan) 1972; Ph.D. (University of Toronto) 1977
- Benjamin, Don Carlos, Jr.** Lecturer in Religious Studies
B.A. (St. Bonaventure University) 1964; M.A. (Catholic University) 1968
- Berthier, Anne Marie Francoise.** Visiting Associate Professor of Mathematics
Diplome d'Etudes (Paris) 1972; Supérieures de Philosophie (Paris) 1973; Ph.D. (Paris) 1975
- Besen, Stanley M.** Professor of Economics
B.B.A. (City College of New York) 1958; M.A. (Yale) 1960; Ph.D. (Yale) 1964
- Bible, Frances L.** Lecturer in Music
Artists Diploma in Singing (Juilliard) 1942; Graduate Diploma in Voice (Juilliard) 1947
- Billups, W. Edward.** Associate Professor of Chemistry and Associate of Will Rice College
B.S. (Marshall) 1961; M.S. (Marshall) 1965; Ph.D. (Penn State) 1970
- Blackburn, James B.** Lecturer in Architecture
B.A. (University of Texas) 1969; J.D. (University of Texas Law School) 1972; M.S. (Rice) 1974
- Bland, Robert Lester.** Associate Professor of Health and Physical Education and Associate of Hanszen College
B.A. (Central Washington) 1953; M.A. (Columbia) 1954
- Blattner, Meera M.** Assistant Professor of Mathematical Sciences and Associate of Richardson College
B.A. (Chicago) 1952; M.S. (Southern California) 1966; Ph.D. (U.C.L.A.) 1973
- Bochner, Salomon.** Edgar Odell Lovett Professor of Mathematics
Ph.D. (Berlin) 1921
- Boorman, Joan Rea.** Associate Professor of Spanish and Portuguese and Associate of Lovett College
B.A. (N.Y.U.) 1954; M.A. (Houston) 1964; Ph.D. (University of Texas) 1970
- Bordelon, Cassius B., Jr.** Lecturer in Health and Physical Education
B.S. (Louisiana) 1964; Ph.D. (Baylor College of Medicine) 1972
- Boterf, Chester Arthur.** Associate Professor of Art and Associate of Will Rice College
B.A. (Kansas University) 1959; M.F.A. (Columbia) 1965

- Bourne, Henry Clarke, Jr.** Professor of Electrical Engineering and Honorary Associate of Baker College
S.B. (M.I.T.) 1947; S.M. (M.I.T.) 1948; Sc.D. (M.I.T.) 1952
- Bowen, Ray M.** Professor of Mechanical Engineering and Mathematical Sciences and Associate of Wiess College
B.S. (Texas A&M) 1958; M.S. (California Inst. of Tech.) 1959; Ph.D. (Texas A&M) 1961
- Brady, David William.** Lecturer in Political Science and Associate of Jones College
B.S. (Western Illinois) 1963; M.A. (Univ. of Iowa) 1963; Ph.D. (Univ. of Iowa) 1970
- Brady, Patrick.** Professor of French
B.A. (Sydney) 1956; Docteur de l'Université (Paris) 1961
- Brelsford, John W., Jr.** Professor of Psychology
B.A. (Texas Christian) 1960; M.A. (Texas Christian) 1961; Ph.D. (University of Texas) 1965
- Brody, Baruch A.** Professor of Philosophy and Administrative Science and Associate of Hanszen College
B.A. (Brooklyn) 1962; M.A. (Princeton) 1965; Ph.D. (Princeton) 1967
- Brooks, Philip R.** Professor of Chemistry and Associate of Lovett College
B.S. (California Inst. of Tech.) 1960; Ph.D. (Berkeley) 1964
- Brotzen, Franz Richard.** Professor of Materials Science, Master of Brown College, and Honorary Associate of Jones College
B.S. (Case) 1950; M.S. (Case) 1953; Ph.D. (Case) 1954
- Brown, Barry W.** Adjunct Professor of Mathematical Sciences
B.S. (Chicago) 1959; M.S. (California) 1961; Ph.D. (California) 1963
- Brown, Carradean L.** Lieutenant (JG), U.S. Navy, and Assistant Professor of Naval Science
B.A. (South Carolina) 1972
- Brown, Christopher J.** Lecturer in Architecture
B.A. (Yale) 1963; M.Arch. (Pennsylvania) 1969; M. City Planning (Pennsylvania) 1970
- Brown, Katherine Tsanoff.** Professor of Art History and Dean of Undergraduate Affairs
B.A. (Rice) 1938; M.F.A. (Cornell) 1940
- Brown, Richard S.** Assistant Professor of Music
B.M.E. (Temple University) 1969; M.M. (Catholic University of America) 1971
- Burnett, Sarah A.** Assistant Professor of Psychology and Associate of Jones College
B.S. (Memphis State) 1966; M.S. (Tulane) 1970; Ph.D. (Tulane) 1972
- Burrus, C. Sidney.** Professor of Electrical Engineering and Honorary Associate of Will Rice College
B.A. (Rice) 1958; B.S.E.E. (Rice) 1958; M.S. (Rice) 1960; Ph.D. (Stanford) 1965
- Bush, George.** Adjunct Professor of Administrative Science
B.A. (Yale) 1948
- Butler, Richard V.** Assistant Professor of Economics and Associate of Lovett College
B.A. (Pomona) 1967; S.M. (M.I.T.) 1968; Ph.D. (M.I.T.) 1977
- Calderon, Calixto P.** Visiting Associate Professor of Mathematics
Licenciado en Matemáticas (Buenos Aires) 1965; Doctor en Matemáticas (Buenos Aires) 1969

- Calfee, Richard V.** Adjunct Lecturer in Biomedical Engineering
B.S. (Texas, Arlington) 1968; M.S. (Texas, Arlington) 1970; Ph.D. (Michigan) 1975
- Callahan, Mercedes V.** Assistant Professor of Spanish and Associate of Richardson College
Bachillerato (Chile) 1946; M.A. (Houston) 1969
- Camfield, William A.** Professor of Art History and Associate of Jones College
A.B. (Princeton) 1957; M.A. (Yale) 1961; Ph.D. (Yale) 1964
- Cameron, Douglas M.** Andrew W. Mellon Instructor in Spanish and Associate of Brown College
B.A. (Harvard) 1966
- Campbell, James Wayne.** Professor of Biology
B.S. (Southwest Missouri) 1953; M.S. (Illinois) 1955; Ph.D. (Oklahoma) 1958
- Campise, James A.** Lecturer in Mathematical Sciences
B.S.E.E. (Rice) 1950; M.S.I.E. (Houston) 1961
- Cannady, William Tillman.** Professor of Architecture
B.Arch. (Berkeley) 1961; M.Arch. (Harvard) 1962
- Cardus, David.** Adjunct Professor of Mathematical Sciences
B.A., B.Sc. (U. of Montpellier, France) 1942; M.D. (Barcelona Medical School) 1949
- Carr, C. Reed.** Instructor in Health and Physical Education and Associate of Will Rice College
B.S. (Brigham Young) 1972; M.S. (Brigham Young) 1973
- Carrara, John D., Jr.** Lecturer in Architecture
B.S. (Christian Brothers College) 1971; M.S. (University of Texas) 1972
- Carrington, Samuel M.** Associate Professor of French and Proctor
A.B. (North Carolina) 1960; M.A. (North Carolina) 1962; Ph.D. (North Carolina) 1965
- Casbarian, John Joseph.** Assistant Professor of Architecture and Associate of Will Rice College
B.A. (Rice) 1969; M.F.A. (California Inst. of the Arts) 1971; B.Arch. (Rice) 1972
- Casey, Richard Edward.** Associate Professor of Geology
A.B. (San Diego State) 1960; Ph.D. (Southern California) 1966
- Castañeda, James A.** Professor of Spanish and Honorary Associate of Will Rice College
B.A. (Drew) 1954; M.A. (Yale) 1955; Ph.D. (Yale) 1958
- Caudill, William W.** Adjunct Professor of Architecture
B.Arch. (Oklahoma State) 1937; M.Arch. (M.I.T.) 1939
- Cech, Irina.** Adjunct Assistant Professor of Architecture
Masters, Engineering (Moscow) 1961; Ph.D. (Univ. of Texas School of Public Health) 1973
- Chambers, Leslie A.** Adjunct Professor of Environmental Science
B.S. (Texas Christian) 1927; M.S. (Texas Christian) 1928; Ph.D. (Princeton) 1930
- Chamberlain, Joseph W.** Professor of Space Physics and Astronomy
A.B. (Missouri) 1948; A.M. (Missouri) 1949; M.S. (Michigan) 1951; Ph.D. (Michigan) 1952
- Chang, Donald C.** Adjunct Assistant Professor of Physics
B.S. (Taiwan) 1965; M.A. (Rice) 1967; Ph.D. (Rice) 1970
- Chapman, Alan Jesse.** Professor of Mechanical Engineering and Dean of the George R. Brown School of Engineering
B.S.M.E. (Rice) 1945; M.S. (Colorado) 1949; Ph.D. (Illinois) 1953

- Characklis, William G.** Professor of Environmental Engineering
B.E.S. (Johns Hopkins) 1964; M.S.Ch.E. (Toledo) 1967; Ph.D. (Johns Hopkins) 1970
- Cheatham, John Bane, Jr.** Professor Mechanical Engineering
B.S. (S.M.U.) 1948; M.S. (S.M.U.) 1953; Ph.D. (Rice) 1960
- Chimoskey, John E.** Adjunct Associate Professor of Biomedical Engineering
M.D. (Michigan) 1963
- Citron, Marcia J.** Assistant Professor of Music and Associate of Brown College
B.A. (Brooklyn) 1966; M.A. (North Carolina) 1970; Ph.D. (North Carolina) 1971
- Clark, Howard Charles, Jr.** Associate Professor of Geology and Associate of Baker College
B.S. (Oklahoma) 1959; M.A. (Stanford) 1965; Ph.D. (Stanford) 1966
- Clark, John W., Jr.** Associate Professor of Electrical Engineering and Associate of Lovett College
B.S. (Christian Brothers) 1962; M.S. (Case) 1965; Ph.D. (Case) 1967
- Clark, Susan Louise.** Associate Professor of German and Associate of Baker College
B.A. (Mount Union) 1969; M.A. (Rutgers) 1972; Ph.D. (Rutgers) 1973
- Clarke, Robert W.** Associate Professor of Accounting and Associate of Brown College
B.S. (Syracuse) 1961; M.B.A. (Syracuse) 1962; Ph.D. (Illinois) 1967
- Class, Calvin Miller.** Professor of Physics
A.B. (Johns Hopkins) 1943; Ph.D. (Johns Hopkins) 1951
- Clayton, Donald Delbert.** Andrew Hays Buchanan Professor of Astrophysics in the Departments of Space Physics and Astronomy and of Physics
B.S. (S.M.U.) 1956; M.S. (California Inst. of Tech.) 1959; Ph.D. (California Inst. of Tech.) 1962
- Cloutier, Paul A.** Professor of Space Physics and Astronomy and Associate of Richardson College
B.S. (Southwestern Louisiana) 1964; Ph.D. (Rice) 1967
- Colaco, Joseph P.** Lecturer in Architecture
B.S. (Bombay) 1960; M.S. (Illinois) 1962; Ph.D. (Illinois) 1965
- Cooper, Joseph.** Lena Gohlman Fox Professor of Political Science and of Administrative Science
B.A. (Harvard) 1955; M.A. (Harvard) 1959; Ph.D. (Harvard) 1961
- Cooper, Paul.** Professor of Music and Composer-in-Residence
B.Mus. and B.A. (Southern California) 1950; M.A. (Southern California) 1953; D.M.A. (Southern California) 1956
- Copeland, James E.** Associate Professor of German and Linguistics
B.A. (Colorado) 1961; Ph.D. (Cornell) 1965
- Crane, David A.** Professor of Architecture
B.S. (Georgia Inst. of Tech.) 1950; B. Arch. (Georgia Inst. of Tech.) 1950; Master of City Planning (Harvard) 1952
- Crouse, Wayne T.** Associate Professor of Music, The Shepherd Quartet Soloist Diploma (Juilliard) 1951
- Curl, Robert Floyd, Jr.** Professor of Chemistry and Associate of Lovett College
B.A. (Rice) 1954; Ph.D. (Berkeley) 1957

- Curtis, Morton L. W. L. Moody, Jr.**, Professor of Mathematics and Associate of Brown College
B.S. (Texas A&I) 1943; Ph.D. (Michigan) 1951
- Cushman, Richard D.** Assistant Professor of Anthropology and Resident Associate of Hanszen College
A.B. (Cornell) 1965; M.A. (Cornell) 1969; Ph.D. (Cornell) 1970
- Cuthbertson, Gilbert Morris.** Professor of Political Science and Resident Associate of Will Rice College
B.A. (Kansas) 1959; Ph.D. (Harvard) 1963
- Dadok, Jiri. G. C. Evans** Instructor in Mathematics
B.S. (Carnegie Mellon) 1972; Ph.D. (M.I.T.) 1976
- Daichman, Graciela S.** Lecturer in Spanish and Associate of Jones College
B.A. (Buenos Aires) 1954; M.A. (Rice) 1975
- Davidson, F. Chandler.** Associate Professor of Sociology
B.A. (University of Texas) 1961; M.A. (Princeton) 1966; Ph.D. (Princeton) 1969
- Davis, Philip W.** Associate Professor of Anthropology and Linguistics
B.A. (University of Texas) 1961; Ph.D. (Cornell) 1965
- Davis, Sam H., Jr.** Professor of Chemical Engineering and Mathematical Sciences and Associate of Richardson College
B.A. (Rice) 1952; B.S.Ch.E. (Rice) 1953; Sc.D. (M.I.T.) 1957
- Deans, Harry Alexander.** Professor of Chemical Engineering and Associate of Brown College
B.A. (Rice) 1953; B.S.Ch.E. (Rice) 1954; M.S.Ch.E. (Rice) 1956; Ph.D. (Princeton) 1960
- DeBremaecker, Jean-Claude.** Professor of Geology and Associate of Jones College
Ingénieur Civil des Mines (Louvian) 1948; M.S. (Louisiana State) 1950; Ph.D. (Berkeley) 1952
- Deck, Warren.** Lecturer in Music
- de Figueiredo, Rui J. P.** Professor of Electrical Engineering and Mathematical Sciences and Associate of Hanszen College
S.B. (M.I.T.) 1950; S.M. (M.I.T.) 1952; Ph.D. (Harvard) 1959
- DeSantis, Albert A., Jr.** Captain, U.S. Marine Corps, and Assistant Professor of Naval Science and Associate of Will Rice College
B.S. (California State) 1969; M.A. (Villanova) 1973
- Dessler, Alexander J.** Professor of Space Physics and Astronomy and Associate of Wiess College
B.S. (California Inst. of Tech.) 1952; Ph.D. (Duke) 1956
- Dipboye, Robert.** Associate Professor of Psychology
B.A. (Baylor) 1968; M.A. (Purdue) 1969; Ph.D. (Purdue) 1973
- Disch, James George.** Assistant Professor of Health and Physical Education and Associate of Baker College
B.S. (Houston) 1969; M.Ed. (Houston) 1970; P.E.D. (Indiana) 1973
- Dix, Robert H.** Professor of Political Science and Associate of Baker College
B.A. (Harvard) 1951; M.A. (Harvard) 1953; Ph.D. (Harvard) 1962
- Dodds, Stanley A.** Assistant Professor of Physics and Associate of Wiess College
B.A. (Harvey Mudd) 1968; Ph.D. (Cornell) 1975

- Donoho, Paul Leighton.** Professor of Physics
B.A. (Rice) 1952; Ph.D. (California Inst. of Tech.) 1958
- Doody, Terrence Arthur.** Associate Professor of English and Associate of Will Rice College
A.B. (Providence) 1965; M.A. (Cornell) 1969; Ph.D. (Cornell) 1970
- Doran, Charles Francis.** Professor of Political Science and Administrative Science and Associate of Lovett College
B.A. (Harvard) 1964; M.A. (Johns Hopkins) 1966; Ph.D. (Johns Hopkins) 1969
- Dorfman, Peter W.** Assistant Professor of Psychology and Associate of Baker College
B.A. (Western Reserve) 1967; M.A. (Maryland) 1970; Ph.D. (Maryland) 1972
- Doughtie, Edward Orth.** Associate Professor of English
A.B. (Duke) 1958; A.M. (Harvard) 1960; Ph.D. (Harvard) 1964
- Douglass, H. Robert.** Adjunct Associate Professor of Architecture
B.Arch. (Nebraska) 1963; M.Arch. (Minnesota) 1966
- Dowden, Wilfred Sellers.** Professor of English and Associate of Baker College
B.A. (Vanderbilt) 1939; M.A. (Vanderbilt) 1940; Ph.D. (North Carolina) 1949
- Downs, Thomas D.** Adjunct Professor of Mathematical Sciences
B.S. (Western Michigan) 1960; M.P.H. (Michigan) 1962; Ph.D. (Michigan) 1965
- Drew, Katherine Fischer.** Professor of History
B.A. (Rice) 1944; M.A. (Rice) 1945; Ph.D. (Cornell) 1950
- Driskill, Linda P.** Assistant Professor of English and Administrative Science and Director of Continuing Studies
B.A. (Rice) 1961; M.A. (Rice) 1968; Ph.D. (Rice) 1970
- Duck, Ian.** Professor of Physics
B.S. (Queen's, Ontario) 1955; Ph.D. (California Inst. of Tech.) 1961
- Duffy, Robert E.** Captain, U.S. Army, and Assistant Professor of Military Science
B.S. (Cameron College) 1972; M.S. (Southern California) 1975
- Dufour, Reginald James.** Assistant Professor of Space Physics and Astronomy and Resident Associate of Lovett College
B.S. (Louisiana) 1970; M.S. (Wisconsin) 1971; Ph.D. (Wisconsin) 1974
- Duke, Reese D.** Lecturer in Education and Director of Student Teaching
B.S. (Ouachita) 1950; M.Ed. (University of Texas) 1954; Ph.D. (University of Texas) 1956
- Dunne, Carrin.** Adjunct Assistant Professor of Religious Studies
B.A. (St. Thomas) 1955; M.A. (Notre Dame) 1965; Ph.D. (Notre Dame) 1970
- Dunning, Frank Barry.** Associate Professor of Physics and of Space Physics and Astronomy and Associate of Jones College
B.Sc. (University College, London) 1966; Ph.D. (University College, London) 1969
- Dyer, James C. IV.** Assistant Professor of Accounting
B.S.B.A. (Rockhurst College) 1970; M.S. (Kansas) 1971
- Dyson, Derek C.** Professor of Chemical Engineering and Associate of Will Rice College
B.A. (Cambridge) 1955; Ph.D. (London) 1966
- Eaker, Helen Lanneau.** Lecturer in Classics and Associate of Hanszen College
B.A. (North Carolina) 1944; Ph.D. (North Carolina) 1955

- Edwards, Edgar Owen.** Henry Gardiner Symonds Professor of Administrative Science
A.B. (Washington and Jefferson) 1947; M.A. (Johns Hopkins) 1949; Ph.D. (Johns Hopkins) 1951
- Eggert, Allen W.** Lecturer in Health and Physical Education
B.S. (Rice) 1963; M.A. (California Western) 1967
- Efler, Margret.** Associate Professor of German
M.A. (Berkeley) 1964; Ph.D. (Berkeley) 1969
- Elliott, Douglas G.** Adjunct Professor of Chemical Engineering
B.S.Ch.E. (Oregon State) 1964; M.S.Ch.E. (Houston) 1969; Ph.D. (Houston) 1971
- Ellison Paul Van Horn.** Assistant Professor of Music
B.M.E. (Eastern New Mexico) 1965; M.M. (Northwestern) 1966
- Engel, Paul S.** Associate Professor of Chemistry
B.S. (U.C.L.A.) 1964; Ph.D. (Harvard) 1968
- Estle, Thomas L.** Professor of Physics
B.A. (Rice) 1953; M.S. (Illinois) 1954; Ph.D. (Illinois) 1957
- Ettelson, Meryl.** Lecturer in Music
B.Mus. (Indiana) 1961; M.M. (Indiana) 1963
- Evans, Elinor Lucile.** Professor of Architecture
B.A. (Oklahoma State) 1938; M.F.A. (Yale) 1954
- Fegan, Howard D.** G.C. Evans Instructor in Mathematics
B.A. (Oxford) 1973; M.A. (Oxford) 1977; M.Sc. (Oxford) 1977; D.Phil. (Oxford) 1977
- Feustel, Edward A.** Associate Professor of Electrical Engineering and Computer Science
B.S.E.E. (M.I.T.) 1964; M.S.E.E. (M.I.T.) 1964; M.A. (Princeton) 1966; Ph.D. (Princeton) 1967
- Few, Arthur A., Jr.** Associate Professor of Space Physics and Environmental Science and Associate of Wiess College
B.S. (Southwestern) 1962; M.B.S. (Colorado) 1965; Ph.D. (Rice) 1969
- Fisher, Frank M., Jr.** Professor of Biology
B.A. (Hanover) 1953; M.S. (Purdue) 1958; Ph.D. (Purdue) 1961
- Fisher, Gary Duane.** Adjunct Professor of Chemical Engineering
B.S. (University of Texas) 1957; Ph.D. (Johns Hopkins) 1965
- Fliegel, Raphael N.** Associate Professor of Music, The Shepherd Quartet, and Associate of Hanszen College
- Forthofer, Ronald N.** Adjunct Associate Professor of Mathematical Sciences
B.S. (Dayton) 1966; M.S. (North Carolina) 1968; Ph.D. (North Carolina) 1970
- France, Newell Edwin.** Adjunct Associate Professor of Architecture
B.S. (Northwestern) 1953; M.S. (Northwestern) 1955
- Frankowski, Ralph F.** Adjunct Professor of Mathematical Sciences
B.S. (DePaul) 1957; M.S. (DePaul) 1959; M.P.H. (Michigan) 1962; Ph.D. (Michigan) 1967
- Freeman, John W.** Professor of Space Physics and Astronomy and Master of Lovett College
B.S. (Beloit) 1957; M.S. (Iowa) 1961; Ph.D. (Iowa) 1963
- Freeman, Thomas F.** Lecturer in Religious Studies
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B.A. (Texas Tech) 1968; M.A. (Texas Tech) 1973; M.L.S. (University of Texas) 1974
- Holibaugh, Ralph W.** Music Librarian
B.A. (Cincinnati) 1964; M.A. (Kent State) 1970; M.S.L.S. (Illinois) 1975
- Hyman, Ferne B.** Humanities Reference Librarian
B.A. (U.C.L.A.) 1948; M.A. (Loyola) 1969; M.L.S. (Illinois) 1969
- Kile, Barbara.** Government Documents, Maps, and Micromaterials Librarian
B.A. (Illinois) 1967; M.S. in L.S. (Illinois) 1968
- Laity, Barbara.** Collection Development Librarian
B.A. (Michigan) 1971; M.L.S. (Michigan) 1974
- Lane, Sarah Louise.** Circulation Librarian Emerita
B.A. (Rice) 1919; B.S. in L.S. (Columbia) 1932
- Law, Daniel T.** Science Reference Librarian and Assistant Director, R.I.C.E.
B.A. (U.C.L.A.) 1966; M.S. (Oregon State) 1968; M.A.L.S. (Rosary Graduate School of Library Science) 1972; Ph.D. (Oregon State) 1975
- Marsales, Rita.** Series Catalog Librarian
B.A. (L.S.U.) 1957; M.L.S. (University of Texas) 1973
- Miller, Shelby.** Art Librarian
B.A. (Texas Women's) 1964; M.S. (L.S.U.) 1967
- Mullins, James R.** Social Sciences Reference Librarian
B.A. (University of Texas) 1973; M.L.S. (University of Texas) 1975
- O'Keefe, Richard L.** University Librarian
Ph.B. (Mount Carmel) 1949; M.S. in L.S. (L.S.U.) 1956
- Parker, Nancy Boothe.** Director of the Woodson Research Center
B.A. (Rice) 1952; M.S. in L.S. (Catholic) 1965
- Perrine, Richard H.** Assistant Librarian for Planning, Coordinator of Reference Services, and Adjunct Associate Professor of Architecture
B.F.A. (Yale) 1940; M.L.S. (University of Texas) 1961
- Redmon, Alice Jane.** Head, Catalog Department
B.A. (Denver) 1937
- Ruecking, Frederick H.** Assistant Librarian for Systems Development
B.A. (University of Texas) 1952; M.A. (University of Texas) 1955; A.M.L.S. (Michigan) 1963

Silversteen, Sophy. Serials Librarian

B.A. (Rice) 1952; M.S. (University of Texas) 1954; J.L.S. (University of Texas) 1964

Swift, Stephen. Special Consultant to the Fondren Library and to the *Austrian History Yearbook*

Diploma (University of Berlin)

Wray, Beth. Manuscripts Curator

B.A. (Emory) 1971; M.A. (Georgetown) 1973

Professional Staff of the Institute for Computer Services and Applications

Beale, Alan R. Systems Programmer

M.A. (Harvard) 1971

Caruso, Nick. Programmer/Analyst

B.A. (Rice) 1970

Fields, Corinne V. Manager of Programming and Data Control

B.B.A. (S.M.U.) 1950

Gerbode, Farrell E. Manager, Systems Support

B.A. (Rice) 1973; M.A.Ma.Sc. (Rice) 1977

Henshaw, Allan M. Programmer/Analyst

B.A. (Westminster) 1975

Huston, Priscilla Jane. Director

B.A. (Mt. Holyoke) 1964

Kelly, Virginia. Systems Programmer

B.A. (Rice) 1971

Lane, Joni Sue. Systems Programmer

B.S. (Oklahoma) 1960

Nichols, Clyde C. Manager, Computer Operations

B.S.E. (Nebraska) 1965

Rickards, Linda. Data Control Programmer

Schafer, Richard. Systems Programmer

B.A. (Rice) 1973; M.A.M.S. (Rice) 1974

Valsecchi, Joseph. Programmer/Analyst

A.S. (NASA Community) 1973

Wakefield, James F. Programmer/Analyst

Williamson, Mark. Systems Programmer

Staff of the Health Service

Brenen, Daniel M., M.D. Director, Psychiatric Service

A.B. (Harvard); M.D. (Baylor)

Fullen, Dollie, L.V.N. Head Nurse

Kadry, Ahmad, M.D. Director, Health Services

B.Sc. (Dalhousie University) 1964; M.D. (Dalhousie University) 1969; D.P.H. (University of Toronto) 1977

Watson, Fay, R.N. Nurse

Staff of the Athletic Department

- Alborn, Raymond.** Head Football Coach
B.S. (Rice) 1962
- Backest, Richard.** Assistant Football Coach
B.S. (Texas A&M) 1968
- Breckwoldt, Frederick B.** Academic Counselor and Swimming Coach
B.S. (Springfield) 1958; M.E.D. (Houston) 1962
- Brown, Steve.** Assistant Athletic Trainer
B.S. (Texas Tech) 1973
- Butler, James E.** Chief Team Physician
B.S. (Sewanee) 1956; M.A. (Southwest Texas State) 1957; M.D. (University of Texas) 1962
- Castañeda, James A.** Faculty Representative
B.A. (Drew University) 1954; M.A. (Yale) 1955; Ph.D. (Yale) 1958
- Dean, Michael.** Assistant Football Coach and Defensive Coordinator
B.S. (Alabama) 1970; M.E.D. (Alabama) 1977
- Eggert, Allen.** Head Athletic Trainer
B.S. (Rice) 1963; M.A. (California Western) 1967
- Erfurth, August F.** Athletic Director
B.S. (Rice) 1949; M.E.D. (Trinity) 1961
- Estes, George.** Assistant Basketball Coach
B.A. (North Carolina) 1971; M.A.T. (The Citadel) 1973
- Mainord, Carlos.** Assistant Football Coach
B.S. (McMurry College) 1966; M.E.D. (Texas Tech) 1969
- May, John Robert.** Head Coach, Track and Field
B.S. (Rice) 1965
- Moore, Charles Edward, Jr.** Assistant Athletic Director
B.S. (Rice) 1938
- Norwood, Gordon W.** Assistant Football Coach
B.S.E. (Arkansas) 1970
- Osburn, Douglas E.** Baseball Coach and Club Sports Coordinator
B.S. (Houston) 1955
- Peiffer, Susan C.** Coordinator of Women's Athletics
B.S. (Ohio University) 1976
- Plumbly, John.** Golf Coach and Executive Secretary of the Owl Club
B.S. (Rice) 1948; M.E.D. (University of Texas) 1951
- Rossley, Thomas.** Assistant Football Coach
B.S. (University of Cincinnati) 1969
- Schuler, Michael H.** Head Basketball Coach
B.S. (Ohio) 1962
- Sexton, Anthony.** Assistant Football Coach and Recruiting Coordinator
B.S. (Cincinnati) 1971
- Straub, Stephen M.** Assistant Track and Field Coach
B.A. (Rice) 1972

Travis, Robert F. Tennis Coach

B.A. (Rice) 1966

Unbehagen, Theodore G. Assistant Head Football Coach and Offensive Coordinator

B.B.A. (Texas A&I) 1969; M.B.A. (Texas Tech)

Whitmore, William Rogers. Sports Information Director

B.J. (University of Texas) 1942

Williams, Bobby. Assistant Football Coach

B.S. (Rice) 1958

University Standing Committees for 1978-1979

The president is an ex officio member of all committees.

Committee on Admissions: Prof. Bowen, *chairman*; Profs. S. L. Clark, Curl, Grob, Jump, Lutes, Marcus, Modrak, Morehead, Nietzsche, Sass, and McIntire; Profs. K. Brown, Koehler, and Mr. Stabell, *ex officio*; Prof. S. A. Baker (college master); Mrs. Archie Hood and Mrs. Pat Moore (alumnae); Mr. Ricky Balthrop and Miss Deborah Sedberry (undergraduate students).

Committee on Affirmative Action: Prof. Lee, *chairman*; Profs. Burnett and Margrave; Mrs. Laura Branch, Ms. Virginia Gonzales, Mrs. Marian-Jordan, Mrs. K.M. Murfin, Mr. John Pesl, Mr. Tomas Sanchez, and Mr. Anthony Sexton (staff); Mr. Mitchell Sadler, *ex officio*; Mrs. Sharolyn Wood (alumna); Mr. Arturo Porras (graduate student); Mr. Kevin Badeaux and Mr. Allan Arthur Sheno (undergraduate students).

Committee on Campus Safety: Prof. Mutchler, *chairman*; Profs. Kilpatrick, Picologlou, and A. M. Santos; Mr. Bob Berger, *ex officio*; Mr. H. R. Rhodes (consultant); Mr. George Hildebrandt (graduate student); and Miss Susan Lopez (undergraduate student).

Committee of the College Masters: Prof. Minter, *chairman*; Profs. Armeniades, S.A. Baker, Brotzen, J. W. Freeman, Huston, W. C. Martin, and Stebbings; Prof. K. Brown and Mr. Marion Hicks, *ex officio*.

Committee on Computers: Prof. Feustel, *chairman*; Profs. Dyson, Glantz, C. Gordon, Jump, N. F. Lane, Michel, Quioko, K. J. White, and Mr. O'Keeffe; Prof. Vandiver and Mrs. Priscilla Huston, *ex officio*; Mr. W. J. Matthias (alumnus); Mr. John Morgan (graduate student); Mr. Ron Cytron and Mr. Mark G. Johnson (undergraduate students).

Education Council: Prof. Wood, *chairman*; Profs. Ambler, Bearden, Burnett, Campbell, Casey, Class, Davidson, B. F. Jones, R. G. Jones, W. A. Kelly, Levin, Meixner, D. H. Nelson, Pfeiffer, Urrutibeheity, Wiener, J. B. Wilson, and L. J. Wilson; Prof. Topazio, *ex officio*; and Antone Hackebell (undergraduate student).

Committee on Examinations and Standing: Prof. Estle, *chairman*; Profs. Citron, Parish, Schum, Spence, Stokes, and Subtelny; Profs. K. Brown and Morehead, *ex officio*; Miss Carmellia Boyer and Miss Dana Miller (undergraduate students).

Faculty Council: Profs. Angene, Bowen, Burrus, Duck, Greanias, W. C. Howell, D. H. Johnson, B. F. Jones, Leland, Minter, Pfeiffer, Rathjen, Spears, von der Mehden, and L. J. Wilson.

Committee on Fringe Benefits: Prof. Rimlinger, *chairman*; Profs. Bourland, Brody, Dowden, Matthews, Ms. Jackie Ehlers, Mr. Glenn Fryer, Mr. Carl Virtue and Mr. Joseph Nagy; Mr. M.O. Sadler and Mrs. Ursula Szmalec (consultants).

Graduate Council: Prof. Margrave, *chairman*; Profs. Doran, F. M. Fisher, D. L. Huddle, Leland, McLellan, Polking, Rowe, Schroeffer, Spears, Tipton, Ward, Warne, and Weissenberger; Prof. Vandiver, *ex officio*; Dr. Isaac Dvoretzky (alumnus); Mr. David Cooke (graduate student).

Committee on the Library: Prof. Matusow, *chairman*; Profs. Boorman, Camfield, Cuthbertson, W. A. Kelly, Kulstad, Kurtzman, Piper, Rudolph, J. R. Thompson, and Wall; Prof. Vandiver and Mr. O'Keefe, *ex officio*; Mrs. C. M. Hudspeth (alumna); Mr. Ho T'Su Ping and Mrs. Florentz Kunze (graduate students); and Mr. Matt Muller (undergraduate student).

Committee on Public Lectures: Prof. Isle, *chairman*; Profs. Camfield, Clayton, P. Cooper, Loevinsohn, Palmer, and A. M. Santos; Mr. David Rodwell, *ex officio*; Mrs. Sam Worden (alumna); and Mr. Curt Jacobson (graduate student).

Committee on Religious Activities: Prof. Nielsen, *chairman*; Profs. Garside, Havens, N. F. Lane, Modrak, Newport, R. Smith, N. R. Wright; Mrs. W. M. Howard (alumna); Mr. Bob Eubank (graduate student); and Mr. Cliff Shapiro (undergraduate student).

Research Council: Prof. Brody, *chairman*; Profs. Alcover, Doran, Harvey, Hyman, Palmer, Rorschach, Thrall, Tittel, and J. B. Walker; Profs. A. J. Chapman, W. E. Gordon, S. Jones, Margrave, Mitchell, Sterling, and Topzaio, *ex officio*; Mr. Lawrence Hamilton and Dr. Archie Hood (alumni); Mr. Mark Farris and Mr. Brian Whitehead (graduate students).

Residential Colleges Management Advisory Committee: Mr. Marion Hicks, *chairman*; Prof. S. A. Baker (college master), *fall semester*; Prof. Armeniades (college master), *spring semester*; Prof. S. D. Baker (faculty associate); and Mr. Chuck Newell (undergraduate student).

Rice University Athletics Committee: Prof. Castañeda, *chairman*; Profs. Campbell, Chapman, Howell, Matthews, Stebbings; Profs. Akers, Vandiver, and Mr. Joseph Nalle (treasurer), *ex officio*; Mr. W. H. Lane (trustee); Mr. T. N. Law (Board of Governors); Mr. Temple Tucker (alumnus); Mr. "Froggie" Williams (R Association); Miss Becky Mathre and Mr. Chuck Jewell (undergraduate students).

- Rice University Marshals:** Prof. Few, *Chief Marshal*; Profs. J. W. Clark, Dorfman, Hempel, Lee, Lutes, D. H. Nelson, Smalley, Widrig, and Wiener.
- Rice University Studies Review Board:** Prof. Eifler, *chairman*; Profs. Curtis, Huddle, Kelber, and Parish; Prof. Drew (editor), *ex officio*.
- R.O.T.C. Committee:** Prof. Boterf, *chairman*; Profs. Carr, Link, E. Nelson Rathjen, and Wilhoit; Prof. Armeniades (college master); undergraduate student to be named.
- Committee on Scholarships and Awards:** Prof. Cloutier, *chairman*; Profs. Brooks, Characklis, Evans, D. H. Nelson, R. J. Smith; Prof. K. Brown, *ex officio*; and Mr. William Broyles, Sr. (alumnus).
- Committee on Space Assignment:** Mr. H. R. Pitman, *chairman*; Prof. A. J. Chapman, W. E. Gordon, S. Jones, Mitchell, Sterling, and Topazio; Profs. K. Brown, Margrave, and Vandiver, *ex officio*.
- Committee on Student Affairs:** Prof. K. Brown, *chairman*; Profs. Carrington (proctor), W. C. Martin (college master), Stebbings (college master), Lee (Student Association faculty adviser), Mr. Roy Beller (Student Association president), Mr. Doug Canter (college president), Mr. Kevin McKenna (college president), Mr. David Cook (graduate student), Mr. Tim Baldwin (graduate student), Mr. James Bernhard (alumnus); Mrs. Bonnie Hellums, Prof. Vandiver, and the coordinator of academic advising, *ex officio*.
- Committee on Student Financial Aid:** Prof. Rorschach, *chairman*; Profs. Drew, Gottschalk, Huston, L. T. Johnson, Milburn, T. W. Parks; Prof. Brotzen (college master); Prof. K. Brown, Mr. G. D. Hunt, and Mr. R. N. Stabell, *ex officio*; Mr. Thomas Greene III (alumnus); undergraduate student to be named.
- Committee on Student Health:** Prof. Castañeda, *chairman*; Profs. Cushman, Eggert, Matthews, Rimlinger; Prof. J. W. Freeman (college master); Dr. A. Kadry, Mrs. B. Hellums, and Dr. D. Brener, *ex officio*; Dr. J. Robert Stanton (alumnus); Miss Mary Ann Tetreault (graduate student); undergraduate student to be named.
- Committee on the Undergraduate Curriculum:** Prof. Klineberg, *chairman*; Profs. Eifler, Huston, McIntire, Parsons, Philpott, Schnoebelen, Talbot, Wiener, Wierum, and W. L. Wilson; Profs. K. Brown and Vandiver, *ex officio*; Mrs. Robins Brice (alumna); Mr. Russell Brown and Mr. Richard Toye (undergraduate students).
- Committee on Undergraduate Teaching:** Prof. Stewart, *chairman*; Profs. Burrus, Davidson, Dunning, B. F. Jones, D. M. Lane, Merwin, Milburn, A. Z. Parks, and Rawlinson; Prof. K. Brown, *ex officio*; Mr. Chris Amandes (alumnus); Mr. Ralph Hornung (graduate student); Miss Karen Appling and Mr. Mark Brennan (undergraduate students).

University Council: Pres. Hackerman, *chairman*; Profs. Akers, Burrus, Margrave, Minter, Patten, Pfeiffer, Rathjen, Rorschach, Vandiver, von der Mehden, and L. J. Wilson; Prof. A. J. Chapman, *ex officio*; Prof. K. Brown, *secretary*; Mr. John Morgan (graduate student); Mr. Frank Bay and Mr. Joel Lueckenhoff (undergraduate students).

University Review Board: Prof. Pfeiffer, *chairman*; Profs. Boorman, Higginbotham, and Spence; Mr. Jim Ray (graduate student); Miss Liz Heitman and Mr. Hal Marcus (undergraduate students).

Chairs and Lectureships

Throughout its history, Rice University has been especially fortunate in the number of its friends and benefactors. Some of these are memorialized in the names of buildings and special physical facilities; others have generously provided for the enrichment of the university's intellectual life by establishing chairs and lectureships either on temporary or permanent bases. Rice takes pleasure in recognizing on these pages some of these contributors to its academic excellence.

J. S. Abercrombie Chair in the School of Engineering

Agnes Cullen Arnold Professorship in Fine Arts

Herbert S. Autrey Chair

Lynette S. Autrey Chair

Brown and Root Chair of Engineering

George R. Brown Chair

Herman and George R. Brown Chair in Civil Engineering

Andrew Hays Buchanan Professorship of Astrophysics

E. D. Butcher Professorship

Louis Calder Professorship in Chemical Engineering

Harry S. Cameron Chair in Mechanical Engineering

Harry and Hazel Chavanne Chair of Religious Studies

Allyn R. and Gladys M. Cline Professorship in Economics and Finance

Carey Croneis Professorship in Geology

Distinguished Professorship of Architecture

G. C. Evans Instructorship in Mathematics

W. Maurice Ewing Professorship in Oceanography

Laurence H. Favrot Professorship in French

Henry S. Fox, Sr., Chair of Instruction in Economics

Lena Gohlman Fox Chair in Political Science

- Noah Harding Professorship of Mathematics
 Reginald Henry Hargrove Chair of Economics
 A. J. Hartsook Chair in Chemical Engineering
 William Pettus Hobby Chair in American History
 Jesse H. Jones Professorship in Management
 Mary Gibbs Jones Professorship in History
 William Alexander Kirkland Professorship in the
 Jesse H. Jones Graduate School of Administration
 Edgar Odell Lovett Chair in Mathematics
 Carolyn and Fred McManis Professorship in Philosophy
 Harris Masterson, Jr., Chair in History
 Andrew W. Mellon Junior Humanities Scholars
 Andrew W. Mellon Professorship in the Humanities
 Libbie Shearn Moody Professorship of English
 W. L. Moody, Jr., Professorship of Mathematics
 Joseph and Joanna Nazro Mullen Professorship in Fine Arts
 George A. Peterkin Chair of Political Economy
 J. Newton Rayzor Chair in Philosophy and Religious Thought
 David Rice Chair in Ethics
 The Schlumberger Chair of Advanced Studies and Research
 Harry K. and Albert K. Smith Chair in Architecture
 Dorothy Richard Starling Visiting Professor of Violin
 Henry Gardiner Symonds Professorship
 Albert Thomas Chair of Political Science
 Radoslav A. Tsanoff Chair of Public Affairs
 Isla and Percy Turner Professorship in Biblical Studies
 Robert A. Welch Chair in Chemistry
 Harmon Whittington Professorship
 Harry Carothers Wiess Chair of Geology
 Brown Foundation — J. Newton Rayzor Lectures
 W. V. Houston Lectureship
 Ervin Frederick Kalb Lectureship in History
 The Rockwell Lectures
 Tsanoff Lectureship in the Humanities





Information for Undergraduates

Curricula, Majors, and Degree Requirements

The Bachelor of Arts degree at Rice is awarded with a designated major in some field of architecture, the humanities, social sciences, science, or engineering. The general university requirements for the B.A. degree, as well as the options open to students in their choice of majors, are described below.

The Bachelor of Music is offered by the Shepherd School of Music only in conjunction with the Master of Music, both of which are awarded simultaneously on completion of a five-year program of professional studies.

The various engineering departments also offer the Bachelor of Science degree which, like the B.A., normally requires four years for completion.

For students interested in teaching in the secondary schools, a program of teacher training leading to state certification may be completed together with the Bachelor of Arts degree. This program is administered by the Education Department.

Programs that satisfy the requirements for admission to medical, dental, or law school are also available in conjunction with various majors.

Degree Requirements and Majors

In March, 1978, the faculty of the university approved changing the designation of graduation requirements, major requirements, and distribution requirements from semester courses to semester hours. The change becomes effective in the academic year 1978-1979. Students enrolled at the university in a degree program prior to or at the beginning of the fall semester 1978 have the option of completing the university and major requirements for their degree according to either semester courses or semester hours. All students entering after fall 1978 will fulfill the semester-hour requirements. In the information that follows, as well as in the requirements for departmental majors listed under Courses of Instruction, university and departmental requirements are stated in semester hours, followed in parentheses by the corresponding requirement in semester courses. No course equivalence is shown for the regulations governing the president's honor roll, academic probation, and academic suspension since these have been calculated by semester hours in the past.

University Credit Requirements

Students completing a Bachelor of Arts degree must pass a minimum of 120 semester hours (forty semester courses of at least 3 semester hours with associated laboratories and tutorial sections). In fulfilling all university and major requirements, many students will complete more than this minimum. Within their total program, students completing a Bachelor of Arts degree in any discipline other than architecture must pass a minimum of 60 semester hours (twenty semester courses of at least 3 semester hours) in addition to major requirements specified by their department. Architecture majors must pass 38 semester hours in addition to their major requirements.

To fulfill the requirements for the degree of Bachelor of Science in one of the several branches of engineering with the exception of chemical engineering, students must pass no fewer than 134 semester hours. Students fulfilling the requirements for the Bachelor of Science in chemical engineering must pass up to 137 semester hours, depending on accreditation requirements.

For either bachelor's degree, no less than 42 semester hours (fourteen courses) completed in fulfillment of the degree requirements must be on an advanced level (numbered 300 or higher).

After students have fulfilled university distribution requirements and the requirements for a designated major (see below), all remaining courses in their degree programs are free electives.

University Distribution Requirements

The university distribution requirements are based on the belief that an undergraduate education should include some acquaintance with areas of study outside the student's field of specialization. Many students fulfill most of their distribution requirements in the first two years, and because they have explored several different areas, they are better prepared to decide on a major at the end of the sophomore year.

Before graduation each student must have completed three or more semester hours (one or more courses) from at least five of the six subject categories listed below, and at least twelve semester hours (four courses) from each pair of subject categories designated by a roman numeral.

- I.
 1. Literature and language
 2. Fine arts, music, philosophy (except logic), and religion
- II.
 3. Economics, history, and political science
 4. Anthropology, behavioral science, linguistics, psychology, and sociology
- III.
 5. Biological science, physical science, and engineering
 6. Mathematics, mathematical sciences, and logic

Skills

English Competency Requirement. Every Rice student must demonstrate competency in English comprehension and composition. This requirement is satisfied by passing the English competency examination administered by the English Department to all entering students during orientation week. Students who fail to pass this test are required to enroll in English 103, a one semester self-paced course in composition which carries both degree and distribution credit. Satisfactory completion of this course will then fulfill the English competency requirement. English 103 is also open, space permitting, to students who have passed the English competency examination but wish to improve their writing skills further.

Physical Education. Each student must pass two semester courses in basic health and physical education. These do not count toward the semester hours (or courses) required for a degree.

Departmental Majors and Honors Programs

Each spring, on Majors Day, freshmen and sophomores are excused from their morning classes to visit the faculty and upperclass students in departments they are considering for their majors. Students normally designate a major in March prior to preliminary registration for the junior year. The department or title of the major is then noted on the student's transcript, and a faculty adviser is assigned in the major department. Introductory courses taken in the freshmen or sophomore years may be counted in fulfilling the major requirements even before formal designation of a major has been made.

Students should be aware that physical limitations of some departments occasionally make it necessary to limit the number of majors admitted to a particular department.

Students are always free to change majors in the junior or senior year, although this may entail one or more additional semesters at the university.

For information on the specific requirements for any departmental major, students should consult the departmental listings under Courses of Instruction and seek the advice of a faculty member in the department.

In establishing an undergraduate major for the Bachelor of Arts degree departments must specify a minimum of eighteen semester hours (six courses) for majors in the humanities and social sciences and twenty-four semester hours (eight courses) for majors in science. No department may specify more semester hours than the number equivalent to twenty courses of three or four semester hours each (related laboratories, required courses, and prerequisites included), the total not to exceed eighty semester hours.

In establishing a departmental major for the degree of Bachelor of Science in one of the various branches of engineering with the exception of chemical engineering, no department may specify more than 92 semester hours (required courses, prerequisites, and related laboratories included). In establishing the departmental major for the B.S. in chemical engineering, the department may specify no more than the semester hours necessary to meet the requirements of the accrediting agency, up to a maximum total of 104 semester hours (required courses, prerequisites, and related laboratories included).

Undergraduate honors programs are open to qualified students, with departmental approval, in several departments. Through small classes and seminars, independent reading or research projects, and close contact with faculty research, students in an honors program may accelerate study in their major fields, and in some cases enter graduate courses. Information on the qualifications for admission and the content of honors programs may be found in the departmental listings under Courses of Instruction.

Areas of Study

Architecture

Students interested in architecture may choose from several options, including programs leading to either the Bachelor of Arts or the Bachelor of Architecture degree. The Bachelor of Arts requires four years of study with a major in either architecture or architectural studies. The Bachelor of Architecture requires six years, with the fifth year being an in-service preceptorship in a professional office.

SCHOOL, DIVISION, DEPARTMENT	DEGREES OFFERED	MAJORS, OPTIONS, AREAS OF CONCENTRATION
The Jesse H. Jones School of Adminis- tration	Master of Accounting, Master of Business and Public Man- agement, Ph.D. (For B.A., see interdepartmental major in Managerial Studies)	Accounting, Management
The George R. Brown School of Engineering		
Chemical Engineering	B.A., B.S., M.S., Master of Chemical Engineering, Ph.D.	Chemical engineering, nuclear engineering, polymer science, petroleum reservoir engi- neering, thermodynamics, biomedical engi- neering
Civil Engineering	B.A., B.S., M.S., Master of Civil Engineering, Ph.D.	Civil engineering, structural analysis and design, structural mechanics, geotechnical engineering, environmental engineering
Electrical Engineering	B.A., B.S., M.S., Master of Electrical Engineering, Ph.D.	Electrical engineering; bio-engineering; cir- cuits, control, and communications systems; computer science and engineering; lasers, microwaves, and solid-state electronics
Environmental Science and Engineering	M.S., Master of Environ- mental Science, Master of Environmental Engineering, Ph.D. (For B.A. as double major, see department)	Environmental science and engineering
Mechanical Engineering and Materials Science	B.A., B.S., M.S., Master of Materials Science, Master of Mechanical Engineering, Ph.D.	Majors: mechanical engineering, materials science. Options: thermal sciences and energy conversion, gas dynamics, hydrodynamics and ocean engineering, stress analysis and me- chanical behavior of materials, aerospace engineering, engineering science
The School of Natural Sciences		
Biochemistry	B.A., M.A., Ph.D.	Biochemistry, biophysical chemistry, molecu- lar biology, organic chemistry
Biology	B.A., M.A., Ph.D.	Biology
Chemistry	B.A., M.A., Ph.D.	Chemistry, organic chemistry, physical chem- istry, inorganic chemistry, chemical physics
Geology	B.A., M.A., Ph.D.	Geology, geochemistry, geophysics, marine geology and oceanography, meteoritics
Mathematical Sciences	B.A., M.A., Master in Applied Mathematical Sciences, Ph.D.	Computer science, numerical analysis, opera- tions research, physical mathematics, proba- bility/statistics
Mathematics	B.A., M.A., Ph.D.	Complex analysis, dynamics, ergodic theory, Lie groups, numerical analysis, partial differ- ential equations, topology
Physics	B.A., M.A., Ph.D.	Physics, space physics and astronomy, bi- physics, nuclear energy, geophysics
Space Physics and Astronomy	M.S., Ph.D. (For B.A., see Physics Department, space physics option)	Experimental and theoretical space physics, observational astronomy, astrophysics, and atomic physics

SCHOOL, DIVISION, DEPARTMENT	DEGREES OFFERED	MAJORS, OPTIONS, AREAS OF CONCENTRATION
The School of Architecture	B.A., B.Arch., Master of Architecture, Master of Architecture in Urban De- sign, Doctor of Architecture	Architecture, Architectural Studies
The Shepherd School of Music	B.Mus./M.Mus. simultane- ously, M.Mus.	Composition, conducting, music history, per- formance, theory
Humanities and Social Sciences		
Anthropology	B.A.	Anthropology, ethnology, archaeology, linguistics, physical anthropology
Art and Art History	B.A., Bachelor of Fine Arts	Art history, studio art, film and photography
Behavioral Science	M.A., Ph.D. (For B.A. see in- terdepartmental major in Behavioral Science below)	Anthropology, sociology
Economics	B.A., M.A., Ph.D.	Economics
Education	Master of Arts in Teaching	Teacher preparatory programs in twenty subject-matter areas
English	B.A., M.A., Ph.D.	English
French and Italian	B.A., M.A., Ph.D.	French language and literature; Italian language
German and Russian	B.A., M.A., Ph.D.	German and Russian language, literature
Health and Physical Education	B.A.	Physical education; health education as teaching field only
History	B.A., M.A., Ph.D.	History
Linguistics	B.A.	Linguistics
Philosophy	B.A., M.A., Ph.D.	Philosophy
Political Science	B.A., M.A., Ph.D.	Political science
Psychology	B.A., M.A., Ph.D.	Psychology
Religious Studies	B.A., M.A., Ph.D.	Religious studies
Sociology	B.A.	Sociology
Spanish, Portuguese and Classics	B.A., M.A.	Classics, Greek, Latin, Portuguese, and Spanish
Interdepartmental Majors		
MAJORS	DEGREES OFFERED	SPONSORING DEPARTMENTS
Area Majors	B.A.	Courses from two or more departments com- bined by the student and faculty advisers to form a coherent program with its own requirements
Behavioral Science	B.A.	Anthropology, Psychology, Sociology
Chemical Physics	B.A.	Chemistry, Physics
Legal Studies	B.A.	Economics, History, Philosophy, Political Science
Managerial Studies	B.A.	Accounting, Economics, Mathematical Sciences, Political Science, Psychology
Materials Science	B.A.	Chemistry, Materials Science

The School of Architecture encourages students to weigh their educational objectives and to choose among alternative courses of study offered. Further information on these programs may be found under Architecture in the Courses of Instruction section.

Computer Science

The computer science program is under the joint sponsorship of the departments of Electrical Engineering and Mathematical Sciences with most of the courses in this area listed by both departments. Students wishing to specialize in computer science may earn a bachelor's degree by majoring in either department, and double majors are common. Both departments also offer a professional master's, a research master's, and a doctor of philosophy degree.

The program is divided into three subject areas: (1) hardware engineering, (2) software systems, and (3) discrete system modeling. Students will take courses from all three of these areas as well as related courses in engineering and mathematics. Detailed information on courses and degree requirements can be found under Mathematical Sciences or Electrical Engineering in the Courses of Instruction section.

Engineering

The George R. Brown School of Engineering at Rice offers through its five departments opportunities for a variety of curriculum and degree choices. Students interested in the engineering profession may major in chemical engineering, civil engineering, electrical engineering, mechanical engineering, or materials science for both undergraduate and graduate degrees. They may also take a double major combining environmental science with another science field. These programs lead to either the B.A. or B.S. degree, and may qualify students for further study leading to a fifth-year professional master's degree, a Master of Science degree, or a doctorate.

During the first two years engineering students should consult with the chairmen of the departments of interest or with the special freshman and sophomore advisers appointed by each department for information and advice about details of the programs and choice of electives, and about engineering as a profession.

Students may take a program of studies during their freshman year which satisfies the first year requirements for all engineering departments. A listing of these courses and other information regarding the first two years of study is found under Engineering and Applied Science in the Courses of Instruction section of this catalog. Degree requirements and advanced courses are listed under the separate departmental listings in the same section.

Humanities and Social Sciences

Majors are offered in anthropology, art and art history, behavioral science, biology, classics, economics, English, French, German, health and physical education, history, legal studies, linguistics, managerial studies, mathematics, philosophy, political science, psychology, religious studies, Russian, sociology, and Spanish.

The requirements of each major may be found in the departmental listings under Courses of Instruction and are also available from department chairmen and from the Registrar's Office. The interdepartmental majors in legal studies and managerial studies are described below.

Legal Studies

The program in legal studies is intended to offer undergraduates an opportunity to obtain understanding and insight into the development and character of modern society and modern values, through the study of the humanistic and social science parameters of the law and of its associated institutions. It is an interdepartmental program leading to the degree of Bachelor of Arts.

Courses are drawn from the departments of Anthropology, Economics, Environmental Engineering, History, Philosophy, Political Science, Psychology, and Sociology. The degree may be taken as a terminal degree or in preparation for law school or graduate work in one of those disciplines. Students contemplating graduate work are strongly advised to consider the possibility of a double major. Students should consult the Legal Studies section under Courses of Instruction for the list of requirements.

The administration of the program is in the hands of a committee consisting of representatives of the departments of Economics, History, Philosophy, and Political Science. Professor Baruch A. Brody, chairman of the Department of Philosophy, is chairman of this committee. Students interested in Legal Studies should see Professor Brody, who will assign them an adviser closely related to the area within legal studies that they wish to emphasize.

Managerial Studies

The managerial studies program is intended to prepare students for management careers in either business or government. The program is interdepartmental and leads to the degree of Bachelor of Arts, either as a terminal degree or in preparation for graduate professional studies in accounting, law, business, or public management. Courses are drawn from the departments of Accounting, Economics, Mathematical Sciences, Political Science, and Psychology.

The program is designed to provide students with a comprehensive understanding both of the environment in which business firms operate and of the tools employed by management in making decisions. To major in managerial studies, students must complete forty-five semester hours of approved coursework in the following subject areas: (1) accounting, (2) economics, (3) finance, (4) statistics, (5) quantitative methods, (6) computer programming, (7) business law, and (8) industrial-organizational psychology. A list of approved courses is available from the Office of the Dean, Jesse H. Jones Graduate School of Administration, 232 Herman Brown Hall, or from the managerial studies program advisers in each of the participating departments.

An honors program is available in managerial studies. This program is designed (1) to provide students with the opportunity to enrich and expand their knowledge of the managerial disciplines by means of specified advanced-level coursework and/or independent research and writing, and (2) to provide an opportunity for the recognition of students who have demonstrated unusual competency in managerial studies.

The managerial studies program is administered by a committee consisting of representatives from the departments of Accounting, Economics, Mathematical Sciences, Political Science, and Psychology. Dean Robert R. Sterling, of the Jesse H. Jones Graduate School of Administration, is chairman of this committee. Student records for all managerial studies majors are maintained in the Jones School. The managerial studies program coordinator assigns

students an adviser closely related to the area in which they intend to specialize. Students should consult with their adviser as early as possible to ensure establishment of an appropriate plan of study.

Music

The Bachelor of Music is offered by the Shepherd School of Music only in conjunction with the Master of Music, both of which are awarded simultaneously upon completion of a five-year program of professional studies. All music majors are required to take the school's core curriculum, which spans the first five semesters.

The final two years are devoted to specialization and can be entered only upon passing qualifying examinations administered in the fifth or sixth semester. Students in the specialized curriculum may elect to be performance majors or applied majors (composition, conducting, music history, theory). Students specializing in conducting may require a sixth year to complete the degrees.

More detailed information about the Shepherd School and the requirements for degrees is given under Music in the Courses of Instruction section of this catalog.

Natural Sciences

Majors included in this program are biochemistry, biology, chemical physics, chemistry, geology, mathematical sciences, mathematics, and physics. The requirements for each major are outlined under departmental listings in Courses of Instruction.

Other Options: Area, Double, Interdisciplinary Majors

In deciding on a major, students are encouraged to select a course of study directed toward their personal goals and abilities. Several options are available besides the normal major in most departments. Further information on these may be found in the departmental listings.

1. **Double majors** that fulfill the major requirements of two departments. The two majors may but need not be in related fields: for example, economics/math science, or biology/art and art history.
2. **Interdepartmental and interdisciplinary majors.** Interdepartmental majors are offered in chemistry with materials science and physics, and in electrical engineering with biology. Behavioral science, legal studies, linguistics, and managerial studies are interdisciplinary majors, combining courses taught by faculty from several departments.
3. **Areas of concentration** within departmental majors. Certain majors, including architecture, geology, German, physics, and Spanish, but not limited to these, have a choice of different areas of concentration with different course requirements within the department major.
4. **Area majors.** Instead of selecting an established departmental major or double major, students have the option of developing an area major which is closer to their particular interests and career goals. Whereas double majors must conform to the requirements of both departments, an area major is a single major combining courses from two or more departments which form a clearly coherent program with its own major requirements.

An area major is normally initiated by the student and worked out in conjunction with faculty advisers from each of the departments involved. Together they must agree on a title, which will then designate the area

major on the student's transcript, followed by the names of cooperating departments: for example, Problems of the Contemporary City (architecture, sociology, environmental science, and engineering). The requirements for each area major are approved by the faculty advisers, who are jointly responsible for the validity and acceptability of the program as a degree plan. In addition, students who elect to take an area major must also complete university semester-hour (or course) and distribution requirements.

Though students normally choose their majors at the end of the sophomore year, it is often possible to change from a departmental major to a related area major in the junior year. Students who might want to develop an area major but are uncertain which departments to approach, or students who wish to change from a departmental major to an area major, should consult with the coordinator of academic advising. The registrar routinely routes all application forms for area majors through the coordinator's office for certification.

Premedical, Prelaw, and Other Preprofessional Programs

In addition to the preprofessional and professional programs offered by Rice in accounting, architecture, engineering, and music, a student may pursue a program which will satisfy the requirements for admission to graduate professional schools in business, dentistry, diplomacy and foreign affairs, finance, health science, law, or medicine. Information about preparation for a career in business or finance can be obtained from the dean of the Jesse H. Jones Graduate School of Administration.

The premedical adviser counsels students interested in premedical or pre dental studies and other areas of the health sciences. Those interested in legal studies should consult the prelaw adviser. Both advisers may be contacted through their offices in the RMC courtyard.

Premedical and Predental Programs. The entrance requirements of medical and dental colleges of the United States are limited to a relatively few courses: one year each of general chemistry, organic chemistry, physics, mathematics, biology, and English, and laboratories required by the foregoing science courses. Because medical and dental schools show little or no preference for any one major, students planning a medical or dental career have the opportunity to choose their major solely on the basis of their interests and capabilities. They should keep two objectives in mind: (1) to secure a broadly-based cultural background and (2) to master the necessary skills for an alternative career. Those who elect to concentrate in the sciences or engineering will automatically satisfy most of the entrance requirements. Students concentrating in the humanities need to make some adjustments in their study plan in order to fulfill the entrance requirements. Premedical and predental students are advised to discuss their plans with the premedical adviser.

An undergraduate major in bioengineering offered by the Electrical Engineering Department is specifically designed for those students who want to combine a future career in the health sciences with a basic preparation in electronics, systems analysis, and control theory. A specific program in preparation for medical school is included. Details are available from the chairman of the department.

In a few cases students may be granted admission to the Baylor College of Medicine or another accredited medical school at the end of the junior year. Through prior arrangement with the Committee on Examinations and Standing, a student may become a candidate for the B.A. degree at Rice upon

completion of the M.D. degree. For details of the requirements and procedure, an interested student should consult the premedical adviser.

Prelaw Studies. The academic requirement for admission to law school is satisfied by all degree programs offered at Rice. While many students major in history, political science, economics, accounting, or legal studies as a base for prelaw studies, no law school specifies particular courses or curricula as pre-requisite to admission. Most require only a baccalaureate degree and the Law School Admission Test.

In a few cases students may be granted admission to the Columbia University School of Law or another accredited law school at the end of the junior year. Through prior arrangement with the Committee on Examinations and Standing, a student may become a candidate for the B.A. degree from Rice upon completion of a law degree. For details of the requirements and procedure, an interested student should consult the prelaw adviser.

The Prelaw Handbook, published by the Association of American Law Schools and the Law School Admission Council, states that pre-legal education should develop oral and written comprehension and expression, creative thinking and critical understanding of human values, and that no one discipline is uniquely concerned with those objectives. Therefore, the prelaw student should strive for development of his or her own capabilities and thorough concentration in the areas of greatest interest. Interested students should contact the prelaw adviser early, preferably in the first year, for assistance in designing a suitable program. The Prelaw Handbook and catalogs of many leading law schools are available in the Prelaw Office in the RMC courtyard.

Reserve Officers' Training Corps Programs

Rice University offers two Reserve Officers' Training Corps programs — the Army and the Navy. These programs seek to train college students so that upon graduation they may qualify as commissioned officers in a component of the United States Army, Navy, or Marine Corps. The Navy has two categories of midshipmen, one working toward a reserve commission and the other toward a regular commission. The Army normally awards reserve commissions; however, certain selected distinguished military students may be offered commissions in the regular Army.

Any student suspended by the university for academic failure or other cause is immediately disenrolled from the ROTC programs. Any student performing unsatisfactory work in military science or naval science courses, or possessing unsatisfactory officerlike qualities, may be disenrolled from ROTC programs regardless of the quality of academic work. Enrollment in the ROTC programs at Rice University is normally made at the beginning of the fall term.

Students completing the full program in either Military Science or Naval Science will be granted the equivalent of two course credits toward their degree. Such credit is not attached to specific courses, and no other degree credit will be given for Military Science or Naval Science programs.

Additional information regarding the ROTC programs and scholarships available is given under Military Science and Naval Science in the Courses of Instruction section of this catalog.

Teacher Certification

Programs of study are offered to fulfill the Texas state requirements for teaching certificates on the secondary level in biology, chemistry, earth science, economics, English, French, German, health education, history, Latin, mathematics, physical education, physics, political science, psychology, Russian, general science, social studies, sociology, and Spanish.

Programs with Other Universities

Rice currently participates in cooperative programs with several other colleges and universities at the undergraduate level. These include programs with Swarthmore College, Texas Southern University, Trinity College of Cambridge University, and Williams College.

Rice-Swarthmore Exchange Program

An exchange program between Rice and Swarthmore College has been arranged for qualified students beyond the freshman year who are interested in spending a semester in another part of the country. Swarthmore, which is situated on a wooded campus near Philadelphia, is a nondenominational coeducational college with academic standards similar to those at Rice.

The exchange is for the fall semester only. Rice students apply in January by submitting their own letter of application and two supporting letters, one from a faculty member in their major department and one from another member of the faculty. The exchange is on a one-for-one basis with each student continuing to pay all charges and fees to his or her home school. Rice students chosen for the exchange may take with them to Swarthmore any financial aid from Rice for which they may be eligible.

Prior approval of transfer credit should be requested for each course from the registrar. Courses to be taken at Swarthmore which will apply to the student's major must also be approved by the department. Students who enroll in the normal program of four four-semester-hour courses at Swarthmore receive upon satisfactory completion sixteen semester hours (or five courses) toward their Rice degree with a notation of specific courses which may count for fulfillment of major requirements or distribution within that block credit.

Dual Degree Program with Texas Southern University

A dual-degree program with Texas Southern University, a predominantly minority institution in Houston, enables students to attend T.S.U. for three years, majoring in mathematics, physics, or chemistry. At the end of the third year, if their work has been satisfactory, the students transfer to Rice as juniors in engineering. After five years, a student will normally receive a B.S. in some branch of engineering from Rice and a B.S. in mathematics, physics, or chemistry from Texas Southern.

While the students are still enrolled at Texas Southern, generally during their third year, they will take two or more courses at Rice in order to prepare themselves for their engineering majors here.

This program may lead to an additional year at Rice for the professional master's degree. It also prepares a student for graduate work at Rice or any other institution offering graduate work in engineering.

C. D. Broad Exchange Program with Trinity College, Cambridge

An exchange program sponsored by the Abraham Student Aid Foundation involves both students and faculty from Rice and from Trinity College, Cambridge. Student participation, available through receipt of a competitive award, confers one year of study as a visiting student at Rice or at Trinity College. During 1978-1979 a student from Cambridge will study at Rice; Rice students may apply to study at Trinity the following year. Similar but

shorter exchanges of Rice and Cambridge faculty members will also be arranged through the program.

Further information on the program may be obtained from Professor David L. Minter, English Department, Rice's coordinator for the program.

Program with Williams College

In 1976 a five-year program with Williams College was established leading to a B.S. degree in one of the various branches of engineering from Rice and a B.A. degree from Williams awarded jointly after three years at Williams and two at Rice. Students applying for the program must submit applications and fulfill all the qualifications for admission to Rice as transfer students.

Academic Regulations

All students seeking an undergraduate degree are subject to the academic regulations of the university. The Committee on Examinations and Standing administers the rules described below. Under unusual circumstances any student may submit a written petition to the committee requesting special consideration. All correspondence with the committee should be addressed in care of the Dean of Undergraduate Affairs.

Registration

Currently enrolled students must complete preliminary registration in April for the following semester. Unless a special tuition plan has been elected, all tuition and fees for the fall semester must be paid by August 14, 1978. Charges for the spring semester are payable December 29, 1978. A student who does not file a course program or request a delay from the registrar by the established deadline will be considered withdrawn from the university by default. To be readmitted the student must be eligible to continue and must pay a \$25 reinstatement fee.

Entering students complete their preliminary registration during orientation for new students the week before classes begin in August.

All students must file a final course registration by the end of the second week of classes. Any student who fails to comply with this requirement will be assessed the \$25 reinstatement fee. A student who changes registration after the second week of classes will be charged a fee of \$10 for each add/drop form submitted, unless the change is a result of a revision in the course offerings or class schedules of the university.

Each student's course registration card must be signed by his or her faculty adviser. Freshmen and sophomores should have their registration approved by the faculty adviser assigned to them in their college. Juniors and seniors have faculty advisers in their major departments. Entering transfer students will be assigned advisers according to their class standing. Freshman students in architecture and music must also consult faculty advisers in their respective fields. Freshmen in engineering must consult faculty advisers in their intended fields of engineering.

The end of the fourth week is the final deadline for late registration or for registering in additional courses. A student may drop courses as late as the

end of the tenth week but must secure permission through the Dean of Undergraduate Affairs to continue the semester with fewer than twelve semester hours (four courses). See Course Programs below.

The above regulations and fees may be suspended for a student who wishes to change majors.

Course Programs

Students at Rice normally enroll in fifteen to seventeen semester hours (five courses) each semester and thus in eight semesters complete the requirements for graduation in their major. Students wishing to register or to be enrolled at any time during the semester for less than twelve or more than twenty semester hours (less than four or more than six courses of at least three semester hours each) must secure approval from the Committee on Examinations and Standing through the Dean of Undergraduate Affairs.

A student who enters with advanced placement credits, takes an overload during the regular term, or enrolls in additional courses in summer school may be able to fulfill the requirements for graduation in less than eight semesters. A student enrolled in fewer than five courses may make up the work in a subsequent semester or in summer school or by continuing beyond the normal four years.

A student on academic probation is not allowed to enroll in more than seventeen semester hours (five courses). A student who receives two or more "incomplete" grades in a semester is not eligible to enroll in more than fourteen semester hours (four courses) in the semester immediately following.

Courses in ROTC are not included in determining the number of semester hours of enrollment in a semester.

Transfer Credit, Including Credit for Summer School Courses Not Taken at Rice

The basis for approval of transfer credit toward a Rice undergraduate degree for courses taken at another college or university is equivalence in content and semester-hour credit to a corresponding Rice course. Transfer credit for no more than fourteen semester hours (four courses of at least three semester hours each) taken during the summer at an accredited college or university other than Rice will be granted if the courses are individually acceptable for transfer credit.

Students who wish to take courses at another university during an approved leave of absence or during the summer are advised to secure prior approval of transfer credit from the registrar by submitting the name of the school and the list of specific courses for which credit is requested. If courses taken elsewhere are to count as part of the student's major requirements, written approval for transfer credit must also be secured from the appropriate department.

Prior approval is recommended but not required. Courses may be submitted for transfer credit after the work has been completed. Final approval of credit will be granted and entered on the student's permanent record when the registrar receives an official transcript verifying completion of the work with a grade equivalent to C or better.

Students transferring to Rice from another college or university should apply to the registrar for transfer credit on the same basis.

Financial aid from Rice is not available for courses taken at another school.

Approval of Degree Plans and Majors

At the time of preliminary registration in April each year continuing students must file a complete degree plan with the registrar and with their major department or college (freshmen only). The degree plan must be approved by the student's adviser and must include: (1) major(s), (2) courses completed to date, (3) proposed courses for each subsequent year which will show when major requirements and distribution requirements will be met, and (4) the expected date of graduation.

A student who wishes to propose a degree plan which varies from the normal requirements for the degree sought may submit it with appropriate explanation and justification to the Committee on Examinations and Standing for approval.

A student's degree plan, including the student's choice of major, may be changed at any time by filing a new, properly approved plan with the registrar.

Final Examinations

Final examinations are given in most courses, but the decision to give a final examination as a required part of the course rests with the instructor and the department.

No student may be required to take a final examination before the official examination period as scheduled on the academic calendar, nor may an instructor require that a take-home final examination be returned before 5:00 p.m. on the last day of the scheduled examination period. These restrictions do not apply to laboratory examinations.

All tests and examinations are conducted under the honor system.

Grade Symbol and the Pass-Fail Option

1	very high standing	P	pass
2	high standing	F	failure
3	satisfactory standing	WD	withdrawn without prejudice
4	low standing	INC	incomplete
5	failure	*	other

Any student may enroll in one course of not more than four semester hours on a pass-fail basis in any four semesters of the normal eight-semester program. This option does not apply to the required courses taken within a student's major department nor to related required courses in other departments which the major department may specify as not available for the pass-fail option. Students wishing to enroll on a pass-fail basis in a course of more than four semester hours may apply to the Committee on Examinations and Standing for approval.

Courses are designated as taken under the pass-fail option by filing the proper form in the Registrar's Office no later than the end of the fourth week of classes. Any course so designated may be converted back to a numerical grade prior to the end of the tenth week.

A grade of "incomplete" is reported to the registrar by the instructor when a student has not been able to complete a course because of illness or other circumstances beyond the student's control during the semester. Such work must be completed and a numerical grade reported by the end of the fifth week of the next semester; otherwise the "incomplete" is automatically converted to 5.

A grade of "other" may be given if a student fails to appear for the final examination after completing all the other work of a course, or if the registrar

has not received grades from the instructor at the time the grade reports are prepared. A designation of "other" must be resolved promptly after the end of the semester; otherwise it will be converted to 5.

Students with designations of "incomplete" or "other" should be aware that they may go on probation or suspension for the previous semester when these are changed to numerical grades.

President's Honor Roll

Outstanding students are recognized each semester through the publication of the President's Honor Roll. In order to be eligible, students must have number grades in a total of twelve or more semester hours, laboratories and courses of less than three semester hours included, and must not have any grade of 5 or F. Approximately 30 percent of all undergraduates will be eligible. The exact cut-off each semester is to be determined by the Committee on Examinations and Standing on the basis of grade point averages provided by the Registrar's Office. A designation of P will not affect a student's eligibility one way or the other, nor will it figure in the calculation of the student's grade point average for the semester. Grades in freshman Physical Education and ROTC courses will not be counted in the required number grades for twelve or more semester hours, nor in calculating a student's grade point average for the semester.

Academic Probation

A student will be placed on academic probation if at the end of any semester:

1. the student fails more than 25 percent of his or her course program for the semester, calculated according to semester hours, or
2. the student does not earn grades of P, 3-, or better in at least 50 percent of his or her course program for the semester, calculated according to semester hours.

Students who earn grades which would place them on probation a third time are automatically suspended from the university.

The period of probation extends to the end of the next semester in which the student is enrolled at the university. A student on probation is not permitted to be a candidate for nor to hold any elective or appointive office. This restriction is also embodied in the constitution of the Student Association.

Academic Suspension

A student will be suspended from the university if at the end of any semester:

1. the student is failing in more than half of his or her course program for the semester, calculated according to semester hours, or
2. the student earns grades which would place him or her on probation a third time.

Provision 1 does not apply to undergraduate students at the end of their first semester at Rice.

Students who are suspended are normally required to withdraw for a period of at least one semester. Readmission after suspension is subject to approval of the Committee on Examinations and Standing.

To obtain readmission, the student should address a letter of petition to the committee at least a month before the beginning of classes, and at the same time request two supporting letters from persons under whom the student has worked or with whom the student has been associated in the interval of the suspension. If the problems causing the previous academic difficulty appear, upon proper consultation, to have been relieved, the student is generally readmitted. In some instances approval of readmission may be postponed, or suspension may be permanent.

If a student who has previously been suspended earns grades which would result in probation, the student will automatically be suspended a second time. The period of second suspension will be at least two semesters.

A student desiring special consideration with regard to readmission following suspension should petition the committee in writing.

Readmission Involving Disciplinary or Other Nonacademic Considerations

Petitions for readmission following suspension, voluntary withdrawal, or a leave of absence beyond two years, which involve disciplinary or other non-academic considerations, may be subject to review by the Proctor before final approval by the Committee on Examinations and Standing.

Voluntary Withdrawal and Readmission

A student may withdraw voluntarily from the university at any time during the semester up until the last day of classes and, if in good academic standing at the time of withdrawal, the student will normally be readmitted upon written application to the Committee on Examinations and Standing.

Any student desiring to withdraw should inform the college master in person and give written notification of withdrawal to the Dean of Undergraduate Affairs, who will notify other offices of the university as necessary. If the student withdraws within five weeks of the final examination period, class grades as of the date of withdrawal will be considered in determining eligibility for readmission. Students who fail to give notice of withdrawal should expect to receive failing grades.

Leave of Absence

A student may request a leave of absence from the university by applying in writing to the Committee on Examinations and Standing at any time prior to the first day of classes in the semester which marks the beginning of the leave. Leave from the university after the beginning of the semester is considered a voluntary withdrawal.

To be readmitted following an approved leave of absence of not more than four semesters, students need only notify the Dean of Undergraduate Affairs of their intention to return at least one month before the beginning of the semester. After four semesters, they should apply in writing to the Committee on Examinations and Standing, as in the case of a voluntary withdrawal.

Approval of a leave of absence is always contingent on the student's satisfactory completion of course work in the semester preceding the leave; otherwise the approved leave may be converted to suspension.

Graduation

To be recommended for any bachelor's degree, students must have earned grades of 3 or better in at least 50 percent of the work prescribed for the degree, including grades of 3 or better in at least 50 percent of the advanced work in their major field, calculated by semester hours.

A student must complete a total of at least 120 semester hours, including 48 semester hours (fourteen courses of at least three semester hours each) in advanced courses, in order to qualify for a Bachelor of Arts degree. Students enrolled in a program leading to a degree of Bachelor of Science in one of the various branches of engineering should check with the appropriate department concerning graduation requirements.

Students must be registered with the university in the semester immediately preceding the awarding of their degrees. Students who have completed their degree requirements in the summer or fall prior to that semester, or who are completing their senior year at another college or university by special arrangement with the Committee on Examinations and Standing, must register on campus or by mail for a no-tuition course DGRE 498b, in order to be listed as degree candidates. They will be charged a \$50 registration fee and a diploma fee.

The Committee on Examinations and Standing reviews each student's record at the time of graduation and recommends to the faculty outstanding students to be granted degrees *cum laude*, *magna cum laude*, or *summa cum laude*.

Rice Tutorial Program

Departments with major teaching assignments provide tutoring to freshmen having academic difficulty. Each participating department names a faculty tutor who is responsible for organizing tutoring activities and assigning students who need tutoring to groups or individual tutors. Assignments are made on a mutually agreeable basis after consultation.

Anyone may recommend or request tutoring for an individual freshman. Students who feel they need help may request it themselves. The normal procedure is to consult with the course instructor or the department tutor first; however, the college liaison associate and the program coordinator are available for consultation and assistance.

Each residential college selects a faculty associate who has agreed to serve in a liaison capacity. The faculty member seeks ways to aid communication and help advise freshmen who may need tutoring. The entire tutoring program is under the supervision of a faculty member who acts as program coordinator.

Information concerning the tutorial program may be secured from the Office of Student Advising and Student Activities.

Admission of New Students

From its very beginning Rice University has sought to maintain an academic program of the highest order of excellence for a small body of students. This number has grown with the expansion of the university's resources over the past decade, but the total number of students admitted to Rice still remains relatively small — approximately 500 students in each freshman class.

In making its selections, the Admissions Committee attempts to seek out and identify students who have demonstrated exceptional ability and the potential for personal and intellectual growth. There is no discrimination whatever on the basis of sex, race, or creed. Decisions are based not only on high school grades and test scores but also on such qualities as leadership, participation in extracurricular activities, and personal creativity. The university's aim is diversity rather than uniformity, and it believes that students learn from each other and from the life of the residential colleges, as well as from their classes and laboratories.

Students are selected on a competitive basis under admissions quotas in (1) architecture; (2) humanities and social sciences; (3) engineering; (4) music; and (5) science. Applicants should give careful consideration to the category under which they wish to be considered. Students, however, are free to change from one of these areas to another, after consultation with their adviser. Only architecture and music have strictly limited enrollments. Occasionally physical limitations of other departments may make it necessary to limit enrollment of majors in some departments.

There are four basic measures used in admissions: (1) scholastic record as reflected by the courses chosen and the quality of performance; (2) scores on the Scholastic Aptitude and Achievement Tests administered by the College Entrance Examination Board; (3) evaluations made by teachers and counselors; (4) personal interviews and the student's statements about his or her interests, experience, and goals. The Admissions Committee is particularly interested in any information that can give insight into the extracurricular areas of development and such unmeasurable factors as motivation, intellectual curiosity, and character.

1. **The High School Record.** The completion of not less than sixteen acceptable units is required. The record must include the following units:

English	4	Laboratory science	2
Social Studies	2	(biology, chemistry, physics, etc.)	
Mathematics (algebra, geometry)	3	Additional credits in above-	
A foreign language	2	listed subjects	3
		Total	16

Preparation in chemistry, physics, trigonometry, and additional advanced mathematics courses is required of applicants for the engineering and science divisions.

2. **Entrance Examinations.** The required entrance examinations are administered by the College Entrance Examination Board. Formal arrangement for applying to take the C.E.E.B. examinations, as well as for paying fees, is a matter between the applicant and the College Entrance Examination Board. The C.E.E.B. bulletins and test applications are available from high school counseling offices. They may also be obtained in the Rice Admissions Office.

The following examinations are required according to the curriculum selected:

A. Humanities, Social Sciences, Architecture, and Music *B. Science and Engineering*

- | | |
|---|---|
| (1) Scholastic Aptitude Test | (1) Scholastic Aptitude Test |
| (2) Three achievement tests as follows: | (2) Three achievement tests as follows: |
| (a) English composition * | (a) English composition * |
| (b) any two of the following: | (b) Mathematics |
| A foreign language | (Level I or Level II) |
| American history and | (c) Chemistry or physics |
| European history and | |
| world cultures | |
| Literature | |
| Mathematics | |
| A science | |

*with or without essay

The courses of study and majors offered may be found on pages 103 through 264.

3. Evaluations from High School Counselors and Teachers. Rating sheets submitted by the applicant's high school teachers and counselors are considered in connection with every application.

4. Personal Interviews. Interviews are an integral part of the admission procedure. They enable the Committee on Admissions to reach a decision based on nonacademic, as well as academic, aspects of the candidate's development. The candidate should arrange for an interview in compliance with the admissions calendar on page 69. Campus interviews will be held at 109 Lovett Hall between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday, and until 11:30 on Saturday mornings. (Summer schedule: Monday through Friday, 9:00 a.m. to 4:00 p.m.) Applicants who cannot visit the university or who are unable to meet with a traveling member of the admissions staff may be interviewed by alumni interviewers located throughout the United States and in several foreign countries. If an applicant cannot be interviewed by one of these methods, the interview will be waived. Candidates for admission to the Shepherd School of Music must arrange for an audition and interview with the music faculty.

Early Decision Plan

The Early Decision Plan is open to candidates for admission who regard Rice University as their first choice and will await the outcome of their application to Rice before applying elsewhere.

Students applying for the fall semester 1979 under the Early Decision Plan must complete the required College Board Examinations on or before June 3, 1978. Applications for admission may be filed between July 1 and October 1. Admission notices will be mailed soon after November 15, 1978.

Requirements for admission will not be altered by an early decision. Those accepted will be expected to complete the remainder of their high school work with superior performance.

Early Decision candidates who apply for financial aid will be notified of admission in mid-November but may have to wait until December 1 to be notified of their financial aid package.

Action on some applications may be deferred until the Regular Decision period if the Admissions Committee does not have adequate grounds for an affirmative decision in November. An additional semester of the high school record and additional C.E.E.B. scores from the November, December, or January tests may be added for later consideration. The applicant would, of course, be released from the pledge to apply only to Rice.

An applicant offered admission under the Early Decision Plan must make a \$100 nonrefundable registration deposit within 30 days in order to hold his or her place in the incoming freshman class. Those who wish to reserve a room on campus must make an additional \$50 deposit.

Interim Decision Plan

Applicants who complete their SAT and Achievement Tests by December and who file the application for admission before December 1 will be considered in the Interim Decision Plan and be notified of the outcome by February 9.

An applicant offered admission under this plan must make a \$100 registration deposit by March 10. This deposit is not refundable after March 10. Those who wish to reserve a room on campus must make an additional \$50 deposit.

Regular Decision Plan

Regular Decision applications completed by February 1 will be considered before April 10. Applications received after February 1 will be considered only after all earlier applications. Candidates who apply after February 1 must do so in full knowledge that they are in a highly speculative position.

Applicants not accepted under the especially stringent guidelines for Early Decision and Interim Decision will normally be advised to keep their applications alive until all applicants can be considered. Regular Decision applicants who are offered admission should make a \$100 registration deposit by May 1 to reserve their places in the incoming class. This deposit is not refundable after May 1. Those who wish to reserve a room on campus must make an additional \$50 deposit.



Admissions Calendar

EARLY DECISION	INTERIM DECISION	REGULAR DECISION	TRANSFER
Application by October 1	Application by December 1	Application by February 1	Application by November 1, for midterm, April 2 for fall
Interview by October 16	Interview by January 1	Interview by March 1	Interview by Nov. 1 for mid-term, April 2 for fall
Required SAT & Achievement Tests in the junior year by May & June	Required SAT & Achievement Tests completed by the December test date	Required SAT & Achievement Tests completed by the January test date	Required SAT if never previously taken
Notification of admission mailed November 15	Notification of admission mailed February 9	Notification of admission mailed April 10	Notification in early May
Financial Aid Form filed by October 1 Financial Aid notification by December 1	F.A.F. filed by January 15, Financial Aid notification by February 9	F.A.F. filed by February 1. Financial Aid notification by April 10	Notification when admitted; allow two months after filing F.A.F.
Deposit within 30 days nonrefundable after May 1	Deposit within 30 days nonrefundable	Deposit refundable until May 1 (Candidates Reply Date)	Nonrefundable \$100 deposit within 30 days

No application fee is required of candidates for admission to Rice.

The \$50 room deposit is due on the same date as the registration deposit. The room deposit may be refunded or credited to the applicant's account until such time as a room is assigned to the applicant.

Advanced Placement

Entering freshmen who have done work well beyond the usual high school courses in certain subjects and who make a score of 4 or 5 on the Advanced Placement Examinations offered by C.E.E.B. and taken prior to matriculation at Rice, will be given university credit toward graduation for appropriate Rice courses satisfying distribution or free elective requirements. Acceptance of such credit in fulfillment of a student's major requirements is subject to approval by the department in question. Credit for specific courses at Rice will depend upon which advanced placement examination was successfully completed.

Students, who make high scores on the College Level Examination Program (CLEP) tests in chemistry may, at the discretion of the Chemistry Department, receive advanced placement and college credit in chemistry. Students with high scores on a departmental examination in biology administered by the Rice Biology Department to entering students will have the opportunity to take the CLEP test in biology and may on the basis of their CLEP scores

receive degree credit as well as advanced placement in biology. College credit is not given for any other CLEP examinations at this time. No degree credit for introductory courses in chemistry or biology on the basis of CLEP scores will be granted to students who have taken more advanced college work in the subject.

During orientation week at the beginning of the academic year, entering students may take advanced placement tests administered by various departments at Rice. On the basis of these tests students may be advised to register in courses beyond the introductory level. College credit is not given for these tests.

Transfer Students

Rice University encourages application from students with superior records who wish to transfer from a junior college or a four-year college or university. Interested students should request a transfer application form from the Office of Admissions.

Applicants should file an application before April 1 if they plan to request admission in the following fall semester. Applications must be accompanied by official transcripts showing all college level work completed to date and courses in progress. Decisions regarding transfer applications for admission to the spring semester are usually made during November. For the fall semester notification of admission is made by early May.

The criteria used in evaluating transfer applications are essentially the same as those applied to applicants for the freshman class, except that special emphasis is given to performance at the college level. Scholastic Aptitude Test scores are required. If candidates have not previously taken C.E.E.B. tests, they must take the Scholastic Aptitude Test no later than January if they wish to apply for admission in the fall. Achievement Tests are not required.

Transfer students must be registered in residence at Rice for at least four full semesters during the fall or spring terms, and must complete not less than fifty-two semester hours (sixteen courses of three or more semester hours each) for a Rice degree.

For further information or application forms, prospective candidates for admission as undergraduates should communicate with the Office of Admissions. When requesting application forms, candidates should clearly indicate that they are prospective transfers from another college.

Visiting Students

Students who wish to spend a semester or a year at Rice taking courses for credit to be applied toward their undergraduate degree at another school should apply for admission as visiting students through the Office of Admissions. The student's application should be accompanied by an official transcript of college work to date and a letter from the student's academic dean or registrar agreeing to grant transfer credit subject to satisfactory performance.

Visiting students will be assigned membership in a college during their stay and will be charged the same fees as other undergraduates. In a few classes where enrollment is limited because of space or other considerations, candidates for Rice degrees will have priority over visiting students. Financial Aid is not available for visiting students.

Class III Students

Class III standing at Rice University designates students with an undergraduate or graduate degree from an accredited college or university who are taking courses for credit but not in a specific degree program. The university keeps a permanent record of such courses and will send a transcript of that record anywhere on request from the student. Courses taken as a Class III student may be used to prepare for advanced degree work or to satisfy requirements for admission into a graduate program. However a graduate degree may not be earned through the Class III program nor may such work be credited toward resident requirements at Rice until the student has applied to the appropriate department, been recommended for admission, and been officially admitted by the Graduate Council.

Although most undergraduate courses and some graduate courses are open to Class III students, in a few classes and laboratories where enrollment is limited because of space or other considerations, candidates for Rice degrees will have priority over Class III students.

Application for admission as a Class III student should be submitted to the Office of the Dean of Advanced Studies and Research. For information on tuition and fees for Class III students, see page 73. Financial Aid is not available for Class III students.

Admission of High School Students to Take Courses for Credit

Accelerated high school juniors and seniors who have taken all the courses in a given discipline available to them in high school, or who have completed their high school graduation requirements, may request admission to Rice for the purpose of taking one or more university level courses on the same basis as Rice undergraduates. Such courses will be graded for credit, and the university will send a transcript of this record on request by the student to any college or university. If the high school student is later admitted to Rice, any such courses which carry credit of three or more semester hours will be counted toward the student's undergraduate degree at Rice.

Tuition for such courses in \$100 per semester hour plus a \$50 registration fee, the total not to exceed \$1250. Application for admission should be made to the Admissions Office. Financial assistance is not available for this program.

Auditors

Any interested person may audit one or more courses at Rice by securing permission of the instructor and by registering as an auditor with the registrar. The university grants no academic credit and keeps no permanent records of courses attended by auditors.

Currently enrolled students may audit courses without charge. Rice alumni may audit as many courses as they wish for a fee of \$25 per semester. All others will be charged \$50 per course per semester for the privilege of auditing.

Student Housing

Prospective students should indicate on the application for admission whether or not they desire to reside on the campus. Information about residence in the college and room application forms will accompany the notice of admis-

sion sent to each new undergraduate. Room reservations cannot be made prior to notification of admission.

At present, Rice University has the capacity to house about 60 percent of its undergraduate students in the residential colleges on campus. Although the majority of students desiring to live in the colleges can be accommodated, demand exceeds the available number of rooms. Every effort is made to provide housing in the colleges for all incoming freshmen who wish to live on campus, but continuing students cannot be promised space and must draw for rooms according to the priority system in each college. No student is required to live on campus. Off-campus members are encouraged to eat in their colleges and to participate in college activities.

Correspondence from new students regarding housing in the residential colleges should be addressed to the Office of Admissions. Information concerning off-campus housing is available from the Office of Student Advising and Student Activities.



Tuition, Fees, and Expenses

The tuition and fees for undergraduate students are set forth below. These charges are subject to change from time to time as the operating expenses of the university change.

Tuition

The tuition for undergraduate students is \$2500 per year, payable \$1250 prior to the beginning of each semester.

Part-time students taking less than four courses by special permission of the Committee on Examinations and Standing will be billed at the part-time rate of \$100 per semester hour for the courses in which they are enrolled plus a \$50 registration fee, the total of tuition and registration fee not to exceed \$1250 per semester.

The tuition charge for Class III students is \$125 per semester hour plus a \$50 registration fee, the total not to exceed \$1250 per semester.

Students completing their degree requirements in the summer or fall prior to the awarding of the degree or students completing their senior year at another university by special permission of the Committee on Examinations and Standing will be charged a \$50 registration fee and a diploma fee for the spring semester. (See Graduation, page 65).

Any undergraduate who withdraws or takes an approved leave of absence and is then readmitted to the university will be charged the tuition in effect during the semester in which he or she returns.

Fees

All undergraduate students and candidates for a second bachelor's degree will be charged the following annual fees, payable in full at the time of the student's first tuition payment for the year or any portion of the year.

Subsidies to students' activities	\$24.55
Tickets to athletic events	4.00
College fee	25.00
Health Service	66.00
Total fees	<u>\$119.55</u>

Special Charges

Orientation Week (room and board)	\$25.00
Late payment	25.00
Late change of registration	10.00
Diploma	22.00
ROTC	15.00
Health Insurance, twelve months, single student (See page 86)	112.75

Guaranty Bond

Every undergraduate student, regardless of age, is required to provide a \$300 guaranty signed by the student and a parent, guardian, or other responsible adult, excluding a spouse or another student. A deposit is not required for this bond.

Refund of Tuition

A student who withdraws during the first two weeks of the semester will not be charged tuition or fees for that semester. A student who withdraws during the third week will be charged 30 percent of the semester's tuition. The amount of the refund will be reduced by 10 percent at the beginning of each successive week. No refund will be made for withdrawals after the ninth week. There is no refund of fees or special charges after the second week of classes in the semester. The \$100 registration deposit paid by incoming freshmen is not refunded at any time if the student withdraws. There is no partial refund of fees paid for the full year for withdrawals or leaves of absence in the spring semester.

Teacher Certification Program Fees

All students enrolling in either the apprenticeship plan or the internship plan will be charged a \$100 registration fee for each semester or summer period.

Delinquent Accounts

No student in arrears in any financial obligation to Rice University as of the date announced for the completion of registration for any semester will be registered. No certificate of attendance, diploma, or transcript of credit will be issued at any time for a student whose account is in arrears.

Students who have not made satisfactory arrangements with the cashier for payment of current charges, or anyone moving on campus without executing a satisfactory room contract, may be dropped from the rolls of the university.

Transcripts

Transcripts are issued on request made to the Office of the Registrar. No transcript is issued without consent of the individual whose record is concerned. Each student is entitled to two free transcripts. There is a charge of \$1 for each additional copy, payable in advance. Those requesting transcripts by mail should include payment with the request.

Living Expenses

Residence fees, to cover costs of dining halls and operation of residences, are established from year to year as requirements dictate. For 1978-1979 the yearly room and board charge for residence in a residential college is \$1990. This charge provides room and three meals per day excluding the evening meals on Saturdays and Sundays. Meals are not served during the Thanksgiving holidays, mid-year, fall and spring midterm recesses, and the Easter holidays. When securing room assignments for the academic year to follow, each student is required to make a room deposit of \$50. To assure reservation of space, current students must make room deposits by the date established in the various colleges, but no later than April 15. New students are required to make a similar deposit prior to May 1. These deposits are returnable but will be applied against the following semester's charges. The balance of the residence fee is payable in installments. The exact amounts and due dates are stated in the residential college agreement which each on-campus resident is required to sign.

All items included, the young man or woman entering Rice University in August 1978 and living on campus will need to have available about \$5550 the first year. For a student living at home the cost will be about \$4500.

Financial Aid

The financial aid program at Rice University seeks to provide assistance as needed in meeting the basic costs of attendance to all students who are admitted. Through grants, low interest loans, campus work opportunities, or a combination of these programs, Rice attempts to give the students sufficient aid to meet educational expenses.

The financial aid program is funded from many sources. Rice University receives from alumni and friends contributions which are used to initiate and maintain scholarships and loan funds. Other funds available to the students are federal programs, both grant and loan, the state grant program, and the Rice University tuition grant and loan appropriation from endowment income.

Awards are based primarily on financial need. It is assumed that (1) students will rely upon their own resources as much as possible and will make a reasonable effort to increase them through summer work and other sources which may be available to them, (2) student expenses will be held to a reasonable minimum, and (3) parents will contribute in proportion to their means and other obligations.

A brochure entitled "Rice: Financial Aid Opportunities" explains the program of assistance in detail. You may secure a copy from the Office of Admissions.

The determination of need is based on information supplied through the College Scholarship Service.

Application

To apply for financial assistance the candidate must file a Rice University financial aid application with the university as well as the Financial Aid Form with the College Scholarship Service. When Rice University receives both forms the applicant is considered for all appropriate assistance administered by the university including grants, scholarships, loans, and work.

Early Decision candidates may obtain the Financial Aid Form from Rice University. This form and the application for financial aid must be filed by October 1. Interim Decision candidates must file the Rice University financial aid application and the Financial Aid Form by January 15 and Regular Decision candidates must file the Financial Aid Form by February 1.

Notifications of offers of financial aid accompany notices of admission to Rice. Financial aid awards are made on an annual basis and are payable as indicated on the award sheet.

Continuing students must file the Rice University financial aid application with the university and the Financial Aid Form with the College Scholarship Service by August 1. Since awards are based on need which may change from year to year, the amount of assistance is reviewed and adjustment made each year as related to the current need.

Financing

In some cases meeting the costs of higher education in a private university is difficult even though the usual financial analysis indicates no need for financial aid. It is understood that even though a family's assets may be adequate to afford the cost of tuition, fees, and room and board without financial

aid, payment of relatively large sums at stated times may require rearrangement of family planning that results in hardships or sacrifice. Rice University offers two payment plans to permit financing of educational costs. Both require very low interest charges.

A short-term, ten-pay plan permits division of the annual university charges over ten months. Arrangements are made through the Cashier's Office, from which details and applications may be obtained.

Longer term financing is available through the Rice University loan program to those for whom lump sum payments would require undue hardship. Under the terms of this plan a student may borrow up to two thousand dollars in one year. Interest is not charged so long as the student is registered as an undergraduate in the university. Upon more than one year's leave of absence, or withdrawal, or following graduation, arrangements are made for repayment over an extended period, interest being charged at a very nominal rate.

Student Loan Funds

A few endowments have been established for student loans primarily as memorial tributes. Others are welcome. These funds are basically part of the normal financial aid program. They are used also, however, for emergency loans to students who experience unexpected financial problems during a term.

Karl Bailey-William Carroll Memorial Loan Fund
 Frank McFadden Caldwell Loan Fund
 Louise Adele Drenkle Loan Fund
 Mary Alice Elliott Loan Fund
 Houston Bridge League Loan Fund
 Leo M. Levy Memorial Loan Fund
 Lora B. Peck Loan Fund
 Rice University Loan Fund
 Students Memorial Loan Fund
 Owen Wister Literary Society Alumnae Loan Fund

Student Employment

Employment is available to students interested in working part time during the academic year. These work opportunities are available both on campus and off campus. Students seeking employment should apply directly to the Financial Aid Office.

Vocational Rehabilitation

The Texas Rehabilitation Commission offers assistance for tuition and nonrefundable fees to students who have certain disabling conditions if their vocational objectives have been approved by a TRC counselor. Examples of such conditions are orthopedic deformities, emotional disorders, diabetes, epilepsy, and heart conditions. Other services are also available to assist the handicapped student to become employable. Application for such service should be made at the Texas Rehabilitation Commission. Students with visual handicaps should contact the Texas State Commission for the Blind.

Undergraduate Scholarships and Awards

Alumni and friends of Rice University have generously endowed many awards and scholarships to assist students. Some of these are awarded on the basis of need as well as academic performance, but a number of scholarships and prizes are given on the basis of academic performance alone.

Students do not apply for these awards and scholarships. Every student is automatically considered for an award or scholarship on the basis of entrance qualifications or performance at Rice, together with evidence of financial need submitted to the Financial Aid Office as these or other qualifications may be appropriate. Further information on the donors, the number and purpose of individual awards, and the names of their most recent recipients are available from the Financial Aid Office or from the office of the Dean of Undergraduate Affairs.

General Awards and Scholarships

Achievement Rewards for College Scientists Foundation Scholarship
 John McKnitt Alexander Chapter of The Daughters of the American Revolution Scholarship
 Joe L. and Barbara Allbritton Scholarship
 Florrie Ethel and M.E. Andrews Scholarship
 Samuel S. Asch Scholarship
 Max Autry Memorial Scholarship
 Axson Club, Ellen Axson Wilson Scholarship
 Axson Club, Katie B. Howard Scholarship
 Axson Club, Special Scholarship Honoring Mrs. A. S. Foote
 Donald R. Baker Scholarships
 Graham Baker Studentship
 James A. and Alice Graham Baker Distinguished Scholarship
 James A. and Alice Graham Baker Honor Scholarships
 Board of Governors Scholarships
 Fletabel Denton Briggs Memorial Scholarships Trinity College,
 Mildred C. Brinn Scholarship
 C. D. Broad Exchange Program Award with
 Cambridge
 Brown and Root Officers Scholarships Honoring George R. Brown
 Clyde and Ethel Butcher Scholarship
 Chapman-Bryan Memorial Scholarship
 Chinese Professional Club Scholarship
 Class of 1921 Scholarship
 Arthur B. Cohn Prize Scholarships
 College Bowl Champions Scholarship
 College Women's Club Scholarship
 Continental Airlines Foundation Scholarship
 Thomas A. and Pauline M. Dickson Scholarship
 Thomas P. and Maude Seeger Dow Scholarships
 Thomas Flaxman Scholarship
 Thomas R. and Julia H. Franklin Scholarships
 Lady Geddes Prize in Writing
 Mary Parker Gieseke Scholarship

Gordon Jewelry Scholarship
 Harold B. Hamilton Scholarship
 William Clifford Hogg Fund Scholarships
 Hohenthal Scholarships
 Mercer T. Ingram Scholarship
 M. M. Feld and J. P. Hamblen Interfaith Charity Scholarships
 Alfred R. and Eleanor H. Johnson Scholarship
 Gaylord Johnson Scholarship
 Jones College Scholarship
 Grant William Jordan and Cora Jordan Memorial Scholarships
 Louise S. Koehler Scholarships
 Patrons of E.L. Lester and Company Scholarship
 Lottman Scholarship
 Margaret Brokaw McCann Scholarship
 J. L. C. McFaddin Scholarship
 W. P. H. McFaddin Scholarship
 Emma S. McGree Scholarships
 Byron Meredith Scholarship
 Achille and Malline Meyer Memorial Scholarship
 Fannie Bess Emery Montgomery Scholarship
 Motheral-Neilan Scholarship
 Muller Scholarship
 Rice Sponsored National Merit Scholarships and National Achievement
 Scholarships
 Ida R. and Hanna E. Nussbaum Scholarship
 Rebecca Raphael and Lilly G. Nussbaum Scholarship
 Raymond Pearson Scholarship
 Emanuel and Mose Raphael Scholarship
 Robert H. Ray Memorial Scholarships
 Ernest R. Rechel Memorial Scholarships
 Rice Service Award
 Richardson Scholarships
 Daniel Ripley Scholarship
 Edith Ripley Scholarships
 James M. and Sarah Rockwell Scholarships
 Catherine Withers Roper and Benjamin E. Roper Memorial Scholarship
 Willie Rowell and Ruth Andrews Scholarship
 The Roy Scholarships
 Kathleen Elaine Schlotterbeck Memorial Scholarship
 Jackie Schnell Memorial Scholarship
 Anita and Campbell Sewall Scholarship
 Society of Rice University Women Scholarship
 Sara Stratford Scholarship
 Teagle Foundation Scholarships
 Herschel M. Vaughan Student Scholarship
 John B. Warren, Jr., Scholarships
 Lady Washington Texas Centennial Award
 Abe and Rae Weingarten Scholarship
 Harris Weingarten Scholarship
 Robert A. Welch Foundation Undergraduate Scholarships
 Elizabeth Aldridge Wells Scholarship
 Blanche White Honor Scholarships
 Charles K. and Maidie Autry Wilbanks Student Fund

Awards and Scholarships in Departmental Disciplines

Accounting and Management

Leo M. Acker Memorial Scholarship
 Atlantic-Richfield Scholarships
 Financial Executives Institute Award
 Haskins and Sells Foundation Scholarship in Accounting
 John T. McCants Prize in Accounting
 Texas Society of Certified Public Accountants Accounting Excellence Award

Architecture

Alpha Rho Chi Award in Architecture
 American Institute of Architects School Medals
 Edward B. Arrants Award in Architecture
 Caudill Rowlett Scott Scholarship
 James H. Chillman, Jr., Prizes
 John Crowder Memorial Scholarship
 M. N. Davidson Fellowships
 Featherlite Scholarship in Architecture
 Jesse H. Jones Scholarship in Architecture
 Fay H. Spencer Memorial Scholarship
 William Ward Watkin Traveling Fellowship

Art

PALS Art Awards
 Christine Croneis Sayres Memorial Art Award

Athletics

George R. Brown Football Awards
 Emmett Brunson Award
 Walter W. Fondren, Jr., Memorial Scholarship
 Joyce Pound Hardy Award
 Joe F. Lipscomb Freshman Award
 George Martin Award
 T. S. Martino Scholarship
 Dell Morgan Award
 Jess Neely Football Awards
 Robert Pilcher Quin Award
 Billy Wohn Award

Chemistry

Z. W. Salsburg Memorial Award
 Richard B. Turner Memorial Awards

Economics

Gibraltar Savings Association Scholarship
 Blanche Randall Haden Scholarship

Education

Millie Tutt Cook Scholarship

Engineering

American Institute of Chemical Engineers Award
American Institute of Chemical Engineers, South Texas Section, Scholarship
R. C. Baker Foundation Scholarships
Mr. and Mrs. Val T. Billups Scholarship
Brown Awards in Engineering
Gerard A. Dobelman Memorial Scholarship
Steven G. Dobelman Memorial Scholarship
Fluor Ocean Services Scholarship
Lillian Haynie Scholarship
Houston Engineering and Scientific Society Scholarship
Kemper Foundation Engineering Scholarships
A. C. Lederer, Jr., Scholarship in Civil Engineering
Mason G. Lockwood Engineering Scholarship
H. A. Lott, Inc., Scholarship
National Society of Professional Engineers Scholarship
Rice Engineering Alumni Outstanding Senior Engineering Student Awards
Spaw-Glass Merit Scholarship in Chemical Engineering, honoring Mr. and
Mrs. L. D. Spaw, Jr.
James S. Waters Creativity Award

French

Pi Delta Phi André Bourgeois Award
William J. Reckling Memorial Scholarship
Schlumberger Foundation French Fellowships.

Geology

Torkild Rieber Award
L. P. Teas Scholarship

German

Max Freund Prize in German

History

Mary Hayes Ewing Publications Prize in Southern History
Barbara Field Kennedy Prize in American History

Mathematics

Spaw-Glass Merit Scholarship honoring Mr. and Mrs. T. F. Glass, Jr.

Military Science

American Legion Scholastic Excellence Awards
Armed Forces Communications and Electronics Association Awards
Society of American Military Engineers Award
Superior Cadet Decoration Awards

Music

Elva Kalb Dumas Award in Music
 Erwin and Emily Heinen Award in Music
 Sallie Shepherd Perkins Award
 Burt Duke Raiza Piano Scholarship
 Benjamin A. Shepherd Awards
 Dorothy Richard Starling Awards

Naval Science

Jesse H. Jones Naval Scholarships
 Leonard S. Mewhinney Scholarship
 Navy League Award
 Society of American Military Engineers Award

Physical Education

G. L. Hermance Award in Physical Education

Physics

Claude W. Heaps Prize in Physics

Political Science

Charles Breckenridge Parkhill Scholarship in Political Science

College Awards

Donald R. Baker Scholarships
 H. E. Bray Freshman Award
 Jones College Scholarships
 Richardson College Master's Award for Excellence in Scholarship
 Z. W. Salsburg Award
 Jackie Schnell Memorial Scholarship
 Corrinne and Radoslav Tsanoff Sophomore and Junior Prizes
 Olga Keith Wiess Award

In addition to the above awards, Rice is invited to nominate students for several scholarships and fellowships which provide funds for foreign study and travel or later graduate work. Final selections for these awards are made nationally or regionally.

Danforth Fellowships
 Fullbright-Hays Scholarships
 Latin American Scholarship Program of American Universities, Inc.
 (LASPAU) Scholarships
 Luce Scholarships
 Marshall Scholarships (British)
 Rhodes Scholarship (British)

Silver Medal of the Royal Society for the Encouragement of Arts, Manufactures, and Commerce (British)

Harry S. Truman Scholarships

Thomas J. Watson Fellowships

Woodrow Wilson Doctoral Dissertation Fellowship in Women's Studies

Zonta International Amelia Earhart Aerospace Award

Honor Societies

The Phi Beta Kappa Society was founded in 1776 at the College of William and Mary for the purpose of recognizing intellectual achievement and the love of learning among students in the liberal arts and sciences. The Rice University chapter was formally installed on March 1, 1929.

Phi Lambda Upsilon, an honorary chemical society, promotes high scholarship and original investigation in all branches of pure and applied chemistry. The Rice chapter was installed in 1927.

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 the Theta chapter at Rice.

The Society of Sigma Xi, for the promotion of research in science, established the Beta of Texas chapter at Rice on March 23, 1938.

The Tau Beta Pi Association, organized to interest engineering students in competing for high standing in scholarship, created the Gamma of Texas chapter at the university on December 18, 1940.

Delta Phi Alpha was founded to promote an interest in the German language and literature. The National Council authorized the Gamma Xi Chapter at Rice in April 1949.

Sigma Delta Pi was founded to promote an interest in the Spanish language and literature. The Rice University chapter was installed on May 14, 1953.

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

Tau Sigma Delta is a national honor society in architecture and applied arts. The Tau Chapter was established at Rice on May 7, 1961.

Student Life

Student Responsibility

Each Rice student is expected to observe standards of conduct consistent with respect for the law, the fulfillment of contractual obligations, consideration for the rights of others, and a high level of personal integrity. Though the university does not intend to supervise the personal lives of its students, all members of the university community are encouraged to be aware that their behavior both on campus and off campus may reflect upon the university.

The student government, the judicial system, and the honor system depend on a willing exercise of responsibility and honor on the part of everyone.

The university reserves the right to require the withdrawal of any student whose conduct may be judged clearly detrimental to the best interests of either

the student or the university. Such action will be taken only after careful consideration by the appropriate branches of the student government and/or the faculty and administration.

No individual or group may use the name of the university or one of its colleges without prior approval of the university and the college.

The Honor System

One of the oldest and proudest traditions at Rice is its honor system administered by a student Honor Council whose members are elected annually by the student body. Adopted by a vote of the student body in 1916, the system has remained essentially unchanged except for changes in the procedures and membership of the Honor Council.

All written examinations and any specifically designated assignments are conducted under the honor code. The student body, through its commitment to the honor system, accepts responsibility for assuring the validity of all examinations and assignments conducted under the system. The Honor Council is responsible for investigation of all reported violations and for trial in those cases when the facts warrant. The Proctor reviews the results of investigations and trials and acts upon recommendations for penalties. The Honor Council conducts a continuing program to orient new students and faculty to the responsibilities and privileges of the system.

Residential Colleges

Every undergraduate student, whether living on campus or not, is a member of one of eight residential colleges. Lovett, Richardson, and Wiess are men's colleges; Brown and Jones are women's colleges. Baker, Hanszen, and Will Rice are coeducational.

Each college is a self-governing group of students whose elected officers and representatives are responsible for directing a variety of cultural, social, and athletic activities as well as maintaining good order in the college. While uniformity among the colleges has never been sought and each college has developed its own particular interests and character, all seek to foster fellowship among their members and a mature sense of honor, responsibility, and sound judgment.

Each college has a faculty master who, with his family, occupies the master's house adjacent to the college. The master has an overall responsibility for all aspects of student life in the college. He is particularly responsible for encouraging broad cultural and intellectual interests among the members and for promoting individual self discipline and effective self government within the college. Other members of the faculty are invited, on consultation between the student members and the master, to become resident and non-resident associates of the college. Faculty associates act as advisers to the members and participate in the fellowship and activities of the college. Several colleges also have community associates from the Houston area, drawn from various professions.

Upon acceptance by the university, each undergraduate student is designated a member of one of the colleges. Two students who are entering Rice for the first time may ask to be assigned to the same college, but may not designate which college. Men and women also may indicate a preference for either a men's college, or a women's college, or a coed college, but may not designate which college. A new student may request membership in the same college as a close relative. No other choice of college is allowed.

The buildings of each college include a dining hall and living rooms, which are available to both resident and nonresident members, and living quarters for approximately 215 students from all classes of the university and all academic disciplines. At present, on-campus residential space is available for most of the freshmen who request it, but a freshman is not assured of space until he or she receives formal notification. Continuing students draw for the available space by the priority and lottery system established in each college since the demand exceeds the available space.

The College Food Service provides nineteen meals per week, excluding evening meals on Saturday and Sunday. Breakfast and lunch meals are cafeteria service, and dinner is seated, family style. No meals are provided on designated holidays and recesses. Various services provided by the College Food Service for students living in the colleges include (1) assistance with special diets prescribed by a physician, (2) sack lunches for students who must miss a meal due to a job conflict, (3) sick trays for students when requested by the Student Health Service, (4) alternate menu entree, whenever possible, in accordance with students' religious practices.

College Courses

As one of their important activities, individual colleges sponsor courses and workshops open to all students. College courses are initiated by students in the colleges during the semester preceding their being offered. Following approval by the master and faculty associates of the college and by the Dean of Undergraduate Affairs, they are accepted for academic credit on the same basis as departmental courses and listed by the registrar each semester during preliminary registration.

College workshops carry no academic credit and do not appear on a student's permanent record. Generally designed for instruction in practical skills, they may meet on a regular schedule throughout the semester or be offered as short courses.

By expanding the course offerings of the departments, college courses promote the academic involvement of the colleges and provide opportunity for interdisciplinary topics of particular interest to students.

Student Government

All undergraduates are members of the Rice Student Association, which is governed through the Student Senate, composed of the president, two vice presidents, the secretary-treasurer, the eight college presidents, and additional representatives of on campus and off campus students.

Alleged violations of university or college rules are handled in accordance with the University Code of Judicial Procedure. In most cases original jurisdiction is assigned to student courts, appeal from whose verdict may be made to the college master, the proctor, or the University Review Board as appropriate. Final appeal is to the president of the university. The Honor Council, which is composed entirely of students, administers the honor system and conducts hearings and trials for alleged offenses against it. The university retains ultimate authority in all matters of discipline and over all actions affecting its educational function or the safety and well being of members of the university community.

The Student Association annually presents two coveted awards, one to a student and one to a faculty or staff member. The Rice Service Award, a memorial to Hugh Scott Cameron, first dean of students at Rice, is a bronze

medallion awarded to currently enrolled or former members of the Student Association who have rendered distinguished service to the student body. Selection is made by a committee of faculty and students appointed by the association. The Mentor Recognition Award recognizes extraordinary service to the student body by a current member of the faculty or staff.

Student Activities

In addition to the many activities of the residential colleges, various campus-wide organizations and activities give students a wide range of choices for extracurricular interests. The official publications include the *Thresher*, the student newspaper; the *Campanile*, the university annual; and the *Rice Literary Review*. The Rice Program Council sponsors various programs of current interest to the student body. A campus radio station, KTRU, is operated by students on a 18-hour, seven day a week schedule broadcasting FM stereo.

A large number of student organizations provide for special interests, such as the Black Student Union, the Rice Association of Mexican American Students, the Chinese Student Association, Rice Democratic Caucus, and Young Republicans. There are sports clubs for sailing, karate, rugby, scuba diving, bicycling, etc. A student debate society, a premed society, and a prelaw society serve other students' interests.

Many organizations are associated with special academic and professional disciplines, such as foreign language clubs, the Architectural Society, the student affiliate of the American Chemical Society, and the student branches of the American Institute of Aeronautics and Astronautics, the American Institute of Chemical Engineers, the American Institute of Physics, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Association for Computing Machinery, and the Institute of Electrical and Electronic Engineers. The Army and Navy ROTC students have the Chevron and the Sextant, respectively, to represent their special interests.

The Rice Players is an extracurricular theater group composed of Rice students and faculty. The Players present at least four productions each year. Recent productions include: Shaw's *Arms and The Man*, *The Visit* by Durrenmatt, Shakespeare's *Twelfth Night*, *Who's Afraid of Virginia Woolf?*, and Stoppard's *Jumpers*. The Players welcome participation by anyone interested in any aspect of theatre production or management.

Women students may join one of the two literary societies — the Elizabeth Baldwin Society or the Owen Wister Society. The Rally Club is a special service organization for men.

Rice students are affiliated with a number of denominational religious organizations. These include the Baptist Student Union, the Canterbury Association, the Christian Science Organization, the Hillel Society, the Lutheran Student Association, the Newman Club, the United Campus Christian Fellowship, and the Wesley Foundation. These organizations are represented on the Student Interfaith Council, a group chartered by the Student Association.

The Student Health Service

All students pay a health service fee by the semester. Rice University participates in the student health service operated by the University of Texas Health Science Center for its own students across the street from the Rice campus. On campus, a student health clinic, housed in the north wing of Hanszen College and staffed by a nurse or qualified attendant and a resident

physician during specified hours, provides first aid and limited medical care. Emergency room services, hospital facilities, and referral to specialists are all available through the University of Texas Health Science Center.

Group health insurance is mandatory for all students except those demonstrating comparable coverage. The plan offered through the university covers the student for twelve months beginning with the fall semester. The charge, payable in one or two installments, is \$112.75 for a single student and \$280.00 for a student with one dependent.

The university Psychiatric Service, which is staffed in cooperation with the Department of Psychiatry, Baylor College of Medicine, provides help to students with many levels and types of problems. The health service fee includes this service, although the Psychiatric Service is independent of the Student Health Service. Consultation and brief psychotherapy are available without additional charge. When it is clear that more prolonged counseling or treatment is necessary, the individual may be referred to a private physician or a clinic at his or her own expense, or as covered by health insurance. An appointment may be made directly by a student either by phone or in person at the office of Psychiatric Service in Lovett Hall. Provisions have been made for emergency situations that occur outside office hours. The confidential relationship between doctor and patient is carefully maintained as necessary to the effectiveness of the services.

Brochures describing the Health Service, Psychiatric Service, and student health insurance are available in the Health Service Office and in the Office of Student Advising and Student Activities.

The Fondren Library

The Fondren Library houses more than 900,000 volumes plus more than 1,000,000 microforms, and receives in excess of 8,000 current serial titles annually. These figures represent collections in art, architecture, history, literature, philosophy, foreign languages, economics, social sciences, natural sciences, and engineering.

Fondren's open shelf policy enables students to locate materials easily and to browse through related volumes. Reference librarians assist students in using the library. Copies of a general guide and special guides on such features as the card catalog, the reserve book room, and the music room are available at the information desk. Fondren Library houses such facilities as individual study carrels, group study rooms, record listening booths, microform reading carrels, and photoduplicating equipment.

The Rice Memorial Center

The Rice Memorial Center, built through the generosity of friends and alumni, was dedicated on Homecoming weekend of the fall of 1958. The center and chapel comprise a memorial to Rice alumni who have died in the service of their country. The chapel is utilized for regular nondenominational religious services directed by a committee of students and faculty.

The center serves as a gathering place for students and provides space for the Office of Student Advising and Student Activities, the Association of Rice Alumni, the Student Association and various student organizations and publications. The Campus Store, Sammy's (snack bar and cafeteria), Willie's Pub, a lounge, and ballroom facilities are also located in the RMC.

Placement Office

The Placement Office is a service provided by Rice University to assist students and alumni in finding employment. Facilities are available for students and alumni to be interviewed for prospective employment by representatives from business, industry, and schools, and to be interviewed for advanced study by representatives from universities and professional schools. Listings and contacts for permanent, part-time, and summer employment opportunities are available, as well as information on qualifications for various professions and occupations.

Intercollegiate Athletics

Rice is a charter member of the Southwest Athletic Conference and a member of the Association for Intercollegiate Athletics for Women. Rice athletes participate in all sports sponsored by the Southwest Athletic Conference (baseball, basketball, football, golf, swimming, tennis, and track) and those included in the Association for Intercollegiate Athletics for Women (basketball, golf, swimming, tennis, track, and volleyball, with possible additions). Football games are played in the 70,000-seat Rice Stadium, tennis in the Jake Hess Tennis Stadium, basketball and volleyball on the Autry Court in the Rice Gymnasium, and track in the Rice Track Stadium. Other facilities include an indoor swimming pool; handball, raquet ball, and squash courts; gymnastic rooms; baseball field; soccer field; and other playing fields.

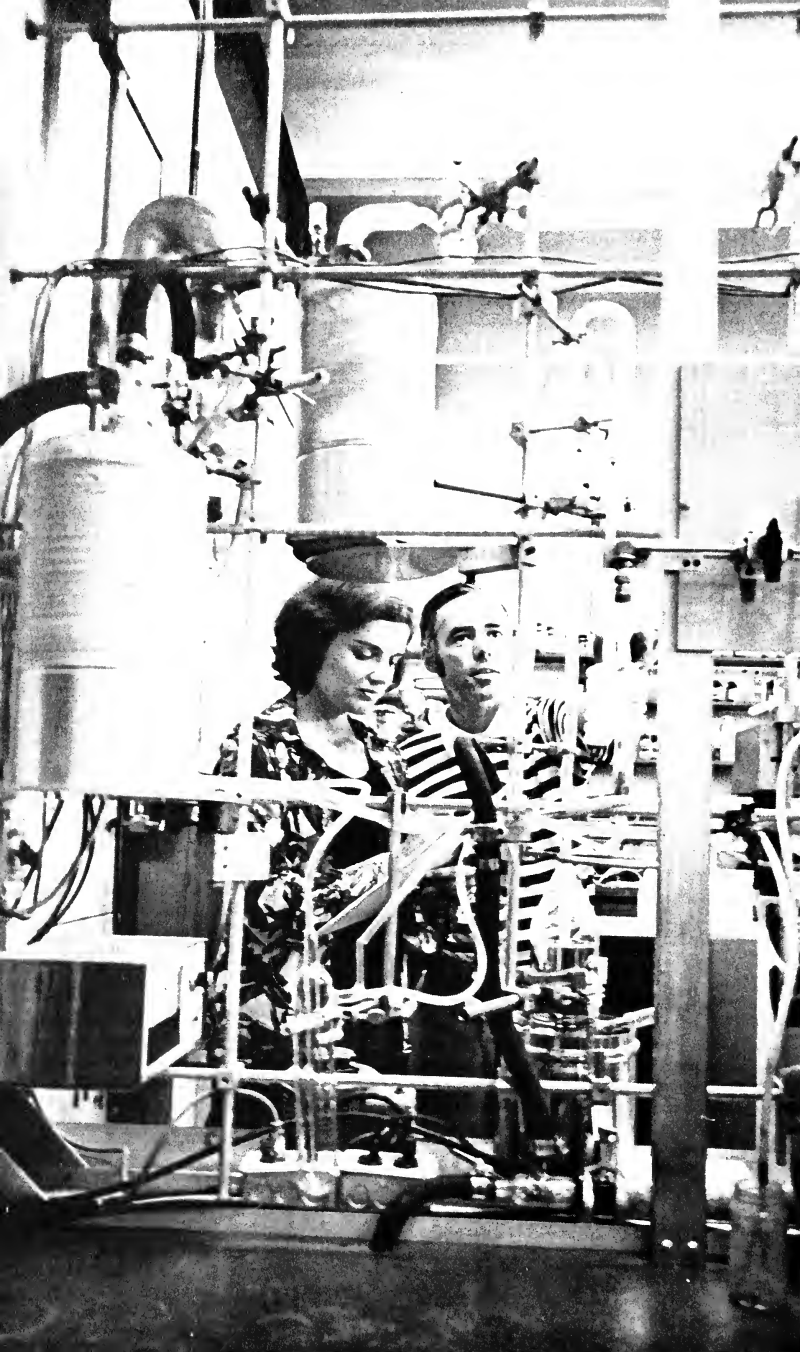
Intramural Sports

The Health and Physical Education Department offers a supervised program of intramural sports for men and women students. Every year over two hundred teams and over half of the student body participate in some thirty tournaments.

An individual may participate in individual or dual sports; any group of interested students may form teams for the various tournaments. A student must compete in the university tournaments to become eligible to represent his or her college in the college team sports tournaments which follow the open tournaments. The most common units for team competition come from the various class sections of the Basic Health and Physical Education program, students in the same major field, students in the same college, and faculty and graduate students.

Student Automobiles

All student automobiles must be registered with the Traffic Division of the Rice University Police Department. Students must park in assigned areas and observe university regulations, subject to tow away and/or fines assessed by the university. Copies of the University Traffic and Parking Regulations, which detail student privileges and responsibilities, may be obtained from the Traffic Division of the University Police, located in Abercrombie Laboratory.



Information for Graduate Students

Since the opening of the university in 1912 the importance of graduate study and research as a principal means of advancing knowledge has been recognized. The first Doctor of Philosophy degree was awarded in 1918 in mathematics. Since that time the graduate area has been expanded through the basic sciences, the humanities, engineering, the social sciences, architecture, music, administration, and to interdepartmental areas. The number of graduate programs has steadily increased and advanced degrees are now offered in twenty-nine fields of study.

Graduate programs fall in two broad categories. Research programs lead to the Doctor of Philosophy, the Master of Arts, or the Master of Science degrees and are preparation for careers in research, university teaching, or related activity. Professional master's programs prepare students for specific areas of employment and lead to such degrees as the Master of Accounting, Master of Architecture, Master of Business and Public Management, Master of Chemical Engineering, Master of Civil Engineering, Master of Electrical Engineering, Master of Environmental Engineering, Master of Environmental Science, Master of Materials Science, Master in Applied Mathematical Sciences, Master of Mechanical Engineering, Master of Music, and Master of Arts in Education.

Two joint graduate programs are also available to Rice students: (1) a course of study with Baylor College of Medicine is available for those who seek both the Ph.D. and M.D. degrees; and (2) students may earn the M.A. in history at Rice concurrently with a law degree from the law schools at the University of Houston or Texas Southern University.

Research Degrees

The degree of Doctor of Philosophy is awarded for original studies in accounting, architecture, behavioral science, biology, biochemistry, chemical engineering, chemistry, civil engineering, economics, electrical engineering, English, environmental science and engineering, French, geology, German, history, materials science, mathematical sciences, mathematics, mechanical engineering, philosophy, physics, political science, psychology, religious studies, and space physics and astronomy. Various areas of specialization are available within these fields of study.

The degree of Master of Arts is available in the various humanities and scientific fields of study including the social sciences. The Master of Science degree may be obtained in the fields of chemical, civil, electrical or mechanical and aerospace engineering, environmental science and engineering, and materials science. The Master of Architecture and the Master of Architecture in Urban Design are also offered.

Interdisciplinary Research Degree Programs

Interdisciplinary program in systems theory. Students with backgrounds in mathematics, mathematical sciences, engineering, physical sciences, or social sciences may earn a Ph.D. in systems theory. These programs are highly interdisciplinary in nature and do not necessarily require an undergraduate major in the area of primary interest to the department. A student working in systems theory enrolls in one of the participating departments, currently the departments of Chemical Engineering, Economics, Electrical Engineering, and Mathematical Sciences. Programs of instruction utilize common courses in systems theory and mathematical sciences, as well as specialized courses in the areas of principal research interest. Supporting courses and research activities are available in a number of cooperating departments, including Mathematics and Behavioral Sciences. Courses and research interests include: algorithm theory, artificial intelligence, biological systems, chemical systems, economic development, information theory, mathematical programming, modeling, modern control theory, network theory, operations research and economics, optimization, stability theory, and statistical communication theory. For applications or additional information, contact the chairman of one of the participating departments listed above.

Interdisciplinary program in solid-state electronics and materials science. This program leading to the Master of Science or Arts and Doctor of Philosophy is open to students with backgrounds in engineering or physical science. The program is sufficiently flexible to accommodate students who do not necessarily have a corresponding undergraduate major. The program consists of a common group of courses, taught jointly by the participating departments, followed by more specialized courses and seminars given by the individual departments. Interdepartmental seminars are also offered. The research leading to the degrees is normally supervised by an interdepartmental research committee. The student is enrolled in one of the participating departments, currently Chemistry, Electrical Engineering, Mechanical Engineering, and Physics. Current courses and research interests include the areas of anelasticity, electrical conductivity, electron microscopy, Fermi surfaces, ferroelectrics, ferromagnetism, high temperature and high pressure phenomena, lasers, lattice theory, microwave and infrared devices, semiconductor devices, solid solutions, thin films, and transport phenomena. For applications or additional information contact the chairman of one of the participating departments listed above.

Interdisciplinary program in bioengineering. Students with backgrounds in engineering, mathematics, physics, biology, or biochemistry may pursue a Ph. D. in bioengineering. The curriculum offered involves not only an extensive introduction to physiology, biophysics, and laboratory methods, but also the analysis, modeling, and instrumentation of biological systems. Additional courses cover the areas of systems science, modern control theory, computer science, communication theory, biology, chemical engineering, and mathematical sciences. Courses offered by Baylor College of Medicine are available to satisfy special needs and interests of the student. The present research areas include: the cardiovascular system, vision research, neurophysiology, biological control systems, ultrasound applications to biological systems, and mechanical receptor physiology. For applications or additional information, contact the chairman of the Department of Electrical Engineering.

Requirements for Research Degrees

General Requirements. The Doctor of Philosophy degree is awarded after successful completion of a program of advanced study extending to the frontier of knowledge and an original investigation reported in an approved thesis. Normally, three or more years of study are required after admission to graduate study. At least two years of full-time study, or the equivalent of sixty semester hours, must be in residence at Rice. As final evidence of preparation for this degree, the candidate must pass a public oral examination.

The Master of Arts, Master of Architecture, or Master of Science degree may be obtained after completion of at least thirty semester hours of study including the thesis or project report, twenty-four of which must have been in residence at Rice. Programs will generally include original work embodied in a thesis, and the candidate's preparation will be evidenced by a public examination. Although students with exceptional qualifications may complete the master's in one year, most students will need three or four semesters of study and research. In many departments students are eligible for a master's degree without submitting a thesis if they have been admitted to candidacy for the Ph.D. degree prior to March 1 of the year in which the degree is to be awarded.

More specific information about requirements for advanced degrees in each field of study is given under department headings in the section of this catalog describing course offerings, which begins on page 103.

Students may pursue their graduate research projects during the summer months by enrolling in appropriate summer study and research programs. The tuition fee is waived for full-time continuing students.

Language Requirements. Foreign language requirements for the master's and doctoral degrees are established by the individual departments according to the need for foreign languages in the conduct of research and scholarship in their respective fields.

Approval of Candidacy. A student seeking the master's or doctoral degree must submit a petition through the departmental chairman to the Graduate Council for the approval of candidacy. The chairman must certify that the applicant has fulfilled the departmental requirements and provide a transcript or other evidence that the work within the department is of high quality.

The final oral examination can be given only after the candidacy has been approved by the Graduate Council.

Applications for the approval of candidacy for the Ph.D. degree must be filed in the Office of Advanced Studies and Research prior to November 1, and for the master's degree prior to March 1, of the academic year in which graduation is expected. The approval is valid for two years if for the master's degree and four years if for the Ph.D. degree (some departments set a time limitation of less than four years). This schedule assures adequate time for preparation, review, and revision of the thesis which documents the actual scholarly research project which the student has pursued. The student must have been approved for the candidacy for the Ph.D. before the beginning of the seventh semester of residency at Rice in order to be eligible for continued financial support. Appointments and support of graduate study are not continued for more than four years except in legitimate cases approved by the Graduate Council.

Oral Examinations. A committee for the oral examination is named by the Graduate Council at the time candidacy is approved. The oral Ph.D. committee consists of at least three members of the Rice faculty: the thesis director, one other member from the department, and one member in a related field outside the department. For the master's oral committee the third member may be from within the department. Additional qualified committee members may be selected, with the approval of the Graduate Council. Candidates are responsible for informing the members of their committee of the nature of the research and its progress; before March 15 the members of the committee should review and approve the thesis in preliminary form in order for the candidate to be eligible to receive the degree in the May commencement.

The oral examination may be scheduled at any time prior to the beginning of examination week in either semester. For the Ph.D. degree, the examination must be announced in the university calendar the previous week. In appropriate circumstances an oral examination for the Ph.D. may be scheduled during the summer and the posting of notice of the time and place on the bulletin board of Fondren Library the preceding week will be acceptable as the public announcement. For the master's degree public notice of the oral examination should be posted on the departmental bulletin board one week in advance.

The length of the examination and the character of the subject matter on which the candidate will be examined are left to the judgment of the committee. Should the candidate fail, the chairman may schedule a second examination. In the event of a second failure, the student will be required to withdraw from the university. Following the successful passing of the oral examination in defense of the thesis, the three copies of the dissertation must be submitted to the dean of Advanced Studies and Research no later than one year from the date of the examination.

Thesis Regulations and Procedure. The thesis, which is the principal record of work for an advanced degree, will be permanently preserved in the library. Directions are provided upon approval of candidacy for the standard form which must be followed in detail. Copies of these instructions may be obtained from the Office of Advanced Studies and Research. Students submitting a dissertation for the Doctor of Philosophy degree must fill out a Survey of Earned Doctorates form and a University Microfilm contract. Fees for the microfilming and binding of the dissertation are to be paid to the cashier prior to submission of the three copies to the dean. The deadline for acceptance of the thesis by the dean is 12:00 noon of the next to last Friday preceding commencement.

Professional Degrees

Rice University offers several advanced degree programs which prepare students for positions in fields such as accounting, business and public management, architecture, mathematical sciences, engineering, secondary education, and music.

Requirements for professional master's degrees usually include the successful completion of ten or more courses at the graduate level. Candidates for the nonthesis professional master's degree are not required to take an oral examination, although some departments may give a final oral, but all students for this degree must petition for approval of candidacy prior to March 1 of the year in which they anticipate graduation. The specific requirements for

each professional master's degree and the regulation of these programs are normally the responsibility of the departments involved and the Graduate Council. Some information on individual departmental requirements is given below; further details are presented in this catalog with the listing for the department concerned in the Courses of Instruction section.

Accounting and Management

The Jesse H. Jones Graduate School of Administration offers two professional degrees, the Master of Accounting and Master of Business and Public Management, as well as the Doctor of Philosophy in Accounting. Applicants to these programs must submit scores on the Graduate Management Aptitude Test (GMAT), all college transcripts, and three letters of recommendation. Application materials may be obtained from the Office of the Dean, Jesse H. Jones Graduate School of Administration.

Admission to the Jones School is open to undergraduates from Rice or other universities, regardless of undergraduate major, but is highly selective and limited to those who have performed with distinction in their previous academic work and on the GMAT. Exceptional students from Rice and other cooperating universities may be admitted to the Jones School after completion of their junior year.

For admission to either master's degree program, undergraduates should take the following Rice courses or their equivalents: Accounting 305 (Introduction to Accounting) and Economics 211 (Principles of Economics). For the Master of Accounting program, the following Rice course or its equivalent should also be taken: Mathematical Sciences 222 (Business Data Processing). Students may be admitted without such coursework but must complete these requirements without graduate credit prior to entering graduate courses.

Completion of the Master of Accounting program requires one to two academic years, depending upon the student's undergraduate preparation, while the Master of Business and Public Management program requires two academic years. To qualify for either degree, the student must maintain a 2 ("B") average and may be required to pass an oral examination during the last semester in residence.

For further information regarding these programs, consult the section for the Jesse H. Jones Graduate School of Administration (Accounting and Administrative Science) in the Courses of Instruction listing.

Architecture

An applicant for admission to the professional master's degree program in architecture should write to the director of the Rice University School of Architecture for specific information about the program for which the applicant would be qualified by education and experience. Completed application materials include the Rice University Application for Graduate Study form, transcript(s), Graduate Record Examination scores, a portfolio of the applicant's work, and a minimum of three letters of recommendation. Candidates will be evaluated on the basis of their academic records and the quality of the design portfolio.

Education

The Master of Arts in Teaching is a professional degree program for students wishing to qualify for secondary school teaching following a liberal

undergraduate education. The degree involves one academic year and two summers of satisfactory graduate work consisting of (1) coursework in the field of teaching and in the candidate's two subject-matter fields and (2) teaching internship.

Admission to the graduate education program at Rice is open to Rice graduates and to appropriately prepared students from other universities who have received a bachelor's degree and who present evidence of scholarly ability and motivation. Applicants will be expected to take the Aptitude Test and appropriate Advanced Tests of the Graduate Record Examination Program. Applications will be reviewed and admission determined by the Rice Teacher Education Council.

Requirements for the Master of Arts in Teaching will be found in the Education Department section of the Courses of Instruction listing.

Engineering

Applications for admission to the professional master's degree program in a specified branch of engineering are considered by the Graduate Council upon recommendation of the various departments and the Engineering Committee on Professional Masters Degrees. Candidates are required to complete ten advanced courses (numbered 300 or higher) in addition to satisfying the requirements of an approved bachelor's degree program. The ten advanced courses include at least four at the 500 or 600 level indicating professional study in depth of a particular area. Four of the remaining six courses are used for additional professional concentration or to add some breadth in another technical area as determined by the department. Courses may not be taken on a pass-fail basis in satisfaction of these course requirements. The student's major department must approve the overall program. Programs which depart from these guidelines must have specific approval of the Engineering Committee on Professional Masters Degrees and the Graduate Council.

Students are recommended for degrees by their departments if they make at least four grades of 1 or 2 and no more than one grade of 4.

Chemical Engineering. Flexibility in course planning permits specialization in such areas as economics, nuclear engineering, reservoir engineering, process control, optimization and systems analysis, applied mathematics, materials science, kinetics, and catalysis.

Civil Engineering. The detailed program of each student is formulated in consultation with a departmental adviser. The student's area of concentration (at least five courses) will be structures and mechanics. Some specialization in solid mechanics, geotechnical engineering, or applied mathematics is possible within the structures and mechanics concentration.

Electrical Engineering. Technical electives permit some specialization in the general areas of bioengineering, systems and information theory, solid-state and physical electronics, and computer science and engineering.

Environmental Engineering. Proper course planning will permit specialization in water resources, air resources, pollution control, process design and optimization, mathematical modeling, applied mathematics, urban systems, and environmental planning.

Environmental Science. Flexibility in choice of electives permits concentration in such areas as the biology, physics, chemistry, and geology of environmental planning and management, pollution detection and control, applied mathematics, and urban systems analysis.

Materials Science. After successful completion of a bachelor's degree in materials science or a related field a student may proceed to the professional Master of Materials Science by choosing eight courses in materials science or related fields plus two free electives.

Mechanical Engineering. For properly qualified students, flexibility in course requirements permits specialization in thermal sciences and energy conversion, gas dynamics, hydrodynamics and ocean engineering, stress analysis and mechanical behavior of materials, aerospace engineering, air pollution, and materials engineering.

Mathematical Sciences

An applicant for admission to graduate study for the professional master's degree in mathematical sciences should obtain specific information about the program and the application form from the chairman of the Mathematical Sciences Department. The completed form with transcript(s) and recommendations, in the case of students who are not undergraduate students at Rice, should be returned to the department. Candidates are evaluated on their previous academic records and their potential for success in and benefit from the professional program.

Music

The Shepherd School will accept applications for admissions to its Master of Music program from recipients of a bachelor's degree from other accredited institutions. Candidates for the Master of Music degree may be required to take additional work at the undergraduate level before continuing their graduate study, as determined by the faculty of The Shepherd School.

For a description of The Shepherd School of Music five-year professional degree, the Master of Music with the Bachelor of Music awarded simultaneously, see Music in the Courses of Instruction section.

Cooperative Graduate Programs

Joint Graduate Programs with Baylor College of Medicine

These programs are designed to provide educational experiences of high quality leading to research careers in medicine, as, for example, in biomedical engineering research. They are directed toward a small number of highly qualified students, with sufficient undergraduate background in mathematics and the physical sciences to undertake graduate work and thesis research. In addition, students must have completed the course work in biological and social sciences required for entrance into medical school. The participants in these programs may secure admission to the M.D. curriculum at Baylor College of Medicine as well as to graduate study at Rice, and must fulfill the respective coursework and degree candidacy requirements at both institutions. Successful completion of a program results in the M.D. from Baylor and the M.S. or Ph.D. from Rice, usually within a period shorter by at least one year than the time required to obtain these degrees separately. The joint programs offer a unique combination of professional medical training with rigorous study in a science or engineering discipline and emphasize an interdisciplinary approach to current problems in biomedicine. These programs are currently

active in the departments of Electrical Engineering (Bioengineering), Chemical Engineering, and Mechanical Engineering and are under consideration in other disciplines. Additional information may be obtained from the respective departments.

Joint Graduate Program in History and Law

This selective program combines graduate work in legal and constitutional history at Rice University with professional work in law at the Bates College of Law, University of Houston, or at the Law School of Texas Southern University. Students in their first or second year of law school may apply for participation through their law school to Rice. Participants will spend one year at Rice in the Master of Arts program, concentrating on legal and constitutional history. After having completed this year of residence and all requirements for the M.A. except the thesis, the student will return to law school to finish his or her legal studies. During the last year of law school, the student will complete a suitable M.A.-level research thesis on a topic in legal and/or constitutional history selected with the approval of the law school instructor and the student's Rice history adviser. The student who completes this program will receive a law degree from his or her law school as well as an M.A. in history from Rice.

Admission to Graduate Study

Graduate study is open to well qualified students who possess adequate background in the field of study they wish to pursue. Normally, but not always, the equivalent of an undergraduate major in the field is required, but the final judgment of preparation rests with the department concerned; the emphasis is on the quality of the applicant's preparation rather than on the academic program pursued or credits earned in achieving it. Applicants for graduate study should arrange to take the Graduate Record Examination since these tests offer an additional opportunity for applicants to demonstrate the quality and depth of their knowledge in the field of study. Completed applications are forwarded by the various departments to the chairman of the Graduate Council for review and action.

Each graduate student will be advised by the departmental chairman or an officially designated faculty member in planning the initial semester of graduate study. Sometime during the first year of graduate work each student should identify with an adviser who will help plan both the course program and the thesis or special project.

Research Degrees

An applicant for admission to graduate study for a research degree should address all communications to the chairman of the appropriate department. The chairman will provide the relevant information about the graduate program and the appropriate application form. The completed form, with the transcript and recommendations, should be returned to the chairman of the department. After a departmental committee has made a preliminary evaluation, the application form and other documents will be transmitted by the chairman to the Graduate Council for final action. Candidates are evaluated on their previous academic records, test scores available, and their qualifications to pursue advanced study. Their capacity for research is primarily determined through references from scholars under whom they have studied.

In addition to any specific requirements of the department, the applicant will be expected to have at least a 2 or "B" average in undergraduate work. Preference will be given to applicants who earn high scores on the Graduate Record Examination. Arrangements to take this examination may be made directly with the Educational Testing Service, Box 955, Princeton, New Jersey 08540 or Box 1502, Berkeley, California 94701. Applicants in the Houston area may also apply in person to the Office of Advanced Studies and Research at Rice for necessary forms.

Normally, all graduate students will be assigned a limited amount of teaching as part of their training for advanced degrees.

Advanced study and research programs leading to the Doctor of Philosophy degree are available in twenty-five areas of study and normally are operated by the departments concerned. Most details of the various departmental requirements for the Ph.D. are found in this catalog under the listings of the individual departments; complete information may be obtained by contacting the appropriate departmental chairman.

Class III Students

Students with an undergraduate or graduate degree from an accredited college or university may enroll as Class III students and take courses for credit without being admitted to a specific degree program. Courses taken under this arrangement cannot later be used to fulfill the requirements for an advanced degree at Rice until the student has applied to the appropriate department, been recommended for admission, and been officially admitted by the Graduate Council. Such part-time study may be used to fulfill the residence requirements for either master's or Ph.D. degrees upon official admission. Further information on enrollment of Class III students is found on page 71.

Tuition, Fees, and Expenses

Tuition for full-time students enrolled in the graduate division is \$2,500 per year (\$1,250 per semester) for all students through six semesters. In addition, each full-time graduate student pays a health service fee of \$66 per year (\$33 per semester) and a Graduate Student Association fee of \$3. After six semesters students continuing any phase of their studies including work on their dissertation, on or off campus, must be registered and are subject to a tuition fee of \$200 per year (\$100 per semester). Continuous involvement and enrollment are expected. Failure to register for any period without a leave of absence granted by the Graduate Council will require reapplication by the student, approval of the Graduate Council for readmission, and the payment of the tuition for up to two missed semesters plus a special registration fee of \$100. A leave of absence is granted only before registration each semester and must have the approval of the department chairman and the Graduate Council. A reactivation fee of \$25 will be required upon return.

The graduate programs at Rice are designed for full-time study, but in special circumstances a limited number of students may be admitted on a part-time basis. The part-time tuition is \$125 per semester hour plus \$50 registration fee each semester, the total not to exceed \$1250 per semester. The tuition for summer study and research, which is applicable to part-time students, is \$200; there is no summer registration fee.

Graduate students who have fulfilled all requirements for the degree sought, including the thesis and/or final public oral examination, not already registered under one of the categories above, must be registered as "Requirements complete — registering for degree only" for the spring semester in which the degree is awarded. This requires the payment of a registration fee of \$50, plus the diploma fee. This registration fee is not refundable and may not be carried forward to a later year. The diploma fee is not refundable but may be carried forward for one year if a diploma is not prepared. The deadline for payment of the fees or cancellation of the diploma is eight weeks prior to the date scheduled for the graduation ceremonies.

All students are required to carry health insurance. Such insurance is available through the director of student activities. This expense is not included in the tuition or fees.

For an annual fee of \$4, a graduate student may purchase admittance to all regularly scheduled athletic events. If married, a student may purchase a season ticket for a spouse at a reduced rate of one-half the regular price, provided the season ticket is purchased at the beginning of the fall term.

The tuition and fees for graduate students as set forth above are subject to change from time to time as the operating expenses of the university change.

Fellowships, Scholarships, and Prizes

Memorial Fellowships, Honors, and Prizes. Provision is made for a variety of fellowships available to graduates of this and other universities. There are several memorial fellowships that have been founded and endowed by gift or bequest on the part of friends of Rice University. These provide stipends designed to enable the holders to devote their time to study and research in their chosen fields. 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 do research.

Leo M. Acker Memorial Scholarship

Amoco Foundation Fellowship in Environmental Science and Engineering

Ora N. Arnold Fellowship for better understanding between the people and governments of Mexico, the South American states, the West Indies, and the Philippine Islands

Nettie S. Autrey Memorial Fellowships in Science

Eleanor and Mills Bennett Fellowships in Hydrology

Ralph Budd Award for Research in Engineering

Samuel Fain Carter Fellowship in Economics

Cities Service Research Fellowship in Geology

Continental Oil Company Fellowship in Geology

William Dunlap Darden Medal in Architecture

Doherty Fellowship in Marine Geology

Environmental Protection Agency Fellowships in Environmental Science and Engineering

Exxon Fellowship in Geology

Financial Executives Institute Award

Ford Foundation Fellowships

John W. Gardner Award in Humanities and Social Sciences
 Gulf Oil Company Fellowship in Geology
 Haskins & Sells Foundation Scholarship in Accounting
 Fannie and John Hertz Foundation Fellowships in Applied Physical Sciences
 Houston Geological Society Outstanding Student Award
 Captain Charles Septimus Longcope Awards in History
 Edgar Odell Lovett Fellowships in Mathematics
 John T. McCants Scholarship in Accounting
 Mrs. L. F. McCollum Fellowship
 National Institutes of Health Fellowships
 National Institutes of Health Traineeships in Biology
 National Science Foundation Graduate Fellowships
 Petroleum Research Fund of the American Chemical Society
 Phillips Petroleum Company Fellowship in Chemistry
 Torkild Rieber Award in Geology
 Schlumberger Foundation Fellowships in Mathematics
 Shell Fellowship in Physics
 Sigma Xi Research Awards
 John Stauffer Scholarship in Chemistry
 Tenneco Oil Company Fellowship in Geology
 Texaco Fellowship in Physics
 Texas Society of Certified Public Accountants' Graduate Accounting Fellowship
 Radoslav A. Tsanoff Fellowship in Philosophy
 Richard B. Turner Memorial Awards in Chemistry
 Union Oil of California Fellowship in Geology
 Wiess Fellowship in Geology
 Robert A. Welch Foundation Predoctoral Fellowships
 H. A. Wilson Award in Physics

Rice Graduate Fellowships. Graduate students with high academic records and outstanding qualifications may receive assistance through awards of Rice University Fellowships. These appointments in most cases provide a stipend plus tuition for the nine-month academic period. Some research assistant positions or special fellowships may be available to provide support during the summer months. Appointees must be engaged in full-time graduate study.

In some departments, Rice Teaching Assistantships may be available to qualified advanced (third- or fourth-year) students. If exceptional teaching ability has been demonstrated, a student may be appointed to a Teaching Associateship.

Graduate Tuition Scholarships. Students whose previous records show marked promise but for whom no graduate fellowships are available may, especially in their first year of graduate study, be awarded full or partial graduate tuition scholarships without stipend. Graduate scholars must carry a full schedule of graduate work.

Tuition grants based on need for financial assistance are available to students in the professional master's degree program in engineering. Normally Rice engineering students who have received financial aid from the university during their undergraduate years may anticipate continuation of assistance as needed for the year of professional study. Others must file the Financial Aid Form, which is the usual application for financial assistance through the College Scholarship Service. Information is available from the Financial Aid Office.

Scholarships which provide both tuition and stipends are also available for a limited number of graduate students who are participants in the Army or Navy ROTC programs. For information on these scholarships, contact the departments of Military or Naval Science.

Financial Aid

Financial aid is available to graduate students through the National Direct Student Loan, Texas Tuition Equalization Grant, and the Federally Insured Student Loan programs. This aid is based on financial need. Application may be made through the Rice University Financial Aid Office.

Assistance through the National Direct Student Loan program may not exceed \$2,500 per academic year for four years. The interest rate is a simple 3 percent on the outstanding balance and interest does not begin to accrue until nine months after a student ceases to be enrolled.

The Texas Tuition Equalization Grant Program provides a maximum of \$600 per year to eligible Texas residents. No repayment of the grant is required.

Under the Federally Insured Loan program borrowers must make their own arrangements directly with a lending agency such as a bank, savings and loan agency, credit union, or, in some instances, their home state. The loan will be guaranteed by the federal government if the adjusted family income is \$25,000 or less. The maximum loan for which a student may apply is \$2,500 per academic year and the interest rate is 7 percent. Repayment does not begin until nine or twelve months after the student ceases to be a student; however, interest commences to accrue immediately. If a student is eligible for federal interest benefits, the federal government will pay the interest while the student is in school.

Applicants for these loan programs must be American citizens or permanent residents, be enrolled at least half time, and prove financial need by filing the Financial Aid Form. This statement is submitted to the College Scholarship Service for processing and evaluation and a small fee is required.

A Gulf Oil Corporation Foundation loan fund is also available to students who are working toward a degree to assist them in meeting educational expenses. The Financial Aid Form is required. The funds of this loan program are limited. Interested persons may contact the Financial Aid Office.

Graduate students wishing to apply for a loan under any of these loan programs should commence application procedures the summer prior to the academic year for which they are seeking assistance. Detailed information and application forms are available in the Financial Aid Office.

An Emergency Loan Fund, originally provided through gifts from the Graduate Wives Club of 1972-1973, the Graduate Student Association, and various faculty members, is available to help graduate students at Rice with short-term needs. Loans from this fund are limited to \$100 and must be repaid within three months. A charge of \$1 is made for loans up to \$50 and \$2 for loans over \$50, in lieu of interest and to help build up the fund.

Graduate Student Life

Graduate Student Responsibility

Rice University encourages student self discipline within the framework of its general objectives. Each member of the community is expected to govern his or her conduct by standards of good taste and ethical judgment and to

exercise personal responsibility.

The university reserves the right to require the withdrawal of any students whose failure to accept responsibilities as evidenced by conduct or their scholastic achievements is considered detrimental to their own or the university's best interests.

The Honor System

Graduate students are expected to observe the provisions of the honor code. The provisions of the honor system are summarized on page 83.

Fondren Library

Fondren Library provides extensive resources for advanced study and research among its collections. Several notable research collections are: Civil War imprints, broadsides, and manuscripts; Austrian history and literature; the Axson Collection of Restoration and eighteenth-century plays; the Nadler German language and literature collection; microform holdings of early American publications.

Fondren's collections can be supplemented through interlibrary loans. Through membership in the Center for Research Libraries, Fondren has access to holdings of more than 3,000,000 volumes, 15,000 journal subscriptions, and numerous special collections. Fondren also provides carrels for the use of graduate students and faculty and a research center housing rare books, manuscripts, and other special materials.

Graduate Student Government and Organizations

All full-time graduate students are members of the Graduate Student Association. It is the sole organ representing the graduate students as a body. Part-time graduate students may become members of the association upon payment of the necessary fee. The governing body of this organization is the Graduate Student Association Council, consisting of a chairman, a secretary, a treasurer, and a representative from each department offering graduate study. Graduate students also participate in university affairs through their representatives on many of the standing committees appointed by the president, such as the Graduate Council, and on various departmental committees as well.

Wives of graduate students are invited to be members of the Graduate Wives Club, which helps provide social opportunities for Rice students and their families.

Housing

At present the university has no campus housing for graduate students. Graduate students may apply for membership in the residential colleges, but at present the demand for on-campus space in the colleges by undergraduates exceeds the available rooms. Within walking distance of the campus there are rooms and apartments for rent. For the convenience of new students, the Student Association keeps a record of rooms and apartments about which it has been notified, and the daily newspapers list still others. Incoming graduate students are advised to arrive in Houston several days early in order to find lodging.

The Student Health Service

A health service is maintained on campus to provide limited medical care including emergency first aid. Limited psychiatric consultation is also available. For more information about the services provided refer to page 85.

Student Automobiles

All automobiles on campus must be registered with the Rice University Police Department. For more information refer to page 87.



Courses of Instruction

Academic departments are listed in this section alphabetically with complete lists and descriptions of courses offered. Most departments also give specific requirements for students both at the undergraduate and graduate levels. These statements are supplemental to the university degree requirements described on pages 50 and 51.

Beginning in 1978-1979, major requirements for graduation will be designated in semester hours instead of semester courses as previously given. Students enrolled at Rice in a degree program prior to or at the beginning of the fall semester 1978 have the option of completing university and major requirements for their degree according to either semester courses or semester hours. Students entering after fall 1978 will fulfill the semester hour requirements. On the following pages departmental requirements are given in semester hours (to include all courses, laboratories, and tutorial sections). The corresponding requirement in courses (which refers only to courses of three or more semester hours and does not include associated laboratories or tutorial sections of less than three semester hours that may also be required) is shown in parenthesis.

Courses numbered below 300 are lower-level or introductory courses. Those numbered 300 to 499 are designated as advanced courses. Advanced courses are open to freshman and sophomore students with proper prerequisites and to graduate students on approval of the individual student's adviser. Courses designed for graduate students are numbered 500 and above. The methods of presentation and quality of work expected make them generally unsuited to undergraduate participation. Undergraduates are permitted to enroll in graduate-level courses only after consultation with their advisers and with the instructor of the course.

The letters "a" and "b" following the course number indicate whether the course is to be taught in the first or second semester in 1978-1979; "c" indicates summer offering. Thus History 201a is taught in the fall semester and History 202b in the spring semester for the current year. The notation "a,b" indicates a course that is to be offered both semesters, while "a/b" indicates a one-semester course which will be offered either in the first or second semester depending upon the demand.

Figures in parentheses following the title of each course signify the number of class hours per week, the number of laboratory hours per week, and the credit in semester hours for the completed course, in that order. Courses that will not be offered during the 1978-1979 year are marked with a †.

Course descriptions in this section illustrate topics within the subject matters of the courses. Topics actually covered in the courses may vary from

the examples given. Courses are subject to cancellation or modification, but cancellation of a course after final enrollment will occur only in extreme circumstances.

Students may obtain more detailed information about courses from the Registrar's Schedule of Courses published each year or by consulting the instructor of the course.

Persons using this catalog to evaluate Rice University transcripts should refer to course titles and descriptions, rather than course numbers, to determine content, because course numbers are occasionally changed.

Accounting and Administrative Science

The Jesse H. Jones Graduate School of Administration

Professor Sterling, *Dean*; Professors P.W. Bell, Brody, J. Cooper, Doran, Edwards, Hale, Howell, Oliver, Thomas, Thrall, Tuggle, von der Mehden, and Zeff

Adjunct Professors Bush and Valentine

Associate Professors R. W. Clarke, L.T. Johnson, and G.W. Smith

Assistant Professors Driskill, Dyer, Greanias, and Windsor

Lecturers Lucas, McClelland, and Viebig

Degrees Offered: B.A. with major in Managerial Studies (interdisciplinary program); Master of Accounting; Master of Business and Public Management; Ph.D. in Accounting.

The Jesse H. Jones Graduate School of Administration was established in 1974 through a gift from Houston Endowment, Inc. Interdisciplinary in nature, the school utilizes faculty of other university departments to augment its own still expanding faculty. The school is dedicated to providing unique educational opportunities for professional training in the fields of accounting and management for highly select graduate students. The curricula leading to the degrees of Master of Accounting and Master of Business and Public Management are designed to be distinctive in terms of scope, realism, and utility. The school also offers a Ph.D. in Accounting, in which students undertake highly individualized research studies under the direction of distinguished scholars.

Undergraduate Program. No undergraduate major is offered in the Jones School; however, such undergraduate courses as accounting may be used to fulfill major requirements in the interdisciplinary program in managerial studies. This degree program is described on page 55.

Students admitted to the Honors Program in managerial studies may elect certain graduate courses in accounting and administration as part of their major requirements. In addition, the undergraduate major in managerial studies may be used to satisfy prerequisites for admission to both the Master of Business and Public Management and Master of Accounting programs.

Graduate Programs. The Jones Graduate School of Administration offers the Master of Accounting and Master of Business and Public Management degrees and the Ph.D. in Accounting. Applicants to these programs must submit scores on the Graduate Management Aptitude Test (GMAT), all college transcripts, and three letters of recommendation. Application forms are available from and should be submitted to the Office of the Dean, Jesse H. Jones Graduate School of Administration. Graduates of any university and from a broad range of undergraduate majors will be considered.

Master of Accounting. The Master of Accounting program prepares students for professional positions in public accounting as well as for a variety of senior financial positions in business and government. Students enrolled in the program represent a wide variety of undergraduate majors, including economics, managerial studies, mathematics, mathematical sciences, political science, history, languages, fine arts, natural sciences, engineering, and business administration.

The Master of Accounting program consists of sixty semester hours plus the Dean's Seminar. Up to thirty semester hours of advanced standing may be granted to students with appropriate previous preparation. Undergraduate preparation for the Master of Accounting program must include, as a minimum, the following Rice courses or their equivalents: Accounting 305 (Introduction to Accounting), Economics 211 (Principles of Economics), and Mathematical Sciences 222 (Business Data Processing). These courses are generally offered at Rice during the summer session. An accelerated "3-2" degree plan is available to exceptional students from Rice and cooperating universities in which students may take graduate courses in their senior year, thereby completing the master's degree by the end of five years of college study.

The following courses are required for the Master of Accounting program: Accounting 511, 512, 513, 521, 522, 527, 551, 552; Administration 531, 532, 541, 542, 543. In addition, students must complete a minimum of twenty-one semester hours of elective course work, of which twelve semester hours must be graduate courses in accounting. The remainder of the course work may be graduate courses in administration or other appropriate upper-division or graduate courses in the university. Students must maintain at least a 2 ("B") average and may be required to pass an oral examination during their last semester in residence.

Master of Business and Public Management (M.B.P.M.). The M.B.P.M. prepares students for high-level management positions in business, government, and nonprofit organizations.

Completion of the M.B.P.M. program requires a minimum of two academic years in residence. Students must successfully complete sixty semester hours in administration and related subjects, plus the Dean's Seminar. Exceptional students from Rice and other cooperating universities may be admitted to the Jones Graduate School of Administration after completion of their junior year. Students who are accepted will be able, during their senior year, to take courses leading to a M.B.P.M. degree and to count their senior year toward the two-year residence requirement.

Undergraduate preparation for the M.B.P.M. program should include the following Rice courses or their equivalents: Accounting 305 (Introduction to Accounting) and Economics 211 (Principles of Economics).

The determination of the course program for the M.B.P.M. degree depends upon the student's previous preparation and present area of interest.

About three-fourths of the course work is part of a required core curriculum, some of which may be waived depending on previous preparation. Each student is required to select an area of concentration for elective courses. Upon entering the program, each student, with the assistance of an adviser, will select courses to meet the student's goals and objectives. Most courses will be in administration and accounting, but they may also include graduate or upper-division offerings in other departments. Students must maintain at least a 2 ("B") average and may be required to pass an oral examination during the last semester in residence.

Doctor of Philosophy in Accounting. The Ph.D. program in accounting prepares candidates for teaching and research careers in accounting. The program, which emphasizes research in accounting theory, usually requires two years beyond the master's degree. Applicants must have a master's degree in accounting or an equivalent degree.

After completing one year of courses and demonstrating proficiency in a related area of concentration, the student is required to pass a general qualifying examination consisting of oral and written parts. Successful completion of this examination qualifies the student to prepare a dissertation that represents an original contribution to the field of accounting.

Accounting

Accounting Courses

305a,b. Introduction to Accounting (3-0-3).

A survey of basic accounting theory and practice with emphasis on the primary problems of asset valuation and income determination. *Staff*

406a,b. Management Accounting (3-0-3).

Cost behavior and estimation, profit planning, capital investment decisions, and accounting for manufacturing operation. Designed for nonmajors and open only to seniors. Jones School students take Accounting 521, 522. Prerequisite: Accounting 305, Economics 211, and a statistics course. *Staff*

495a, 496b. Senior Independent Study (0-0-3 each semester).

Independent study on an approved project under faculty supervision. Enrollment by special permission. *Staff*

500a,b. Master's Thesis Research.

Staff

511a. Asset Accounting (3-0-3).

Major topics are the valuation of assets and the measurement of income in accordance with generally accepted accounting principles. Prerequisite: Accounting 305. *Mr. Johnson*

512b. Equity Accounting (3-0-3).

Major topics are the valuation of equities and the measurement of income in accordance with generally accepted accounting principles. Prerequisite: Accounting 305. *Mr. Thomas*

513b. Special Topics in Accounting (3-0-3).

Partnerships, consolidation, interim reporting, foreign operations, and fund accounting. Prerequisite: Accounting 511, 512, and graduate standing or permission of instructor. *Mr. Zeff*

521a, 522b. Managerial Accounting I, II (3-0-3 each semester).

Cost behavior and estimation, profit planning, budgeting, capital investment decisions, transfer pricing, and accounting for manufacturing operations. Prerequisite: Accounting 305 and graduate standing. *Mr. Thomas*

524a. Seminar in Managerial Accounting (3-0-3).

Accounting applications of quantitative, behavioral, and financial tools in planning, decision-making, and control. Prerequisite: Accounting 522 and graduate standing. *Mr. Thomas*

527a, 528b. Managerial Information Systems I, II (3-0-3 each semester).

Basic concepts of developing and implementing computerized managerial information systems; informational needs for management and systems approach stressed. Prerequisite: Accounting 522 and graduate standing or Accounting 406 and permission of instructor. *Staff*

531a, 532b. Federal Taxation I, II (3-0-3 each semester).

A comprehensive examination of taxation as applied to individuals and corporations with an emphasis on tax planning. Prerequisite: Accounting 305 and graduate standing. *Mr. Clarke*

534b. Special Topics In Taxation (2-0-2).

An examination of the basic elements of Federal estate and gift taxation, with consideration of both compliance and planning possibilities. Prerequisite: Accounting 531 and graduate standing. *Mr. Viebig*

541a. Auditing I (4-0-4).

Auditing standards and procedures, statistical sampling in applications, audit programs and reports, and professional ethics associated with the public accounting profession. Prerequisite: Accounting 511, 512, and graduate standing. *Mr. Viebig*

542b. Auditing II (3-0-3).

Continuation of Accounting 541. Prerequisite: Accounting 541 and graduate standing.

Mr. McClelland

543a. Seminar in Financial Accounting Practice (3-0-3).

A comprehensive examination of currently effective authoritative pronouncements that govern financial accounting. Included are pronouncements of the AICPA, the FASB, and the SEC. Prerequisite: Accounting 511, 512, and graduate standing. *Mr. Lucas*

551a, 552b. Seminar in Accounting Theory I, II (3-0-3 each semester).

The nature and verification of theories in general and a comparison and evaluation of competing accounting theories in particular. Prerequisites: Accounting 511, 512, and graduate standing. *Mr. Zeff, Mr. Edwards*

560b. Law for Accountants (3-0-3).

Civil law; common law; equity; court systems; contracts; bailments and carriers; commercial paper; partnerships; corporations; unfair competition; bankruptcy; secured transactions; Uniform Commercial Code; Uniform Partnership Act. Prerequisite: graduate standing. *Mr. Greanias*

590b. Accounting Workshop (3-0-3).

A review of recent literature on major accounting issues leading to writing of a substantial research paper. Prerequisite: Accounting 551, 552 and graduate standing. *Staff*

597a, 598b. Independent Study (0-0-3 each semester).

Independent study on an approved project under faculty supervision. Enrollment by special permission. Prerequisite: graduate standing. *Staff*

600a,b. Doctoral Dissertation Research.

Staff

601a. History of Accounting Theory.

Staff

602b. The Price-Level Problem in Accounting.

Staff

603a. Alternative Basic Concepts of Accounting.

Staff

604b. Valuation Alternatives in Accounting.

Staff

605a. Economic Concepts Applied to Accounting.

Staff

606b. Measurement Theory Applied to Accounting.

Staff

607a. Philosophy of Science Concepts Applied to Accounting.

Staff

608b. Behavioral Research in Accounting.

Staff

609a. Research Methodology in Accounting.

Staff

610b. Efficient Markets Research in Accounting.

Staff

700c. Summer Graduate Research.

Staff

800b. Degree Candidate Only.

Staff

Administrative Science

Administration Courses

501a, 502b. Dean's Seminar (2-0-1 each semester).

A weekly seminar held each semester in which invited speakers discuss a variety of management topics. Prerequisite: graduate standing. *Mr. Sterling*

503a. Ethics, Law, and Managerial Decisions (3-0-3).

A critical examination of the moral and legal problems arising from managerial decision-making and various moral and legal problems of importance to the managerial community. *Mr. Brody*

505a, b. Managerial Communications (3-0-3).

Information flow in institutions and business: analysis of communications system components; proficiency in designing and writing materials for such systems. Prerequisite: graduate standing. *Ms. Driskill*

511a, 512b. Industrial and Organizational Psychology I, II (3-0-3 each semester).

Practical and theoretical aspects of psychology applied to industrial and other organizations. Topics include work motivation and satisfaction, selection, placement training, and evaluation. Also offered as Psychology 530. *Mr. Howell*

514b. Organization Theory I (3-0-3).

The development of organization theory, current approaches to complex organizations, and the operation of major types of complex organizations in both private and public sectors. Also offered as Political Science 527. Prerequisite: graduate standing. *Mr. Cooper, Mr. Bush*

515a. Organization Theory II (3-0-3).

Examination of problems or organizational analysis and design in both the public and private sectors. Also offered as Political Science 528. Prerequisite: graduate standing. *Mr. Cooper, Mr. Bush*

517a. Management of Bureaucracies (3-0-3).

Problems in designing, maintaining, and controlling large organizations. Behavioral science and case study approaches. Emphasis on public bureaucracy, but problems apply to private organizations. *Staff*

531a. Decision Analysis (3-0-3).

Use of statistical methods to analyze decision problems. Prerequisite: graduate standing. *Staff*

532b. Operations Research (3-0-3).

Survey of operations research models and their applications; topics include linear programming, game theory, decision theory, queuing models; inventory theory, dynamic programming, and Markov processes. Prerequisite: Mathematical Sciences 280, Administration 531 or Economics 350 or equivalent, and graduate standing. *Staff*

534b. Topics in Decision Analysis (3-0-3).

Decision models including decision trees, benefit-cost and cost-effectiveness models, handling hard and soft data; applications to energy management, ecology management, health care, and legal actions. *Mr. Thrall*

541a. Managerial Decision Economics I (3-0-3).

Analysis of business decision-making processes with particular emphasis on consumption-investment-production decisions in the context of various market structures. Prerequisite: Accounting 305 and Economics 211 or equivalent, and graduate standing. *Mr. Bell*

542b. Managerial Decision Economics II (3-0-3).

Extension of Administration 541 to the macroeconomic environment of the firm: income, employment, interest, investment, consumption, international trade, fiscal and monetary policy. Prerequisite: Administration 541 or equivalent, and graduate standing. *Mr. Edwards*

543a. Managerial Decision Economics III (3-0-3).

Extension of Administration 541 to financial planning and control: allocation, acquisition, and control of funds; monetary system and financial institutions; investor relations, valuations, mergers, and governmental regulations. Prerequisite: Administration 541 and 542 or equivalent, and graduate standing. *Mr. Valentine*

544b. Financial Management (3-0-3).

Advanced topics in financial planning and control with emphasis on application of quantitative techniques. Prerequisite: Administration 543 or equivalent. *Mr. Valentine*

551a, 552b. Public Management I, II (3-0-3 each semester).

Policy making in the public sector; managerial issues in government; analytical, budgetary, and financial techniques; economic policies; public control of private enterprise. Prerequisite: second year graduate standing. *Mr. Windsor, Mr. Greanias*

561a, 562b. Legal Analysis and Processes I, II (3-0-3 each semester).

History and sources of the law; theories of jurisprudence; constitutional questions; legal analysis, statutory regulation; administrative law; legal problems peculiar to business; resolution of conflict by judicial process. Prerequisite: graduate standing. *Mr. Greanias, Mr. Oliver*

571a. International Relations and Business I (3-0-3).

Emphasizes through comparative political analysis the societal conditions in the advanced industrial and developing countries and their impact on business. Political risk analysis projects. Also offered as Political Science 571. *Mr. von der Mehden*

572b. International Relations and Business II (3-0-3).

International trade, tariff, and financial policy from the perspective of the government decision maker and the individual businessman. Participating lecturers will examine political and commercial implications. *Mr. Smith*

573a. The Multinational Corporation and U.S. Foreign Policy (3-0-3).

Defining the responsibilities of the multinational firm within the context of contemporary foreign policy; problems for the multinational firm created by its role as a nonterritorial actor. *Staff*

574b. International Problems of Energy Supply (3-0-3).

Explores the energy question as a global imbalance between energy demand and supply, the policies of major consumer nations and OPEC's imbalance. Visiting authorities will discuss the problem. Also offered as Political Science 542. *Mr. Doran*

591a, 592b. Management Workshop I, II (3-0-3 each semester).

Interdisciplinary, team-taught examination of managerial and organizational problems in the private and public sectors; emphasis on case materials which illustrate fundamental principles of management practice. Prerequisite: second year graduate standing. *Mr. Tuggle*

597a, 598b. Independent Study (3-0-3 each semester).

Independent study on an approved project under faculty supervision. Enrollment by special permission. Prerequisite: graduate standing. *Staff*

*Managerial Studies Courses***303b. Personal Finance (3-0-3).**

Planning, organization, and control for financial decisions. *Mr. Hale*

404a. Investments (3-0-3).

Security analysis and portfolio management. *Mr. Hale*

495a, 496b. Senior Honors Thesis (0-0-3).

Completion of senior honors thesis. Open only to seniors in managerial studies honors program. *Staff*

Anthropology

Professor Hole, Chairman; Professors Norbeck and Tyler
Associate Professor P. W. Davis
Adjunct Associate Professor Schreiber
Assistant Professors Cushman, Marcus, and Uzzell

Degrees Offered: B.A.; B.A. and Ph.D. in Behavioral Science (interdisciplinary program).

The Undergraduate Major in Anthropology. Anthropology is a discipline that encompasses many subjects of study, all related to understanding man and his culture. A student may organize a major in one or more of anthropology's principal fields or may combine a major in anthropology with one in another discipline. Students majoring in anthropology are required to take a total of thirty semester hours in anthropology (ten semester courses) including Anthropology 201 and nine other courses, seven of which must be upper-level courses. With the approval of the departmental adviser, a maximum of two semester courses in biology, history, and the social sciences may be substituted for courses in anthropology. Within the general requirements, the program of each student majoring in anthropology is planned to meet individual interests and plans for future careers. Majors who plan to pursue graduate training toward a professional career in anthropology will need a reading knowledge of one or two European languages and are urged to enroll in undergraduate language courses. These majors are also urged to apply for admission to the honors program.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 90 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Honors Program. The department offers an honors program to provide selected undergraduate majors with an opportunity to receive advanced training, particularly in the planning and execution of independent research, within their chosen areas of specialization in anthropology. Students accepted into the program will undertake research leading to a thesis which must be presented at the end of the first semester of the senior year. Admission to the program and acceptance of the thesis is determined by the Honors Committee. Interested students may apply to the honors program chairman, Mr. Cushman, during the first semester of the junior year.

Graduate Work in Anthropology. The Doctor of Philosophy in Behavioral Science with a major in anthropology is offered under an interdisciplinary program. See Behavioral Science.

Anthropology Courses

201a. Introduction to Anthropology (3-0-3).

An introduction to the study of human societies and cultures within the main components of anthropology: archaeology, physical anthropology, linguistics, and cultural and social anthropology.

Mr. Cushman, Mr. Norbeck, Mr. Hole, and Mr. Davis

207a. Introduction to General Linguistics (3-0-3).

An introduction to the study of language and linguistics including basic synchronic concepts and techniques; phonetic transcription, phonological, grammatical, and semantic systems. Also offered as Linguistics 201.

Mr. Davis

208b. Introduction to General Linguistics (3-0-3).

A continuation of the above with an introduction to diachronic linguistics and methods in linguistic prehistory. Also offered as Linguistics 202. *Mr. Davis*

225. Survey of Primitive Art (3-0-3).†

African, oceanic, and North American Indian arts sampled. The style and function of art in preliterate societies discussed and history of Western appreciation considered. Also offered as History of Art 225.

235a. Art of Beginning Civilizations (3-0-3).

Comparative human expression in arts and architecture from neolithic origins to the ancient Near East empires (Egypt to Mesopotamia) and pre-Columbian America (Mexico to Peru).

Mr. Scott

302. Syntactic Analysis (3-0-3). †

The theory and techniques of syntactic analysis. Prerequisite: Anthropology 207, 208 or consent of instructor. Also offered as Linguistics 302.

303a. Modern Linguistic Theory (3-0-3).

A survey of the development of linguistic theory from de Saussure to the present. Prerequisite: Anthropology 207, 208 or consent of instructor. Also offered as Linguistics 303.

Mr. Davis

304b. Phonological Analysis (3-0-3).

The techniques and assumptions of phonological analysis; an examination of various phonological theories current in modern linguistics. Prerequisite: Anthropology 207, 208 or consent of instructor. Also offered as Linguistics 301.

Mr. Davis

305. Historical Linguistics (3-0-3). †

Mechanisms of language change in terms of transformational generative grammar are developed and related to the social and geographical context of language and language acquisition. Also offered as Linguistics 305.

306b. Anthropological Study of Religion (3-0-3).

Comparative survey of religion and magic, and anthropological interpretations of their nature and roles in human life.

Mr. Norbeck

310b. World Ethnography (3-0-3).

Introduction to cultural geography through survey of geographical and cultural areas of the world. Emphasis on the interrelationships between human societies and their physical environments. No prerequisite. Also offered as Geography 310.

Mr. Cushman

312b. North American Ethnology (3-0-3).

A general survey of native cultures north of Mexico. Intensive study of selected peoples in light of the processes of culture.

Mr. Norbeck

313. Language and Culture (3-0-3). †

Investigates the systematic relations between linguistic form and expression and culture. No prerequisite. Also offered as Linguistics 310.

316. Fundamentals of Archaeology (3-0-3). †

Principles and methods of archaeology as exemplified by case studies.

320. Old World Prehistory (3-0-3). †

A survey of the origin and development of human culture to the beginnings of literate civilizations in Southwest Asia. Emphasis on Africa, Southwest Asia, and Europe.

321. New World Prehistory (3-0-3). †

Man's entry into the Americas; his dispersal and varied ecological adaptations; the development of these cultures to the beginning of food-producing and of village life.

322. New World Prehistory (3-0-3). †

The evolution of New World civilizations, in Mesoamerica and the Central Andes, to the Spanish conquest.

323. Archaeological Techniques (2-4-3). †

Introduction to archaeological theory as it relates to excavation; the principal techniques used in field work, laboratory analysis of artifacts, and interpretation of archaeological data. Prerequisite: Anthropology 316, 320, 321, or 322.

325. Peoples and Cultures of Latin America (3-0-3). †

Survey of the Spanish and Portuguese speaking peoples of the New World. Development of cultures and subcultures as a response to local, national, and world situations.

326a. African Art (3-0-3).

The traditional tribal arts of sub-Saharan West Africa in the context of their cultures. Function and style areas stressed. Consideration given to common forms, their meaning and distribution. Also offered as History of Art 325. *Mr. Scott*

327a, b; 328a, b. Problems in Media in Anthropology (1-6-3 each semester).

Application of film and video tape to problems in anthropology as research method or as means of communicating anthropological observations and ideas. Grounding in film and video tape techniques followed by individual projects. Also offered as Arts 327, 328. *Staff*

330. Early Civilization (3-0-3). †

The growth and characteristics of civilization in Mesopotamia, Egypt, India, Mesoamerica, and Peru are examined historically and comparatively.

331b. Culture Contact (3-0-3).

Intercultural communication and understanding, including Western and non-Western; cultural contact from early European explorations, through colonization, to contemporary development and modernization. *Mr. Marcus*

332. Physical Anthropology (3-0-3). †

Cultural and biological factors in the evolution of man, human genetics, races of man and problems of race.

333. The Nature of Culture (3-0-3). †

Introduction to anthropology, designed for juniors and seniors, with major emphasis on cultural and social anthropology.

334. Primate Behavior (3-0-3). †

Comparative social behavior of nonhuman primates. Description of major types of social structure: interrelationships between social behavior and ecological, physiological, and genetic factors.

335. Anthropology of Education (3-0-3). †

A consideration of education in general and problems of contemporary education in the United States from an anthropological perspective.

336. Oceanic Art (3-0-3). †

The art of the aboriginal peoples of Melanesia, Polynesia, Micronesia, and Australia. Emphasis on stylistic analysis and function of objects within the context of each culture; the meaning, origin, and diffusion of similar forms. Also offered as History of Art 336.

341. Kinship and Social Structure (3-0-3). †

Introduction to anthropological concepts and theories relating to kinship, marriage, and social structure in cross-cultural perspective.

348. Economic Anthropology (3-0-3). †

Comparative structure and operation of economic systems in small-scale, non-Western societies and the contemporary development of such systems in larger national and international entities.

350. Peoples and Cultures of the Middle East (3-0-3). †

Ethnology of the Middle East, including northern Africa.

352a. Peoples and Cultures of Oceania (3-0-3).

The ethnology of the three major cultural divisions of Oceania: Polynesia, Melanesia, and Micronesia. Emphasis on political and cultural evolution of Pacific societies from pre-European times to the present. *Mr. Marcus*

353. Cultures of India (3-0-3). †

Summary of the prehistory, ethnography, and ethnology of the Indian subcontinent. Special emphasis on ideology and social organization.

356. Peoples and Cultures of China (3-0-3). †

A survey of the prehistory and ethnology of China with special emphasis on traditional Chinese society, regional variation, Chinese-minority relations, and the Communist transformation.

361a. Culture and Personality (3-0-3).

Consideration of studies of interaction between personality and culture in various societies from the point of view of cultural relativity.

Mr. Uzzell

366. Political Anthropology (3-0-3).†

Emphasis on fundamentals of political order in kingships, bands, tribes, and feudal systems. The political systems and processes of these social systems compared with those of modern, complex societies.

371a. The Anthropology of Law (3-0-3).

Social conflict and methods of dispute management in Western and non-Western societies. Comparison of legal institutions in band, tribal, early state, and complex industrial societies.

Mr. Marcus

373a. The Anthropology of Literature (3-0-3).

Comparison of oral traditions and written literatures, Western and non-Western, and of their use for ethnographical and ethnohistorical research.

Mr. Cushman

381a. The Study of Cities (3-0-3).

Comparative study of cities in different areas of the world, identifying constants and variables of urban culture, ancient and modern.

Mr. Uzzell

383b. Utopian Societies and Communes (3-0-3).

A consideration of Utopian and communal societies in historical and cross-cultural perspectives as alternatives to the dominant social structures and cultures in which they developed.

Mr. Marcus

385. History and Culture of Japan (3-0-3).†

A general survey of Japanese culture from its prehistoric beginnings with emphasis on modern times.

400a. Ethnological Theory (3-0-3).

Seminar surveying major trends of ethnological theory from the beginning of anthropology. Also offered as Behavioral Science 515.

Mr. Norbeck

402b. Cultural Ecology (3-0-3).

Discussion of systematic relations of humans and their biological and social environments.

Mr. Uzzell

403. Field Methods and Analytic Techniques (3-0-3).†

The techniques of observation, analysis, and recording of human language. Prerequisite: Anthropology 207, 208 or consent of instructor. Also offered as Linguistics 406.

404a, b. Independent Study (0-0-3 each semester).

Directed reading and preparation of written papers on anthropological subjects not offered in the curriculum and advanced study of subjects on which courses are offered.

Staff

406b. Cognitive Anthropology (3-0-3).

Focuses on the relations between thought, language, and culture. Special emphasis will be given to systems of folk classification and the logical principles underlying them. Also offered as Linguistics 410.

Mr. Tyler

407, 408. Special Topics in Anthropology (3-0-3 each semester).†

Lectures or seminar devoted to restricted topics reflecting current research interests of the staff. May be repeated for credit.

410. Archaeological Analysis (3-0-3).†

Tutorial course covering techniques of studying and interpreting archaeological data. Students work individually on collections of excavated material. Limited to 10 students. Prerequisite: Anthropology 316.

420a. Classics in Ethnography (3-0-3).

Detailed consideration of selected ethnographic accounts with primary emphasis on their contributions to the development of anthropological theory and the refinement of field techniques.

Mr. Cushman

430b. Medical Anthropology (3-0-3).

An introduction to the rapidly growing field of medical anthropology, which concerns anthropological aspects of medicine.

Mr. Uzzell

438. Indian Art of North America (3-0-3).†

Indian art of the United States and Canada with emphasis on the Southwest, the Northwest Coast, and the Alaskan Eskimo. Formal analysis of types, meaning, and function. Also offered as History of Art 438.

444b. The Ethnography of the Past (3-0-3).

Examination of anthropological approaches to the reconstruction of social history in Western and non-Western societies with primary emphasis on the problems of interpreting original historical materials.

Mr. Cushman

446b. Ancient Art of South America (3-0-3).

Survey of the evolution of the arts in Andean civilizations from preceramic coastal communities to the Inca state. Includes northern South America, lower Central America, and Antilles. Also offered as History of Art 446.

Mr. Scott

447. Ancient Art of Mesoamerica (3-0-3). †

Art of Mexico, Guatemala, and Honduras, from the Olmec culture (c. 1200-600 B.C.) to the Aztec. Chronological development, stylistic analysis, and the origin and meaning of forms. Also offered as History of Art 447.

450. Ethnography of Urban Places (3-0-3). †

A seminar that will provide students an opportunity to plan and conduct ethnographic studies in the Houston area. Also offered as Behavioral Science 550.

490b, 491a. Directed Honors Research (0-0-3 each semester).

A two-semester sequence of independent research culminating in the preparation and defense of an honors thesis. Open only to candidates formally accepted into the honors program.

Staff

508b. Linguistic Anthropology (3-0-3).

Devoted to the application of linguistic theory and method in the analysis of cultural materials. Also offered as Behavioral Science 546 and Linguistics 412.

Mr. Tyler

510. Current Topics and Problems in Anthropology (3-0-3). †

Advanced seminar on anthropological topics and problems including major new subjects of investigation. Also offered as Behavioral Science 510.

School of Architecture

Professor Mitchell, *Dean*; Professors Cannady, Crane, Evans, Krahl,

Morehead, Ransom, Taniguchi, and Todd

Adjunct Professors Caudill, Thomsen, and Willems

Associate Professors Papametriou, S. W. Parsons,

Rowe, A. M. Santos, A. P. Santos, and D. L. Williams

Adjunct Associate Professors Bartlett, Douglass, France,

Perrine, and Rea

Assistant Professors Casbarian, A. Z. Parks, and Sharpe

Adjunct Assistant Professors Cech, Montgomery, and Turner

Lecturers Blackburn, C. J. Brown, Carrara, Colaco,

Kerner, Linville, Lord, McDaniel, Mixon, Moore, Naman,

Scoular, and Tapley

Instructor Bavinger

Degrees Offered: B.A., B.Arch., M.Arch., M.Arch. in Urban Design, D.Arch.

Preceptors

The Architects Collaborative, Inc.
Cambridge, Massachusetts

Brown/Sullivan Associates
Philadelphia, Pennsylvania

Cambridge Seven Associates
Cambridge, Massachusetts

Caudill Rowlett Scott
Houston, Texas

Community Planning & Development
Woodlands Development Corp.
Houston, Texas

David A. Crane & Partners
Philadelphia, Pennsylvania

Daniel, Mann, Johnson & Mendenhall
Los Angeles, California

Gensler & Associates
Houston, Texas

Hellmuth, Obata & Kassabaum
San Francisco, California

McKittrick, Drennan, Richardson &
Wallace
Houston, Texas

Mitchell/Giurgola Associates
Philadelphia, Pennsylvania

S. I. Morris Associates
Houston, Texas

C. F. Murphy Associates
Chicago, Illinois

I. M. Pei & Partners
New York, New York

Rice Center for Community Design
and Research
Houston, Texas

Skidmore, Owings, & Merrill
Chicago, Illinois

Robert A. M. Stern Associates
New York, New York

Vastu-Shilpa, B. V. Doshi
Ahmedabad, India

Venturi & Rauch, Architects
Philadelphia, Pennsylvania

Wallace, McHarg, Roberts & Todd
Philadelphia, Pennsylvania

Frank R. Welch, Architect
Midland, Texas

The School of Architecture seeks to contribute through teaching and research to a more humane environment. Its primary educational missions are teaching and research, development of a broad liberal education for undergraduates in the allied sciences and arts of architecture, and professional education at the graduate and post graduate level in architecture and urban design.

These programs are offered in the setting of a small school to provide intimate student-faculty interaction, freedom for learning, and unrestricted institutional cooperation within and outside the university.

Degrees Offered. Five degrees are offered: Bachelor of Arts, Bachelor of Architecture, Master of Architecture in Urban Design, and Doctor of Architecture. The Bachelor of Arts, a liberal arts degree, may emphasize a major in either architecture or architectural studies; the two programs are described below. The B.A. is awarded after successful completion of the first four years of study. The Bachelor of Architecture is available to recipients of the B.A. degree from Rice and requires two additional years of work, one of which will be an in-service preceptorship in a professional office.

The master's degrees are awarded after successful completion of one and one-half to three and one-half years of study beyond the B.A., depending upon previous undergraduate and professional studies. Recipients of the B.A. degree

from Rice normally undertake a minimum of three years of further work for one of the Master of Architecture degrees of which one year will be an in-service preceptorship in a professional office. Approval of Rice students for admission to either bachelor's or master's programs is contingent upon evaluation of the student's undergraduate academic record at the conclusion of the fourth year of study. Other applicants for the master's degree are evaluated in terms of their prior preparation, which may reduce their required period of study at Rice. The Master of Architecture is an accredited first professional degree, whereas the Master of Architecture in Urban Design requires prior or concurrent completion of accredited bachelor's or master's degrees.

Undergraduate Program in Architecture. For both the B.A. and the B.Arch. degrees, the first two years center upon a carefully integrated study of the principles of architecture. In the third and fourth years students are encouraged to develop their own interests and talents through an individual set of seminars, studio projects, and interdisciplinary courses.

Below is a suggested course of study for either the B.A. or the B.Arch. degree. The order in which courses are taken is optional subject to the following exceptions: (1) health and physical education must be taken in the freshman year, and (2) failure to take prerequisite courses in the earlier years may cause serious problems later on.

First year:

History of Art, six semester hours
(two semester courses)
Physics 121, 122 (for architects)
Architecture 101, 102
Electives, twelve semester hours
(four semester courses)
Physical Education
ROTC, if elected

Second year:

Architecture 201, 202
Architecture 213, 214
History of Art, six semester hours
(two semester courses)
Electives, twelve semester hours
(four semester courses)
ROTC, if elected

Third and fourth years:

Architecture 301, 302
Architecture 401, 402
Architecture 313, 314
Electives, at least thirty semester
hours (ten semester courses)

Fifth year (B. Arch. program):

Architecture 601, 602
Electives, at least twelve semester
hours (four semester courses)
Electives (for M.Arch. applicants;
at least six semester hours or two
semester courses)

Preceptorship year:

Architecture 500

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 38 semester hours outside the departmental requirements, for a total program of at least 130 semester hours. See Degree Requirements and Majors, pages 50 and 51.

B.A. students have two options in their choice of a preprofessional major during the third and fourth years:

(1) The **architecture major** requires two years of advanced studio courses and additional professional group requirements that permit reasonable elective freedom. This curriculum serves the needs of students who anticipate professional studies at an advanced level and who wish to have the alternatives of doing so through either the Bachelor of Architecture at Rice or various first professional master's degrees at Rice or other institutions.

(2) The **architectural studies major** requires two years of advanced work combining architectural studies with other fields. It is focused on an approved, preprofessional theme for interdisciplinary studies chosen by the individual and approved by an adviser. Application to this program must be made during the second year of studies. Reduced architectural course requirements encourage the pursuit of a double major with another department. This curriculum can be regarded as a liberal arts education for its own sake, but it also offers opportunity to prepare for a wide variety of graduate studies and career options in different design and planning related fields at Rice or other institutions. This program provides opportunity to pursue architectural or urban design master's degree programs at Rice by entering through the Qualifying Graduate Workshop program, but it does not include the option of a Rice Bachelor of Architecture.

Upon satisfactory completion of the B.A. degree with either above major, students may apply during the senior year for admission to the appropriate advanced professional degree programs.

Auxiliary services at Rice span the gap between school and practice: the preceptorship program, the visiting lecturer series, and the visiting critic series. The preceptorship program is designed to bridge classroom studio learning and professional practice. Qualified students who have been admitted to the professional degree programs work for an entire year with outstanding architects throughout the world who are designated by the school as preceptors. The timing of preceptorship service varies according to the level of design and technical proficiency reached during the B.A. program. For those admitted to the Bachelor of Architecture the preceptorship will occur immediately on the receipt of the B.A.

Notes

1. History of Art 205, 206 are required in the first two years and will be scheduled where history of art electives are noted. History of Art 345, 346 are required for a major in architecture.
2. Electives must satisfy School of Architecture distribution requirements in addition to general university requirements.
3. A student who has studied physics in high school may substitute approved natural science courses in place of physics.
4. Studio courses (Architecture 201, 202; 301, 302; and 401, 402) which carry six semester hours each semester in the sophomore, junior, and senior years count toward graduation as the equivalent of one course per semester in the sophomore year and as two courses per semester in the junior and senior years.

5. Students contemplating later specialization in the fields of structural or environmental engineering are advised to take Mathematics 101, 102 and Physics 101, 102 and 132.

Graduate Programs in Architecture. The School of Architecture offers the degrees of Master of Architecture and Master of Architecture in Urban Design. Within the two degree programs varied areas of interest are open to students, including:

1. Housing and community development
2. Community facilities and community development
3. Transportation and urban infrastructure
4. Health care facilities and delivery systems
5. Land and natural resource utilization

An advanced building design curriculum is the basis for the Master of Architecture degree program. This program is designed to provide the student an individual course of study with a wide choice of special project, research, and internship opportunities both within and outside the School of Architecture.

The first year of the urban design curriculum is composed of studio and lecture courses. The second year allows student choice and specialization in the areas of interest listed above.

Joint degree programs with other disciplines are available for students with special interests. The Texas School of Public Health offers a cooperative program with the Rice School of Architecture. Joint programs within the university include behavioral science, computer science and technology, and environmental science.

Clinical practice is an important dimension of graduate education in architecture at Rice. Normally, one semester plus a summer (or one summer in special cases) will be spent in full-time clinical education for academic credit during a two-year master's program. Two alternative vehicles for clinical service are available:

The Rice Center for Community Design and Research is an off-campus, nonprofit corporation concerned with practical problems of planning and designing, clinical education, public service, contract research, and professional services. Students and faculty of the School of Architecture are employed in the center, where they serve in professional teams on actual projects with experts from many other fields.

Full time internships provide clinical service in applied research and innovative design projects, under supervision of practitioners in the Houston area as determined by the special expertise of the chosen office.

Graduate studies are open to candidates who hold the degree of Bachelor of Architecture, or who have a Bachelor of Arts with a major in architecture. Candidates with a Bachelor of Architecture degree are normally expected to complete three academic semesters plus one semester of clinical education. Candidates with a Bachelor of Arts degree with a major in architecture are normally expected to complete four academic semesters plus one semester of clinical education, which may occur in the intervening summer. Students without sufficient architectural background are expected to complete a program of special studies before admission to one of the graduate options. This

program takes a minimum of two semesters, depending on the individual's preparation, and stresses history, theory, technology, and design techniques.

Students not possessing a prior first professional degree and completing the Urban Design program requirements will receive a Master of Architecture degree with a certificate in Urban Design.

For students having a bachelor's degree with no architectural background the Qualifying Graduate Workshop program is offered. This is normally a seven-semester program leading to the Master of Architecture degree. The first four semesters consist of special studio offerings plus selected seminar and lecture courses. The last three semesters are spent in the regular graduate programs.

An option for a master's thesis in lieu of part of the clinical education requirements is available for students who are oriented toward research and teaching in architecture or urban design.

Doctor of Architecture. Admission to the Doctor of Architecture program requires a bachelor's or a master's degree in architecture. A student entering with a master's degree normally takes one and one-half years of course work before the qualifying examination; a student with a bachelor's degree normally requires two and one-half years of course work before the qualifying examination. Candidates should be prepared for advanced analytic and creative work in their specialized field. Such preparation may include foreign languages, statistics, or a computer language. This requirement will be established individually when the student is admitted.

After successful completion of all required course work plus the language examination or equivalent, students may apply for the qualifying examination. At this time students must submit an outline of their research program for the doctoral dissertation. This dissertation must represent an original contribution to knowledge in the field of architecture. The completion of the dissertation and the passing of the final oral examination required for the doctorate in architecture take a minimum of one year.

Architecture Courses

101a. Principles of Architecture I (2-6-4).

Visual studies of restricted dimensions, explorations using simple tools and materials to develop an awareness of the environment. Requisite for architecture majors. Limited enrollment.

Miss Evans, Mr. Parks

102b. Principles of Architecture I (2-6-4).

A development of communication of formal information from further investigation of visual structures and their order. Requisite for architecture majors, but Architecture 123 may be substituted. By permission of instructor only.

Miss Evans, Mr. Parks

123. Design Analysis and Representation (1-6-3). †

132b. Changing Perspectives of Architecture (0-3-1).

Introductory tutorial. Reading, field trips, and observation of current events and public affairs; values, institutions, and nature of environmental changes relating to future role and practice of architecture.

Staff

201a, 202b. Principles of Architecture II (3-9-6 each semester).

Introduction to concepts of beginning architectural design. Manipulation of visual structure to render formal and operational information. Design process as problem-solving with emphasis on conscious method. Requisite for architecture majors.

Mr. Casbarian, Visiting Critics

213a, 214b. Structural and Construction Systems (3-0-3 each semester).

Introduction to characteristics of materials, basic structural analysis, design of wood and masonry structures, field trips. Requisite for architecture majors. *Mr. Morehead*

301a, 302b. Architectural Problems: Studio (2-12-6 each semester).

Variety of intermediate level problems for developing comprehensive experience in design methods and processes. Requisite for preprofessional major in architecture. Prerequisite: Architecture 201, 202. *Mr. Parsons, Mr. Taniguchi, Mr. Todd, Mr. Cannady, Visiting Critics*

308b. Architecture for Non-Architects (3-0-3).

Designed to increase awareness of architectural issues through site visits and comparative building studies, guest architects, design problems, lectures, readings, and discussion. Impact of architecture on its users and its relation to institutions that produce it. Enrollment by permission of instructor. *Mr. Casbarian*

313a,b; 314b. Intermediate Architectural Technology (3-0-3 each semester).

Analysis and design of structural systems. Investigation of environmental controls systems. Selfpaced "Keller Method" with lectures and exercises. Prerequisite: Architecture 213, 214. *Mr. Morehead*

315a, 316b. Architectural Technology Laboratory (Credit variable).

Laboratory exercises for testing of structural and environmental control systems and subsystems. *Mr. Merwin*

322b. Architectural Presentation Techniques (3-0-3).

Exploration and practice with varying types of presentation techniques with emphasis on graphic communication of architectural concepts. *Staff*

331b. Housing Design Problems and Principles (3-0-3).

Review of international problems in housing and community development. Design criteria and processes responding to user needs and aspirations. Open to students outside of architecture. *Mrs. Santos*

334b. Human Behavioral and Social Impacts of Environmental Design (3-0-3).

Overview of research, theory, and practice of relating building design and community development to individual and collective behavioral responses and/or societal needs. Open to students outside of architecture. *Staff*

336b. Architecture and Urban Issues (3-0-3).

Major issues and problems confronting metropolitan centers; emphasis on physical and built environment. Visiting lecturers on transportation, housing, education, minority problems, new communities, physical development and redevelopment. Course is open to all students. *Staff*

341a. Theory and Practice in Urban Design (3-0-3).

Comparative analysis of recent theory and practice in projecting and controlling urban growth and change. Open to students outside of architecture. *Mr. Mitchell*

342b. History and Theory of Modern Movements in Architecture and Urban Design (3-0-3).

A critical review of theory and specific examples of leading schools of thought in architecture and urban design from the early twentieth century to the present. Open to all students outside of architecture by permission of instructor. *Mr. Santos*

351a. Design Methods (3-0-3).

Rational processes of design, problem-solving methods, simple statistics, data surveys and handling, graph theory, graphic information systems, computer applications in design. *Mr. Sharpe*

352b. Computer Applications in Architectural Programming and Evaluation (3-0-3).

Seminar on present and potential uses of electronic computers in architectural programming, graphic display, and problem analysis. Limited enrollment. *Staff*

401a, 402b. Architectural Problems: Studio (2-12-6 each semester).

Vertically integrated studio with Architecture 301, 302. Same description.

Mr. Parsons, Mr. Taniguchi, Mr. Cannady, Mr. Todd, Visiting Critics

413a. Design of Structural Systems I (3-0-3).

Structural systems for wood buildings, high-rise buildings, concrete thin-shell roofs, space trusses; also intermediate-span bridges, long-span suspension bridges. Graduate credit offered with approval of school. Prerequisite: Architecture 313, 314. Meets with Civil Engineering 413.

Mr. Krahl

414b. Design of Structural Systems II (3-0-3).

Structural systems for low-rise buildings, industrialized building systems, cable-supported roofs, inflatables; also short-span bridges, long-span truss bridges. Graduate credit offered with approval of school. Prerequisite: Architecture 313, 314. Meets with Civil Engineering 414.

Mr. Krahl

415a. Advanced Architectural Technology Laboratory (Credit variable).

Laboratory exercises for testing of structural and environmental controls systems and subsystems.

Mr. Merwin

417a, 418b. Teaching of Technology (0-0-3 each semester).

Classroom teaching under the supervision of the instructors.

Mr. Morehead

442b. Recent Trends in Architecture (3-0-3).

An historic-critical presentation of modern architecture since World War II, examination of its maturity and transformation on a global scale. By permission of instructor.

Mr. Papademetriou

451a,b. Architectural Measured Drawings (3-0-3).

Analysis of historic and contemporary examples of architecture or civil engineering through measured drawings constructed to standards. Drawings become part of a permanent architectural archive. Limited enrollment. Permission of instructor required.

Mr. Papademetriou

461a,b. Special Projects in Architecture (Credit variable).

Independent research or design arranged in consultation with a faculty member. Subject to approval of faculty adviser and director. Very limited enrollment.

Staff

500a,b. Preceptorship Program (0-0-15).

Requisite for admission to graduate studies in architecture for all recipients of Rice B.A. degrees in preprofessional or area majors. Student completes 9-12 months of full-time internship under guidance of an appointed preceptor.

Mr. Parsons

501a, 502b. Qualifying Graduate Workshop I, II (10-15-15 each semester).

Requisite for admission to graduate professional program options in architecture or urban design for students with non-architectural bachelor's degree. Lectures, seminars, laboratories, and design studio projects adjusted to individual needs. Prerequisites determined by the Committee on Advanced Standing within the School of Architecture.

Mr. Todd, Mr. Papademetriou, Staff

503a, 504b. Qualifying Graduate Workshop III, IV (5-15-10 each semester).

Design studio to follow Architecture 501, 502. Preparation for entering studios in the regular graduate programs in architecture and urban design in the following semester.

Mr. Santos, Mr. Taniguchi

601a,b. Architectural Problems: Studio (5-15-10).

Emphasis on abstract thought and design capabilities relevant to systematic processes of designing specific buildings and facilities. Prerequisite: Architecture 500; or Architecture 501, 502, 503; or B. Arch. degree.

Mr. Santos, Mr. Cannady, Staff

603a, 604a,b. Urban Design Problems: Studio (5-15-10 each semester).

Developing abstract thought and applied design and planning capabilities to total urban systems of facilities, large-scale developments, or other broad environmental action. Prerequisite: Architecture 500; or Architecture 501, 502, 503; or B. Arch. degree. Requisite for M. Arch. Urban Design degree.

Mr. Crane, Mr. Rowe, Mrs. Santos, Staff

606b. Thesis (0-14-10).

Independent investigations in architecture or urban design culminating in preparation and presentation of a master's thesis. *Staff*

608b. Architecture for Non-Architects (0-0-3).

Classroom teaching under the supervision of the instructor. For elective credit only.

Mr. Casbarian

611a. Design of Structural Systems I (3-0-3).

Structural systems for wood buildings, high-rise buildings, concrete thin-shell roofs, space trusses; also intermediate-span bridges, long-span suspension bridges. Prerequisite: Architecture 313, 314. Meets with Civil Engineering 517.

Mr. Krahl

612b. Design of Structural Systems II (3-0-3).

Structural systems for low-rise buildings, industrialized building systems, cable-supported roofs, inflatables; also short-span bridges, long-span bridges. Prerequisite: Architecture 313, 314. Meets with Civil Engineering 518.

Mr. Krahl

613a, 614b. Teaching of Technology (0-0-3 each semester).

Same as Architecture 417, 418.

Mr. Morehead

615a, 616b. Industrialized Building Technologies I, II (3-0-3 each semester).

Changing forces in the building industry contributing to industrialized processes and technologies of factory production, distribution, assembly, site erection of building components, and management.

Staff

621a. Theory and Practice in Urban Design. (3-0-3).

Comparative analysis of recent theory and practice in projecting and controlling urban growth and change.

Mr. Mitchell

622b. History and Theory of Modern Movements in Architecture and Urban Design (3-0-3).

Same as Architecture 342.

Mr. Santos

626b. Transportation Facilities, Systems Design and Environment (3-0-3).

Theories and practice related to the professional urban designer's role in multidisciplinary transportation planning teams.

Mr. Anstrand

627a. Housing Design Problems Theory and Principles (3-0-3).

Same as Architecture 331.

Mrs. Santos

628b. Graduate Seminar in History and Theory of Modern Movements in Architecture and Urban Design (3-0-3).

A critical review of history and specific examples of leading schools of thought in architecture and urban design from the early twentieth century to the present.

Mr. Santos

630b. Recent Trends in Architecture (3-0-3).

Same as Architecture 442.

Mr. Papademetriou

632b. Problem-Solving Methods in Architecture and Urban Design (3-0-3).

Advanced problem-solving seminar and case studies. Application of rational methods and tools, modelling and simulation techniques. Prerequisite: equivalent of Architecture 351.

Mr. Rowe

634b. Architectural Programming (3-0-3).

Fundamental procedures of programming architectural facilities and systems for various types of public and private construction. Emphasis on health care and correctional facilities.

Mr. Douglass

637a, 638b. Advanced Computer Projects (Credit variable).

Individual projects in the application of computer technology to architectural programming, planning, and urban design, graphic display, and problem analysis.

Mr. Rowe

640b. Seminar in Recent Trends in Architecture. (3-0-3).

Same as Architecture 442.

Mr. Papademetriou

- 642b. Human Behavioral and Social Impacts of Environmental Design**
(3-0-3).
Same as Architecture 334. *Staff*
- 646b. Seminar on Natural Environmental Factors in Community Development** (3-0-3).
Readings and discussion of natural environment factors affecting and affected by the development of the built environment. Review of sources of data, analytical procedures, and implementation tactics.
- 648b. Graduate Seminar on Housing Design Principles and Problems**
(3-0-3).
Review of international problems in housing and community development. Design criteria and processes responding to user needs and aspirations. *Mrs. Santos*
- 651a, 652b. Planning Law and Land Development I, II** (3-0-3 each semester).
Legal and economic considerations in practical land and building development; public controls, private/public sector relationships, entrepreneurial objectives, financing methods. Case studies in total development "packaging." *Mr. Miron, Mr. Brown*
- 655a. Housing Programs in the United States** (3-0-3).
Critical review of housing programs under government assistance as they have evolved historically; factors shaping new policies and relationships in housing delivery at national, state, and local levels. Open to students outside of architecture. *Mr. Lord*
- 700a,b. Practicum** (0-0-12).
Full-time internship service in approved local offices under interdisciplinary supervision. Emphasis on "real world" design, planning, or research experience. Special tuition. May be taken in any semester or in summer. *Clinical Staff*
- 710c. Summer Graduate Research** (Credit variable).
Independent graduate research supervised by faculty member subject to approval of student's faculty adviser and director. *Staff*
- 711a,b. Special Projects** (Credit variable).
Independent research or design arranged in consultation with a faculty member subject to approval of the student's faculty adviser and director. *Staff*
- 751a,b. Graduate Research.** *Staff*
- 800b. Degree Candidate Only.**

Art and Art History

Associate Professor Oliver-Smith, *Chairman*

Professors K. T. Brown, Camfield, Havens, O'Neil, D. G. Parsons,
and Winningham

Visiting Professor Friedlander

Associate Professor Boterf

Assistant Professors Poulos, J. F. Scott, Widrig, and Wirz

Lecturers Badner and Huberman

Visiting Lecturer McEvelley

Degrees Offered: B.A., B.F.A.

The Department of Art and Art History offers courses in three distinct disciplines: the history of art, studio art (painting, drawing, sculpture, etc.), and film and photography. Majors may elect to concentrate their study in any of these areas of specialization.

Requirements for a Major in Fine Arts. A minimum of thirty-six semester hours (twelve semester courses) is required, including at least nine semester hours (three courses) in the history of art and nine semester hours (three

courses) selected from studio, film, and photography. Double majors must take a minimum of thirty semester hours (ten courses), including at least nine semester hours (three courses) in both the creative arts and the history of art. History of Art 205, 206 are required of all majors.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 84 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

A reading knowledge of French, German, or Italian is strongly recommended for all majors, especially those who intend to take 300- or 400-level courses in the history of art.

Students interested in further guidance in planning the Bachelor of Arts degree with a major in art and art history should consult departmental faculty advisers.

Bachelor of Fine Arts Program. The Bachelor of Fine Arts program consists of a fifth year of intensive study in the creative arts to be taken after a student has obtained a B.A. degree in art at Rice or its equivalent at another university. Candidates possessing a B.A. degree with a major in a field other than art may in exceptional cases be admitted to the program. Special fifth-year courses are available to the B.F.A. candidate only, in addition to advanced courses normally offered by the department. Satisfactory completion of a total of thirty semester hours or the equivalent in approved major electives at the 300, 400, or 500 level is required for the B.F.A. degree.

Admission to the program is determined by the Committee on Examinations and Standing on recommendation of the Bachelor of Fine Arts Committee. For further information about application forms, deadlines, admission standards, and the like, write to the chairman of the Department of Art and Art History.

Sewall Art Gallery Chester Boterf, *Director*

Sewall Art Gallery, located on the main floor of Sewall Hall, operates under the auspices of the Department of Art and Art History. Exhibitions of moderate size, usually directly related to departmental courses, are held throughout the academic year. Works from the departmental collection, student exhibitions, as well as shows drawn from outside sources are recurrent parts of the program.

Institute for the Arts Dominique de Menil, *Director*

The Institute for the Arts organizes exhibitions and publishes catalogs of national and international interest. It operates the Rice University Museum located at the University Boulevard and Stockton Street entrance to the campus. Exhibitions of the institute have traveled to major museums in the United States and abroad. Visits to the campus by distinguished lecturers, art historians, and creative artists are sponsored by the institute.

Educational and other services provided by the Institute for the Arts include: the art-to-schools program, a lecture series on art that is presented to school children by volunteer docents; the campus loan collection, art available for exhibition in various campus facilities; the teaching collection, art available to faculty for teaching purposes.

A large portion of the institute's functions are open to the general public as well as the university community and are thus designed to enrich the cultural ambience not only of the campus but also of the city of which it is a part.

History of Art and Architecture

History of Art Courses

205a, 206b. Introduction to the History of Art (3-0-3 each semester).

A survey of painting, sculpture, and architecture from the Paleolithic period to the twentieth century. Open to all students. *Mr. Widrig, Mr. Camfield*

215a. History of the Film (3-0-3).

The silent period. Emphasis on Griffith, Chaplin, Eisenstein, and the German Expressionists. Classic films, approached theoretically and technically. *Mr. McEvilley*

216b. History of the Film (3-0-3).

The sound period through the 1960s. The problem of assimilating sound and its effects. Primarily European, but some attention to Indian and Japanese films. *Mr. McEvilley*

225. Survey of Primitive Art (3-0-3). †

African, oceanic, and North American Indian arts sampled. The style and function of art in preliterate societies discussed and history of Western appreciation considered. Also offered as Anthropology 225.

235a. Art of Beginning Civilization (3-0-3).

Comparative expression in visual arts and architecture from Neolithic origins to establishment of empires in the ancient Near East (Egypt to Mesopotamia) and pre-Columbian America (Mexico to Peru). Also offered as Anthropology 235. *Mr. Scott*

301a, 302b. Symbols in the Visual Arts (3-0-3 each semester).

Paleolithic caves, neolithic temples, Egypt, Mesopotamia, Crete, Greece, India, the Far East, Christianity, cabalism, alchemy, tarot. Numerical, geometrical and natural symbols. Diffusion patterns. Psychological and philosophical interpretations. *Mr. McEvilley*

303, 304. World Mythology (3-0-3 each semester). †

Primitive, Near-Eastern, Egyptian, and Greek myths. Spring semester: India, China, Japan, New World, Medieval, and Modern. Origin, diffusion, and development of myths; relation to religion, philosophy, literature, and psychoanalysis.

305, 306. Greek Art and Archaeology (3-0-3 each semester). †

The Bronze Age; tangible remains of Greek culture from its beginnings to the end of the Archaic period. Spring semester: development from Early Classical through Hellenistic periods.

308b. Roman Art and Archaeology (3-0-3).

The painting, sculpture, and architecture of ancient Rome from roots in Etruscan art through the Republican and Imperial eras to the age of Constantine. *Mr. Oliver-Smith*

309. Late Antique and Early Christian Art (3-0-3). †

Transformation of Late Antique art and its adaptation to Christian content from the third to ninth centuries. Emphasis placed on establishment of the church form itself.

310b. Byzantine Art (3-0-3).

The architecture, painting, mosaic, and sculpture to the fall of Constantinople and their evolution from Eastern Early Christian art. *Mr. Widrig*

312. Early Medieval and Romanesque Art (3-0-3). †

Western European art and architecture from the fifth to twelfth centuries focusing on the evolving form of the Medieval church.

319, 320. Gothic Art (3-0-3 each semester). †

A survey of European architecture, sculpture, and painting, both religious and secular, from the mid-twelfth century to the early sixteenth century.

325a. African Art (3-0-3).

Traditional arts of sub-Saharan West Africa in the context of tribal cultures. Distribution of common forms and courtly arts. Also offered as Anthropology 325. *Mr. Scott*

336. Oceanic Art (3-0-3). †

Aboriginal arts of the Pacific Islanders in the context of their cultures. Diffusion of similar forms and Asiatic sources. Also offered as Anthropology 336.

340. Expression of French Society Through Its Cinema (3-0-3). †

The topic will change from year to year. Open to all students. Directed in English. French majors will have separate discussions in French. Also offered as French 340.

345a. Renaissance and Baroque Architecture (3-0-3).

Renaissance architecture considered as a conscious break with medieval modes, its stylistic and theoretical development, primarily in Italy during the fifteenth, sixteenth, and seventeenth centuries.

Mr. Widrig

346b. Modern Architecture (3-0-3).

The origins of modern architecture in rival modes of the eighteenth and nineteenth centuries; the new architecture of Richardson, Sullivan, Wright, and others; the International style and mid-twentieth-century trends.

Mr. Widrig

355a. American Art (3-0-3).

A survey of American art from colonial period to 1940s. Emphasis on painting with some consideration of architecture, sculpture, and decorative or applied arts.

Mr. Camfield

356. American Art (3-0-3). †

Continuation of History of Art 355.

415a, 416b. Renaissance Art (3-0-3 each semester).

A survey of European architecture, sculpture, and painting from the beginning of the fifteenth century to the late sixteenth century.

Mrs. Brown

417, 418. Baroque and Rococo Art (3-0-3 each semester). †

European architecture, sculpture, and painting from the late sixteenth to the late eighteenth century. Continuation, criticism, and transformation of Renaissance form and space; discovery of new possibilities.

425a. The Art of Venice (3-0-3).

Venetian art and architecture traced from its Late Antique origins to its flowering in the sixteenth century and its subsequent refflorescence in the eighteenth century.

Mr. Oliver-Smith

438. Indian Art of North America (3-0-3). †

Arts of historic and prehistoric Indian cultures of the United States and Canada; emphasis on Southwest, Northwest Coast, and the Alaskan Eskimo. Also offered as Anthropology 438.

442b. Recent Trends in Architecture (3-0-3).

Historic-critical presentation of modern architecture since World War II, examination of its maturity and transformation on a global scale. By permission of instructor. Also offered as Architecture 442.

Mr. Papademetriou

446b. Ancient Art of South America (3-0-3).

Survey of the evolution of the arts in Andean civilizations from preceramic coastal communities to the Inca state. Includes northern South America, lower Central America, and Antilles. Also offered as Anthropology 446.

Mr. Scott

447. Ancient Art of Mesoamerica (3-0-3). †

The pre-Hispanic art of Mexico, Guatemala, and Honduras, beginning with the Olmec culture (c. 1200-600 B.C.) and culminating with that of the Aztec. Also offered as Anthropology 447.

458b. Latin American Art (3-0-3).

The art and architecture of Hispanic America after the European conquest, analyzing European and native contributions. Emphasis on Mexico with reference to Hispaniola, Peru, and Brazil.

Mr. Scott

461a. Nineteenth-Century Art in Europe (3-0-3).

Major movements in painting and sculpture from late eighteenth century Neo-Classicism and Romanticism through Realism, Impressionism, and Post-Impressionism. Brief consideration of architecture.

Mr. Camfield

463. Trends in Art Since 1945 (3-0-3). †

Trends in American and European art, Abstract Expressionism to the present. Emphasis on American art and criticism. Prerequisite: History of Art 475 or permission of instructor.

475a. Twentieth-Century Art in Europe (3-0-3).

The revolutionary movements of modern painting and sculpture from roots in Impressionism through numerous "isms" of the twentieth century — Expressionism, Cubism, Abstraction, Dada, and Surrealism.

Mr. Camfield

491, 492, 493, 494, 495, 496. Special Topics.

Advanced courses irregularly offered or special research and reading tailored to the individual student. Prerequisite: permission of instructor.

Staff

497a, 498b. Senior Thesis (1-0-1 first semester; 3-0-3 second semester).

Thesis written under the direction of a member of the faculty. Limited to senior art majors. Permission of faculty required.

Staff

Studio Art

Arts Courses

101a. Design I (1-6-3).

Principles of two-dimensional design, including color theory. Strongly recommended for art majors; open to all students.

Mr. O'Neil

102b. Design I (1-6-3).

Continued study of the elements and principles of design. Three-dimensional problems will be introduced. Prerequisite: Arts 101.

Mr. Boterf

225a,b; 226b. Drawing I (1-6-3 each semester).

An introduction to the problems of drawing, using various media (pencil, charcoal, pen-and-ink). Open to all students.

Staff

325a,b. Life Drawing (1-6-3).

Drawing from the model in various media. Prerequisite: permission of instructor.

Mr. Boterf, Mr. Poulos

401, 402. Design II (1-6-3 each semester).†

Advanced design problems in two and three dimension. Prerequisite: Arts 102 or Architecture 102.

411a, 412b. Printmaking (1-6-3 each semester).

Etching, lithography, and other printmaking methods, both in black and white and in color. Prerequisite: Arts 225, 226.

Mr. Wirz

425a, 426b. Painting I (1-6-3 each semester).

Problems of painting, both traditional and experimental, in various opaque media. Open to all students. Prerequisite: Arts 225, 226 or permission of instructor.

Mr. O'Neil, Mr. Wirz

435a, 436b. Sculpture I (1-6-3 each semester).

Sculpture in clay, ceramics, metal welding, and other sculptural media. Open to all students.

Mr. Parsons

449a, 450b, 451a, 452b, 453a, 454b. Special Problems (1-6-3 each semester).

Advanced problems in creative art with individual instruction and criticism. Admission by permission of department chairman and instructional staff. May be repeated for credit.

Staff

465a, 466b. Sculpture II (1-6-3 each semester).

Advanced problems in various media. Prerequisite: Arts 435, 436.

Mr. Parsons

475a, 476b. Painting II (1-6-3 each semester).

Advanced problems in painting. Individual projects. Prerequisite: Arts 425, 426.

Mr. Poulos

501a, 502b. Independent Study (1-6-3 each semester).

Individual work in the studio arts, film, or photography under the direction of one or more staff members. Restricted to B.F.A. degree candidates.

Staff

503a, 504b. Independent Study (2-12-6 each semester).

The same as Arts 501, 502 with increased credit hours.

Staff

505a, 506b. Independent Study (3-18-9 each semester).

The same as Arts 501, 502 with increased credit hours.

*Staff***507a, 508b. Independent Study (4-24-12 each semester).**

The same as Arts 501, 502 with increased credit hours.

Staff

Film and Photography

Arts Courses

205a, 206b. Photography I (3-3-3 each semester).Exploration of the basic materials and processes of the photographic medium; viewing, analysis, and discussion of the medium's history and current trends. *Mr. Winningham***305a, 306b. Photography II (3-3-3 each semester).**Advanced problems in photography. Emphasis on independent pursuit of projects submitted by students. *Staff, Mr. Winningham***327a,b; 328a,b. Film and Videotape Making I (3-0-3 each semester).**

A study of the expressive possibilities of the mediums. Synchronous sound, using super-eight millimeter film. Also offered as Sociology 327, 328 and Anthropology 327, 328.

329a, 330b. Film Form I (3-0-3 each semester).Viewing, analysis, and discussion of modern and classic films. Also offered as English 329, 330. *Mr. Huberman***345a, 346b. Alternative Problems in Photography I, II (3-0-3 each semester).***Staff***405. Contemporary Trends in Photography (3-0-3).†**

Seminar: Survey of contemporary trends in photography.

427a, 428b. Film and Videotape Making II (3-0-3 each semester).One major film project by each student. Production planning and use of professional techniques, employing sixteen millimeter film and synchronous sound. Prerequisite: Arts 327, 328. *Mr. Huberman***429a, 430b. Film Form II (3-0-3 each semester).**Viewing, analysis and discussion of films. More academic course with assigned reading and reports. *Mr. Huberman***431. New American Independent Avant Garde Cinema (3-0-3). †**

A historical and analytical study of the efforts and ideas shaping the development of the new American Independent Avant Garde Cinema, sometimes known as the Underground.

432b. Film Genre: The Western (3-0-3).The essential American film experience spanning all the years of U.S. cinema. Focusing on the Western, the course concerns itself with questions regarding what creates a genre. *Mr. Huberman***449a, 450b, 451a, 452b, 453a, 454b. Special Problems (1-6-3 each semester).**

See Studio Art section for description.

*Staff***455. Computer Graphics and Animation Seminar (1-6-3). †**

Study of the relationships between the art of design and the methods of science, through algorithmic, mathematical, and logical languages usually associated with digital computers.

501a-508b. Independent Study.

See Studio Art section for description.

Staff

Theater

The Rice Players is an extracurricular group that presents a wide range of theatrical performances. In recent years these have included classics such as Shakespeare's *Much Ado About Nothing* and the *Alchemist* by Ben Jonson,

as well as modern experimental shows such as *The Serpent* of Jean Claude van Italie and Charles Marowitz's *A Macbeth*. The Players have presented their own adaptation of *Alice in Wonderland* and the musicals *Zorba* and *The Canterbury Tales*. Participation is open to any Rice student or faculty member.

Theater Course

300a,b. Introduction to Theater (3-0-3 each semester).

Analysis and interpretation of plays from the viewpoints of the theater artists: director, actor, and designer. Techniques of theater production.

Mr. Havens

Behavioral Science

Degrees Offered: B.A. (interdisciplinary degree), M.A., Ph.D.

Undergraduate Program. The major in behavioral science centers on a nucleus of courses in anthropology, psychology, and sociology. The student will ordinarily, but not necessarily, emphasize one of these three fields.

Students majoring in behavioral science will be required to take a minimum of thirty semester hours (ten semester courses) in anthropology, psychology, and sociology, of which twenty-four semester hours (eight courses) must be courses numbered 300 or higher. A minimum of six semester hours (two courses) in each of the three fields of anthropology, psychology, and sociology is required. With the approval of the major adviser, a maximum of six semester hours (two courses) in courses numbered 300 or higher in related fields outside the core fields may be included in the major. Six semester hours (two courses) at the 200 level may be substituted for advanced-level courses if they are in a field of the major in which no courses have been taken previously. Students are encouraged to plan in consultation with the program adviser an independent study course (to be taken in the fall of their senior year) that will integrate the varying perspectives of anthropology, psychology, and sociology.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 90 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Program. The departments of Anthropology and Sociology offer an interdisciplinary graduate program in behavioral science leading to the doctorate with specialization in either anthropology or sociology. A qualifying examination in either sociology or anthropology must be taken at the end of the first year and must be passed not later than the end of second year. Comprehensive examinations in either anthropology or sociology must be passed before the student is admitted to candidacy for the Ph.D and undertakes work on the doctoral dissertation. Many courses given in anthropology and sociology, as well as those bearing the title behavioral science, may be taken by students specializing in either field. The program of each student is individually planned to take advantage of interdisciplinary training. There is no foreign language requirement for majors in sociology; competence in one foreign language is usually required of majors in anthropology.

An important part of the student's training is participation in research and teaching. Each student will have an individual adviser and will ordinarily participate in research programs and teaching. Upon completion of the comprehensive examinations and approval of candidacy for the Ph.D., the M.A. is

optionally offered, but no students who intend to complete only the M.A. are admitted to the program. The M.A. as a terminal degree will be awarded only in unusual cases. In such cases, the M.A. will require satisfactory completion of thirty semester hours of course work approved by an adviser, a passing grade on the qualifying examination in the candidate's field of concentration, and a thesis.

Additional information may be obtained from the departments of Anthropology and Sociology.

Behavioral Science Courses

500. Basic Trends in Sociological Theory (3-0-3). †

Classical theories of Durkheim and Weber and their contribution to contemporary sociological perspective. Examination of current sociological theory: conflict theory, exchange theory, social behaviorism, and microsociology. Also offered as Sociology 315.

505a,b. Independent Study and Tutorial (0-0-3 to 9 each semester). Staff

510. Current Topics and Problems in Anthropology (3-0-3). †

515a. Ethnological Theory (3-0-3).

Seminar surveying major trends of ethnological theory from the beginning of anthropology. Also offered as Anthropology 400. *Mr. Norbeck*

546b. Linguistic Anthropology (3-0-3).

Linguistic theory and method in the analysis of cultural materials. Also offered as Anthropology 508 and Linguistics 412. *Mr. Tyler*

550. Ethnography of Urban Places (3-0-3). †

A seminar that will provide students an opportunity to plan and conduct ethnographic studies in the Houston area. Also offered as Anthropology 450.

597a, 598b; 697a, 698b. Research and Thesis in Behavioral Science (0-0-3 to 9 each semester).

700c. Summer Graduate Research.

800b. Degree Candidate Only.

Biochemistry

Professor Schroeffer, *Chairman*; Professors Awapara, Palmer, and J. B. Walker

**Associate Professors Matthews, Olson, Quioco, and Rudolph
Assistant Professor Bennett
Lecturer R. H. White**

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Program. Undergraduate biochemistry majors must complete the following courses:

Freshman level: Mathematics 101, 102 or 121, 122; Chemistry 101, 102, 107; Physics 101, 102 or 111, 112; Physics 132.

Sophomore level: Mathematics 211, 212; Chemistry 211, 212; Chemistry 213, 214; and any advanced physics or mathematics course or Mathematical Sciences 220 or 223 or Engineering 240.

Advanced level: Biochemistry 361, 365, and 367; Chemistry 311, 312; at least nine semester hours (three courses) at the advanced level in biochemistry, biology, or chemistry in addition to those specified.

An undergraduate major in biochemistry must have forty-two semester

hours (fourteen courses) in courses numbered 300 or higher to obtain a Bachelor of Arts degree.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 129 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Undergraduate majors in biochemistry are encouraged but not required to pursue independent supervised research in Biochemistry 401. Concurrent registration in Biochemistry 411 is required. In addition, undergraduate majors in biochemistry are strongly encouraged, but not required, to enroll in Chemistry 401, Chemistry 402, and Biochemistry 460. Undergraduates wishing to enroll in graduate courses in biochemistry normally require permission of the instructor.

Graduate Program. Graduate study in biochemistry leading to the M.A. or Ph. D. degrees is open to qualified students holding a bachelor's degree or the equivalent. Admission to the graduate program is based on previous academic performance, recommendations, and performance on the Graduate Record Examination. Entering students are expected have very strong backgrounds in one or more of the following: chemistry, biochemistry, or biology. Candidates for advanced degrees must meet the general university requirements (see pages 91-92) and specific departmental requirements determined in consultation with an adviser. For further information, interested applicants should contact the departmental chairman.

Biochemistry Courses

101a. Nutritional Biochemistry for Nonscience Majors (3-0-3).

Biochemical concepts underlying the science of nutrition and related subjects; food composition, calories and energy needs, needs for special nutrients, nutritional deficiencies, current nutritional topics. No previous chemistry courses required. *Mr. Awapara*

200c, 201a, 202b. Special Topics in Biochemistry for Undergraduates (0-TBA-2 each semester).

Independent program of study and research under direction of faculty member. Requires permission of supervising faculty member and of the departmental chairman. *Staff*

361a. General Biochemistry (6-0-6).

The chemistry, biological functions, and metabolism of molecules in living cells. Topics include enzymic catalysis, metabolic control, and energy production and utilization. Prerequisite: Chemistry 211, 212. *Mr. Palmer, Mr. Rudolph*

365a,b. Experimental Biochemistry (Lecture) (3-0-3).

A lecture course on modern techniques of biochemical investigation. Prerequisite: Biochemistry 361. *Staff*

367a,b. Experimental Biochemistry (Laboratory) (0-9-3).

Modern techniques of biochemical investigation: chemistry of lipids, carbohydrates, nucleic acids; separation techniques; spectroscopy; measurement and safe-handling of radioisotopes; enzyme purification and methods of kinetic analysis. Prerequisite or corequisite: Biochemistry 365. *Staff*

400c, 401a, 402b. Undergraduate Research in Biochemistry (0-15-5 each semester).

Open only to undergraduate majors with the permission of the research supervisor and the chairman. Prerequisite: Biochemistry 361, 365, and 367, and enrollment in Biochemistry 411. *Staff*

410c. Undergraduate Research Seminar in Biochemistry (3-0-3). *Staff*

411a, 412b. Undergraduate Research Seminar in Biochemistry (3-0-3 each semester).

Discussion of current research in area under investigation. Prerequisite: enrollment in Biochemistry 401. *Staff*

460b. Advanced Biochemistry (3-0-3).

The structure and metabolism of macromolecules, advanced intermediary metabolism, reaction mechanisms, regulation (including hormonal control of metabolism), and enzyme kinetics. Prerequisite: Biochemistry 361. *Staff*

501a. General Biochemistry for Graduate Students (6-0-6).

Chemical nature of molecules in living cells and their biological functions; biosynthesis and degradation; mechanisms and stereochemistry of enzymic catalysis; metabolic control, energy production, and utilization. Prerequisite: graduate status, one year of organic chemistry. *Mr. Palmer, Mr. Rudolph*

515a, 516b. Experimental Biochemistry (Lecture) (3-0-3 each semester).

An intensive lecture course dealing with modern techniques of biochemical investigation. Prerequisite: graduate status and completion of enrollment in Biochemistry 501 or equivalent. *Staff*

517a, 518b. Experimental Biochemistry (Laboratory) (0-9-3 each semester).

Modern techniques of biochemical investigation: chemistry of lipids, carbohydrates, nucleic acids; separation techniques; spectroscopy; measurement and safe-handling of radioisotopes; enzyme purification and methods of kinetic analysis. Prerequisite: graduate status and enrollment in Biochemistry 515 or equivalent. *Staff*

560b. Advanced Biochemistry (3-0-3).

Same as Biochemistry 460. Prerequisite: 361 or equivalent and graduate status. *Staff*

566b. Advanced Experimental Biochemistry (3-0-3).

The biochemical application of spectroscopic (including ORD-CD, ESR, NMR, and mass spectroscopy) and other physical approaches (including ultracentrifugation and x-ray crystallography). *Staff*

568b. Advanced Experimental Biochemistry (Laboratory) (0-9-3). *Staff***571a, 572b. Special Topics in Biochemistry (3-0-3 each semester).**

Subject to be announced.

575a. Introduction to Research (0-3-1).

A rotation of first-year graduate students through the research laboratories of individual faculty members. *Staff*

581a, 582b. Graduate Seminar in Biochemistry (2-0-2).

A discussion of selected biochemical topics.

Mr. Schroepfer

601a, 602b. Graduate Research in Biochemistry (Credit Variable).**611a, 612b. Biochemistry Research Seminar (3-0-3).**

Discussion of current research in area under investigation. Prerequisite: enrollment in Biochemistry 601.

621a, 622b. Biochemistry Department Thesis Seminar (1-0-1 each semester).

Biology

Professor F. M. Fisher, *Chairman*; Professors Campbell, Philpott, Sass, Storck, Subtelny, and C. H. Ward
Associate Professors Ansevin, Glantz, Harcombe, and Stewart

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Program. Biology majors are required to take eight semester hours of introductory biology (Biology 101, 102 and 103, 104), seven semester hours of introductory physics (Physics 101, 102 and 132 or 111, 112

and 132 or Physics 121, 122 and 123 or 124), six semester hours of introductory mathematics (Mathematics 101, 102 or 103, 106), eight semester hours of introductory chemistry (Chemistry 101, 102 and 103, 104), eight semester hours of organic chemistry (Chemistry 211, 212 and 213, 214), six semester hours of general biochemistry (Biochemistry 361), twenty-one semester hours of advanced biology electives, and four semester hours of advanced biology laboratory.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 128 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Undergraduate Alternative Programs. Up to six semester hours of the required advanced biology electives may be satisfied as follows: three semester hours in either Biology 401 (402), 403 or a 500-level biology course and three semester hours in either Biochemistry 460 or Biochemistry 365. An additional semester of Biology 401 (402) may be substituted for one semester hour advanced laboratory credit; Biochemistry 367 may also be substituted for an additional one semester hour advanced laboratory credit. With the exception of Biochemistry 365, 367, and 460, all courses taken outside the Biology Department must be approved by the department for credit toward the major.

Undergraduate Double Major. Double majors including biology must comply with the above requirements for a major except that only fifteen semester hours of advanced biology electives are required. Three semester hours may be satisfied as described in the above paragraph on undergraduate alternative programs. Double majors are also required to take four semester hours of advanced biology laboratories (300-level and above).

Major Following Early Admission to Medical School. A major in biology will normally be approved for students entering medical school at the end of their junior year provided they have satisfied the requirements for the double major described above. These requirements may be completed following matriculation in medical school only by enrollment in courses offered by the department. They may not be satisfied by transfer credit for preclinical courses taken in medical school.

Graduate Program. The graduate program is open to qualified applicants who hold a bachelor's degree or equivalent. Prospective graduate students must take the Graduate Record Examination, preferably including the advanced examination in biology. The entering graduate student generally is expected to have a strong background in one of the several areas of biology; in addition, completion of courses in physics (one year), mathematics (including calculus), and chemistry (including organic) is required. The above requirements do not preclude admission of qualified applicants who have majored in areas other than biology. Any deficiencies must be made up no later than the first year of residence in graduate study, including the first summer. It is strongly recommended that deficiencies be made up during the summer preceding the first semester of residence. A preliminary examination will be administered during the first year. Students entering with the master's degree are normally exempt from this examination.

Program for the Degree of Doctor of Philosophy. In addition to the general university requirements for advanced degrees (pages 91-92), the following departmental requirements must also be met:

1. Three or more years of graduate study with at least two years in residence at Rice

2. An original investigation worthy of publication in a scientific journal, and a doctoral thesis as described in the *General Announcements*
3. A grade average of 2 or better in courses taken in the department and satisfactory grades in courses taken outside the department
4. Satisfactory performance in Biology 503 for at least four semesters
5. Satisfactory performance on a candidacy examination administered by the advisory committee; this examination may be oral and/or written
6. Public defense of the thesis
7. Presentation of a departmental seminar on the candidate's research

Program for the Degree of Master of Arts. The degree of Master of Arts may be obtained after the completion of thirty semester hours of graduate study, six hours of which must be earned by the completion and public defense of a thesis embodying the results of an original investigation.

Assistantships. A limited number of graduate fellowships are available on a competitive basis. All graduate students in biology are expected to engage in laboratory instruction for at least two years, regardless of appointment.

Biology Courses

101a. Introduction to Biology (3-0-3).

A study of the basic principles of biology through analysis of form and function in animals. *Mr. Fisher*

102b. Introduction to Biology (3-0-3).

Molecular and cellular biology, genetics, and developmental biology. Background preparation in the physical sciences recommended. *Mr. Sass, Mr. Stewart, and Mr. Subtelny*

103a. Laboratory in General Biology (0-3-1).

Experimental approaches in the functional morphology of animals. *Staff*

104b. Laboratory in General Biology (0-3-1).

Experiments in molecular and cellular biology, genetics, and developmental biology. *Staff*

320b. General Physiology (3-0-3).

Role of the plasma membrane in cell function. Emphasis on the physiology of nerve and muscle cells. Prerequisite: Biology 101, 102; Introductory Physics. *Mr. Glantz*

322b. Laboratory for General Physiology (0-3-1).

Limited to 20 students. *Mr. Glantz*

326a. Comparative Physiology (3-0-3).

A general review of homeostatic mechanisms operating in the adaptation of animals to different environments. Prerequisite: Biology 101, 102. *Mr. Campbell*

331a. Developmental Biology (3-0-3).

An analysis of processes and principles in development of organisms with emphasis on experimental embryology. *Mr. Subtelny*

341a. Ecosystem Biology (3-0-3).

Analysis of species interactions, plant and animal community organization, and ecosystem function. Prerequisite: Biology 101, 103. *Mr. Harcombe*

343a. Laboratory in Ecosystem Biology (0-3-1).

Field studies of natural ecosystems. Saturday field trips required. Corequisite: Biology 341. *Mr. Harcombe*

350b. Plant Biology (3-0-3).

Analysis of the physiology, morphology, and evolution of plants in terms of adaptation to environment. Prerequisite: Biology 101, 103. *Mr. Ward, Mr. Harcombe*

352b. Laboratory in Plant Biology (0-3-1).

Field and laboratory studies of plant adaptation to environment. Corequisite: Biology 350 or consent of instructor. Limited to 32 students. *Mr. Ward, Mr. Harcombe*

360b. Genetics (3-0-4).

An analysis of the structure, function, and transmission of the genetic material. It is recommended, but not required, that Biology 103, 104 and Biochemistry 361 be taken first.

Mr. Stewart

362b. Genetics Laboratory (0-3-1).

Corequisite: Biology 360 or consent of instructor.

Mr. Stewart

401a,b; 402c. Undergraduate Honors Research (2-6-4 each semester).

Normally limited to senior biology majors with superior academic records. Permission of supervising professor and chairman required. Written thesis may be required.

Staff

403a,b. Special Topics in Biology (Credit variable).

Used for transfer credit and other special circumstances. Permission of departmental undergraduate affairs committee required.

Staff

405a, b. Undergraduate Research Seminar in Biology (Credit variable).

A discussion of contemporary research areas in the biological sciences. Recommended for those students participating in departmental research projects.

Staff

411. Parasitism and Symbiosis (3-3-4). †

An introduction to the biology of symbiosis; special emphasis on parasitism and on the physical and chemical relationships between organisms.

Mr. Fisher

419. Biological Oceanography (4-3-1). †

Study of the biological aspects of oceanography, emphasizing planktonic organisms. Nektonic and benthonic organisms will also be considered, as will be paleoceanography. Prerequisite: consent of instructor.

Mr. Casey, Mr. Fisher

420. Neurobiology (3-0-3). †

Mechanism involved in the development, maintenance, and functioning of nervous systems of simple and complex organisms. Prerequisite: Biology 320 and/or consent of instructor. Enrollment limited to 20 students.

421a,b. Biophysical Chemistry (3-0-3).

Physical chemistry applied to problems in the biological sciences: solutions of macromolecules, ionic processes, interfacial phenomena, transport systems, and molecular models of biochemical and physiological processes. Prerequisite: Biology 103, 104; Chemistry 101, 102; Mathematics 211, 212 or consent of instructor.

Mr. Sass

424b. Comparative Biochemistry (3-0-3).

Diversity in biochemistry with emphasis on animal metabolism; the origin of life and establishment of biochemical unity; molecular mechanisms operating in evolution.

Mr. Campbell

430b. Cellular and Molecular Aspects of Development (3-0-3).

Mechanisms of information transfer and their controls in development. Analysis of determination and differentiation of cell phenotypes. Prerequisite: Biology 331 and Biochemistry 361.

Ms. Anserin

432b. Laboratory for Development Biology (0-6-2).

Observation and experiments on amphibian and avian embryos. Enrollment limited to 16 students. Prerequisite: Biology 331 or registration in 430 and consent of instructor.

Ms. Anserin

471a. Microbiology (3-0-3).

Anatomy, physiology and molecular biology of microbial prokaryotes and eukaryotes and of viruses. Prerequisite: Biochemistry 361 or consent of instructor.

Mr. Storck

473a. Laboratory in Microbiology (0-3-1).

Methods of isolation, identification and numeration of bacteria. Corequisite: Biology 471. Enrollment limited to 24 students.

Mr. Storck

481a. Cells and Tissues (3-0-3).

The morphology and function of cell components, cells and tissues as revealed by light and electron microscope and associated histo- and cytochemical methods. Prerequisite: Biology 320 and Biochemistry 361.

Mr. Philpott

483a. Cells and Tissues Laboratory (0-3-1).

Laboratory work in histology and histochemistry and other selected methods for studying cells and tissue. *Mr. Philpott*

501a,b. Seminar in Biology (1-0-1).

General departmental seminar. Required of all graduate students. *Staff*

503a,b. Teaching in Biology (Credit variable).

Supervised instruction in teaching in the various areas of biology. Prerequisite: graduate standing in biology. *Staff*

511. Physiology of Parasitism (3-0-3). †

Conferences and student reports on the physiology of parasites and the functional relationships of hosts and parasites; growth, metabolism, nutrition, and physiological evolution of parasites. Prerequisite: Biology 411 or equivalent. *Mr. Fisher*

521. Advanced Cell Physiology (3-0-3). †

Seminar on selected research areas in cell structure and function. Prerequisite: Graduate standing and Biochemistry 361 or equivalent. *Mr. Campbell*

523a. Advanced Comparative Biochemistry (3-0-3).

A seminar on current literature on comparative animal biochemistry. Prerequisite: graduate standing and Biochemistry 361 or equivalent. *Mr. Campbell*

525a. Concepts of Nervous Systems Functions (3-0-3).

Vertebrate and comparative neurophysiology. Prerequisite: Biology 320 or equivalent and consent of instructor. Understanding of cell physiology is assumed. Limited to 15 students. *Mr. Glantz*

532b. Cell and Tissue Interactions in Development (3-0-3).

Seminar course surveying recent literature on the subject. Prerequisite: Biochemistry 361, Biology 331 and 430. *Ms. Anserin*

533a,b. Special Projects in Developmental Biology (0-6-2).

Laboratory training in experimental manipulations on developing eggs and embryos; individual research projects. *Ms. Anserin, Mr. Subtelny*

534. Advanced Developmental Biology (3-0-3). †

Informal seminars on recent advances in problems of embryonic development. Prerequisite: Biology 331 and 430. *Mr. Subtelny*

543. Marshland and Estuarine Biology (1-6-3). †

Student reports, conferences, and field work on the physical composition and the biota of nearby coastal environments. *Mr. Fisher*

547a,b. Topics in Ecosystem Biology (3-0-3).

Discussions, seminars, and projects concerning organization, structure, and function of ecosystems. Prerequisite: consent of instructor. *Mr. Harcombe*

553a,b. Topics in Plant Biology (3-0-3).

A seminar on current literature and research in plant biology. Prerequisite: consent of instructor. *Mr. Ward*

569a,b. Topics in Microbial Genetics (3-0-3).

Student seminars analyzing recent research on a subject of current interest in microbial genetics and molecular biology. Prerequisite: consent of instructor. *Mr. Stewart*

571a,b. Topics in Microbiology (3-0-3).

Discussion of research literature. Prerequisite: consent of instructor. *Mr. Storck*

580b. Cell Biology (2-6-4).

The study of cells and cell phenomena and interpretation of observations. Advanced laboratory and seminar. Prerequisite: Biology 320, 481, 483, and Biochemistry 361. *Mr. Philpott*

582b. Topics in Cell Biology (3-0-3).

Prerequisite: Biology 481 or permission of instructor. *Mr. Philpott*

601a,b. Graduate Research (Credit variable).

Independent research open to first year graduate students. *Staff*

701a,b. Thesis Research (Credit variable).

Staff

800b. Degree Candidate Only.

Chemistry

Professor Wenkert, *Chairman*; Professors Brooks, Curl, Hackerman, Hayes, Kilpatrick, Lewis, Margrave, Sass, Schroepfer, and Wall
Associate Professors Billups, Engel, Glass, Parry, and L. J. Wilson
Assistant Professors Fukuyama, Mukamel, Smalley, and Sosinsky

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Program. Undergraduates electing chemistry as a major are expected to take the following courses in their freshman year: Mathematics 101, 102 (or equivalent honors courses); Physics 101, 102, 132; Chemistry 101, 102, 107. In general they will take Chemistry 211, 212 and 213, 214; Physics 201, 202; and Mathematics 211, 212 in the sophomore year. The department further requires satisfactory completion of the following courses:

Junior and Senior Years

Chemistry 311, 312 and 313, 314

Chemistry 401 and 403

Chemistry 430

Chemistry 460 or 495

Two additional courses in advanced chemistry, physics, mathematics, mathematical sciences, or biochemistry. Superior students may substitute undergraduate research (Chemistry 491, 492) for one or two semesters of classroom instruction.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 133 semester hours. See Degree Requirements and Majors, pages 50 and 51.

American Chemical Society Certification. The Rice chemistry department is on the approved list of the Committee on Professional Training of the American Chemical Society and as such can certify that graduates have met the appropriate standards. For certification, two additional advanced courses are required and a foreign language, preferably German, is recommended.

Accelerated Ph.D. Plan. Because of the high level of training provided in the Rice B.A. program, it is possible for certain especially qualified undergraduate students to be admitted to an accelerated program that will normally lead to the Ph.D. degree about two years after completion of the B.A. program. In order to complete the work in this time, the student will initiate research during the summer following the junior year and will continue research by taking Chemistry 491, 492 during the senior year. The student may start taking cumulative examinations during the senior year and should be able to complete all courses and examinations before the end of the second year after the B.A. The student should in most cases, if not all, be able to complete the thesis in this time as well.

Interdepartmental Majors. Interdepartmental majors are offered in chemical physics and materials science by the Department of Chemistry in conjunction with the Departments of Physics and Materials Science, respectively. Students electing one of these majors should discuss their programs with both the Department of Chemistry and the other department concerned.

The Graduate Program. Students who have completed work equivalent to that required for the bachelor's degree in chemistry offered at Rice University may be admitted to graduate standing. Preference is normally given to applicants who earn high scores on the Graduate Record Examination, including the advanced test in chemistry (see pages 96 and 97). A minimum of one year of graduate study is required for the degree of Master of Arts and at least two years for the degree of Doctor of Philosophy. A nominal amount of undergraduate teaching is normally considered an integral part of the graduate program.

Candidates for the degree of Master of Arts are required to demonstrate a reading knowledge of scientific German, French, or Russian; complete six one-semester courses; present in a thesis the results of a program of research approved by the department; and pass a final oral examination.

Candidates for the degree of Doctor of Philosophy must complete for publication a thesis which represents a distinctly original and significant contribution to the field of chemistry. They must possess a reading knowledge of two modern languages, besides English, in which there is a significant body of chemical literature, usually German, French, or Russian. Candidates must further have acquired through course work and independent study a broad fundamental knowledge of chemistry in addition to those areas of the subject encompassed by their own research interests. Cumulative examinations for the Ph.D. degree are given periodically and a final oral examination on the thesis is required for all candidates.

Chemistry Courses

101a, 102b. Introductory and Analytical Chemistry (3-0-3 each semester).

The basic phenomena and principles of chemistry. Normally taken with Chemistry 107; the three courses (or equivalent) are prerequisite to advanced courses in chemistry. Prerequisite: high school chemistry. *Mr. Kilpatrick*

106b. Honors Laboratory (0-4-1).

Independent projects in synthesis and characterization of compounds; experiments related to environmental chemistry. Prerequisite: Chemistry 101, 107, and permission of instructor.

Mr. Sosinsky, Mr. Wilson

107a,b. Introductory and Analytical Chemistry Laboratory (1-4-2).

Volumetric and gravimetric methods of quantitative analysis; fundamentals and methods of qualitative analysis. Normally taken with Chemistry 101, 102; the three courses (or equivalent) are prerequisite for advanced courses in chemistry. *Mr. Brooks, Mr. Curl*

211a, 212b. Organic Chemistry (3-0-3 each semester).

Aliphatic and aromatic organic chemistry with emphasis on structure, bonding, and reaction mechanisms. Second semester, greater emphasis on the chemistry of various functional groups. Normally accompanied by Chemistry 213, 214. Prerequisite: Chemistry 101, 102.

Mr. Billups

213a, 214b. Organic Chemistry Laboratory (0-4-1 each semester).

Synthesis, purification, and characterization of organic compounds. Experiments related to topics covered in Chemistry 211, 212. Second semester includes identification of unknown organic compounds. Corequisite or prerequisite: Chemistry 107 and 211, 212. *Staff*

311a, 312b. Physical Chemistry (3-0-3 each semester).

The principles of thermodynamics including topics of equilibria, theory of solutions, and electrochemistry. Second semester, kinetic theory of gases, kinetics, transport properties, photochemistry, the solid and liquid states, surfaces, and polymers. Prerequisite: Mathematics 211, 212; Physics 101, 102 (Physics 201, 202 or 211, 212 recommended); Chemistry 101, 102.

Mr. Brooks, Mr. Glass

313a. Experimental Physical Chemistry (1-4-2).

Experiments illustrating techniques employed in high vacuum, optical spectroscopy, calorimetry, electrochemistry, and surface area measurements.

Mr. Smalley

314b. Advanced Instrumental Laboratory (0-8-2).

Principles and application of modern instrumental methods to inorganic and physical chemistry. Prerequisite: Chemistry 311 and 313.

Mr. Smalley

401a. Advanced Organic Chemistry (3-0-3).

The course develops, in detail, the concepts of modern organic chemistry. A major portion is devoted to reactions of synthetic importance. Prerequisite: Chemistry 211, 212.

Mr. Engel

403a. Advanced Organic Laboratory (1-8-2).

Covers the techniques of modern organic chemistry. Designed to accompany Chemistry 401. Prerequisite: Chemistry 211, 212.

Mr. Fukuyama, Mr. Lewis

411a. Spectral Methods in Organic Chemistry (3-0-3).

Elucidation of organic structures by physical techniques. Interpretation of infrared, ultraviolet, nuclear magnetic resonance, and mass spectra. Prerequisite: Chemistry 401.

Staff

415a. Chemical Kinetics (3-0-3).

Measurement of reaction rates, phenomenological and theoretical treatment of kinetics of simple and chain reactions. Prerequisite: Chemistry 311, 312.

Mr. Glass

420b. Statistical Thermodynamics (3-0-3).

A development of the equilibrium theory of statistical mechanics. Applications to imperfect gas theory and the calculation of thermodynamic properties of molecules. Prerequisite: Chemistry 311, 312, 430; Mathematics 211, 303; Physics 201, 202 or 211, 212.

Mr. Wall

421a, 422b. Biophysical Chemistry (3-0-3 each semester).

Physical chemical principles applied to current problems in life sciences. Macromolecules, ionic processes, interfacial phenomena, transport systems, and molecular models of biochemical and physiological processes. Prerequisite: Biology 101, 102; Chemistry 101, 102; Mathematics 211, 212.

Mr. Sass

430a. Quantum Chemistry (3-0-3).

Quantum mechanics, atomic structure, the nature of the chemical bond, and statistical mechanics. Prerequisite: Mathematics 211, 212 and 303; Physics 101, 102 and 201, 202 or 211, 212; Chemistry 311.

Mr. Smalley

445b. Physical-Organic Chemistry (3-0-3).

Organic reaction mechanisms; substituent and medium effects, linear free energy relations, and acidity functions. Prerequisite: Chemistry 311, 312 and 401.

Mr. Engel

460b. Inorganic Chemistry (3-0-3).

Atomic and molecular structures; bonding in covalent, ionic, and electron deficient systems; thermochemical principles and experimental techniques for analysis, structure determination, and synthesis.

Mr. Margrave

471b. Molecular Spectroscopy (3-0-3).

The spectra of simple molecules, including microwave, infrared, visible, ultraviolet, and Raman spectra; introductory aspects of molecular symmetry and group theory; resonance spectroscopy.

Mr. Curl

491a, 492b, 493c. Special Study and Research for Undergraduates

(Credit variable).

Open only to chemistry majors with superior records and with the permission of the chairman. Written thesis required.

Staff

495a. Transition Metal Chemistry (3-0-3).

Mechanisms of inorganic reactions, group theory applications to chemistry, ligand field theory, and coordination chemistry. Prerequisite: Chemistry 311, 312.

Mr. Wilson

501a, 502b; 503a, 504b; 505a, 506b; 507a, 508b. Graduate Research
(Credit variable). *Staff*

516. Advanced Chemical Kinetics (3-0-3).†

Molecular beams, unimolecular rate theory, flames and explosions, catalysis; surface reactions, electrode and electrode reactions. Prerequisite: Chemistry 415.

521a. Chemical Thermodynamics (3-0-3).

An intensive review of thermodynamics designed primarily for first-year graduate students. *Mr. Wall*

531. Fundamentals of Mass Spectrometry (3-0-3).†

Instrumentation, ionization cross-sections and efficiency curves, Franck-Condon principle, ionization potentials, appearance potentials and heats of formation, simple mass spectra, fragmentation mechanisms, and quasi-equilibrium theory.

541, 543, 545, 546. Special Topics in Organic Chemistry (3-0-3 each semester).†

542a. Special Topics in Organic Chemistry (3-0-3).

Chemistry and mechanisms of reactions of organic compounds containing nonmetallic elements in addition to carbon, hydrogen, oxygen, and amine nitrogen. *Mr. Lewis*

544. Special Topics in Organic Chemistry (3-0-3).†

Photophysics of organic molecules and their light-induced chemical reactions.

552. Reaction Kinetics and Mechanisms in Solutions (3-0-3).†

A consideration of the rates of reactions with emphasis on homogeneous kinetics as a tool in the study of reaction mechanisms. Prerequisite: Chemistry 445.

561a, 562b. Advanced Organic Chemistry (3-0-3 each semester).

Organic reaction mechanisms, modern structure theory, and synthetically important reactions; designed primarily for first-year graduate students. *Mr. Engel, Mr. Fukuyama*

581, 582, 583, 584. The Chemistry of Organic Natural Products (3-0-3 each semester).†

590, 591. Advanced Topics in Physical and Theoretical Chemistry (3-0-3 each semester).†

592. Special Topics in Physical Chemistry (3-0-3).†

595. Special Topics in Organometallic Chemistry (3-0-3).†

Topics in homogenous catalysis with particular emphasis on the role of ion specificity in synthesis.

596. Special Topics in Inorganic Chemistry (3-0-3).†

Physical techniques used in modern transition metal chemistry, including magnetochemistry, electrochemistry and esr, pmr, photoelectron and Mossbauer spectroscopy.

597. Special Topics in Inorganic Chemistry (3-0-3).†

Synthetic and theoretical approaches to new areas of inorganic chemistry, e.g., fluorine chemistry, baron chemistry, radiochemistry.

605, 606. Special Topics in Inorganic Chemistry (3-0-3 each semester).†

Advanced survey of descriptive inorganic chemistry. Self-study reading course by permission of the instructor.

611a. High Temperature and High Pressure Chemistry (3-0-3).

The techniques for generation and measurement of high temperatures and high pressures and of the nature of phenomena under extreme conditions. *Mr. Margrave*

651a. Quantum Mechanics (3-0-3).

A development of the elements and techniques of quantum mechanics. Prerequisite: Mathematics 211, 303. *Mr. Mukamel*

652b. Quantum Mechanics (3-0-3).

Application of quantum mechanics to atomic and molecular systems. *Mr. Mukamel*

660. X-ray Crystal Structure Analysis (3-0-3).†

A course in X-ray analysis, including experimental methods, symmetry and space groups.

700c. Summer Graduate Research.

Staff

800b. Degree Candidate Only.

Staff

Economics

Professor Rimlinger, *Chairman*; Professors Besen, Huddle, Krzyzaniak, McLure, Soligo, and Young
Adjunct Professor Mieszkowski
Associate Professors G. W. Smith and K. J. White
Assistant Professors Butler, Kelly, Pomery, and Wright
Visiting Assistant Professor McCaleb
Adjunct Assistant Professors Lairson and Swint

Degrees Offered: B.A., M.A., Ph.D.

The Undergraduate Program in Economics. Undergraduate majors are required to take a minimum of nine courses totaling twenty-seven semester hours in economics, including:

1. Economics 211, 212, and 370
2. Either Economics 375 or 355
3. At least three of the following: Economics 301; 355*; 415; 416; 417; 420; 430; 435; 436; 438; 445; 448; 450; 461; 483; 485; 486

*Students may take Economics 355 to satisfy this last requirement only if they have taken Economics 375 to satisfy the requirements in macro theory.

Mathematics 101, 102 or 103, 104 and Mathematical Sciences 381 and 480 are recommended for students intending to do graduate work in economics. Furthermore, in lieu of one or two semesters of course work, the department offers an independent work program, admission to which is granted on a selective basis.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

The Graduate Program in Economics. Admission to graduate study in economics is granted each year to a limited number of students who hold an undergraduate degree (or the equivalent), whether in economics or another field. The graduate program is designed primarily for students qualified to pursue a course of study leading to the Ph.D. degree.

Training in mathematics through calculus and linear algebra at the undergraduate level is advisable but is not a prerequisite for admission. The Economics Department also offers graduate work leading to the M.A. degree.

Candidates for the Ph.D. degree who have good undergraduate preparation in economics should expect to devote two to two and one-half years to full-time study (or the equivalent) before taking the general examinations which must be passed before the submission of the doctoral dissertation. A minimum of one additional year is usually necessary for completion of the dissertation. Applicants are required to take the Graduate Record Examination.

Requirements for the Ph.D. Degree:

1. Demonstrated proficiency in statistics, elementary mathematical economics, and economic history or history of economic thought
2. Completion of an approved program of graduate courses
3. Satisfactory performance on written general examinations on:
 - a. Economic theory
 - b. A major field chosen from: (1) econometrics, (2) economic development, (3) industrial organization and regulation, (4) international trade and finance, (5) mathematical economics, (6) monetary economics, (7) public finance, (8) economic theory, or (9) economic history
4. Satisfactory performance on an oral examination emphasizing the field of specialization and the methodology to be used in dissertation research
5. Completion and oral defense of a doctoral dissertation setting forth in publishable form the results of original research

Requirements for the Master's Degree:

1. Thirty semester hours, including the thesis, with not more than nine semester hours at the undergraduate level.
2. Attainment of a grade point average exceeding 2.5 in all courses, except the thesis
3. Successful completion of a master's thesis

A master's degree may also be awarded to students who attain candidacy for the Ph.D. degree.

*Economics Courses***211a,b. Principles of Economics (3-0-3).**

Nature of economics; the price system; household decisions; production; cost and supply; marginal productivity and capital theory; industrial organization and control; economic efficiency, externalities, and public goods. *Staff*

212b. Principles of Economics (3-0-3).

Measurement and determination of national income; money, banking, and fiscal policy; business cycles, unemployment, and inflation; international trade and balance of payments; other contemporary economic problems. Prerequisite: Economics 211. *Staff*

301b. History of Economic Analysis (3-0-3).

The fundamental ideas of great economic thinkers from Plato to the present. Prerequisite: Economics 211. *Mr. Rimlinger*

350a. Elements of Statistical Method (3-2-3).

Basic concepts and techniques in probability theory and statistical inference. A student taking Economics 350 may not also receive credit for Mathematical Sciences 280. *Mr. White*

355a. Money and Banking (3-0-3).

Demand and supply of money; determinants of prices, interest, and income; American financial institutions; monetary policy; inflation. Prerequisite: Economics 211, 212. *Mr. Smith*

370a,b. Microeconomic Theory (3-0-3).

Intermediate level analysis of markets, firms, households, income distribution and general equilibrium. Prerequisite: Economics 211. *Mr. Young*

375a,b. Macroeconomic Theory (3-0-3).

Intermediate level analysis of relationships between the levels of income, employment, interest, investment, consumption, and government spending. Prerequisite: Economics 211, 212. *Staff*

400b. Econometrics (3-0-3).

Estimation and forecasting models; topics include multiple regression time-series, contingency table analysis, and Bayesian inference. Prerequisite: Economics 350 or Mathematical Sciences 380 and 381. *Mr. White*

403a, 404b. Senior Independent Research (0-0-3 each semester).

Independent research project for seniors on an approved topic of their own choosing. Enrollment is by special permission. *Staff*

415. Human Resources, Wages, and Welfare (3-0-3).†

Study of labor markets and wage determination. Special emphasis on "investment in human capital" through education, training, and health services. Prerequisite: Economics 211.

416. Economic History of the U.S. 1700-1945 (3-0-3).†

Economic history of the United States from the Colonial Period to the end of World War II. Attention will focus upon the trends in per capita income and the forces behind these trends. Prerequisite: Economics 211.

417. Comparative History of Industrialization (3-0-3).†

Comparative historical analysis of industrialization of Western Europe, the United States, and Russia from the eighteenth century to World War I. Prerequisite: Economics 211.

420b. International Economics (3-0-3).

A study of the economic relationships between countries. Trade theory, tariffs and other trade restrictions, international finance, trade and development, and current policy issues. Prerequisite: Economics 211, 212. *Mr. Smith*

430. Comparative Economic Systems (3-0-3).†

Theoretical models of various economic systems as a basis for analyzing the operation and the institutional characteristics of economies including the U.S., the U.S.S.R., Yugoslavia, and China. Prerequisite: Economics 211.

435a. Industrial Organization (3-0-3).

Market structure, concentration, barriers to entry, and oligopoly pricing. Application of micro theory to industry problems. Prerequisite: Economics 211 or approval of instructor. *Mr. Wright*

436b. Government Regulation of Business (3-0-3).

Analysis of governmental regulatory activities under antitrust laws and in such regulated industries as communications, energy, and transportation. Prerequisite: Economics 211. Economics 370 and 435 suggested. *Mr. Butler*

438b. Economics of the Law (3-0-3).

The role of economic reasoning in understanding the enactment, interpretation, and enforcement of the law. Applications to contracts, property, torts, discrimination, and criminal justice. Prerequisite: Economics 211. *Mr. McCaleb*

445a. Managerial Economics (3-0-3).

Application of economics to decision making within the firm; organization theory, cost, pricing, and problems of control. Prerequisite: Economics 211. *Mr. Wright*

448b. Corporation Finance (3-0-3).

Financial analysis, planning, and control in modern corporations; includes valuation, cost and allocation of capital, capital markets. *Mr. Wright*

450b. World Economic and Social Development (3-0-3).

Examines past and future development in advanced and poor countries emphasizing resources, population, entrepreneurship, education, and planning. Prerequisite: Economics 211, 212. *Mr. Huddle*

461a. Urban Economics (3-0-3).

Economic analysis of the development and problems of urban areas with particular attention to current policy issues. Prerequisite: Economics 211 or approval of instructor. *Mr. Butler*

471a. Linear Programming (3-0-3).

Formulation of managerial and technical problems; simplex method; revised simplex method; duality theory and applications; transportation problems; decomposition techniques. Also offered as Mathematical Sciences 471. *Mr. Young*

475a. Operations Research, Deterministic Models (3-0-3).

Optimization problems in a managerial and economic context. Familiarity with linear programming and microeconomic theory is strongly recommended. Also offered as Mathematical Sciences 475.

476b. Operations Research, Stochastic Models (3-0-3).

Decision theory, waiting-in-line theory, Markov chains, inventory models, replacement models, simulation. Prerequisite: Mathematical Sciences 380 or 381. Also offered as Mathematical Sciences 476. *Mr. Owen*

477b. Mathematical Structure of Economic Theory I (3-0-3).

Competitive economics from a mathematical perspective, unifying calculus, matrix algebra, and set-theoretic approaches. Theories of household, firm; production models. Prerequisite: Economics 211, Mathematics 212, Mathematical Sciences 310. Also offered as Mathematical Sciences 477. *Staff*

478b. Mathematical Structure of Economic Theory II (3-0-3).

Continuation of Economics 477, which is prerequisite. Also offered as Mathematical Sciences 478.

483a. Public Finance (3-0-3).

Tax and expenditure policies at the federal, state, and local levels; emphasizes resource allocation and equity. Prerequisite: Economics 211. *Mr. McCaleb*

485, 486. Contemporary Economic Issues (3-0-3 each semester).†

Analysis of urgent and significant economic problems. Emphasis on the evaluation of policy remedies. Principal topics vary from year to year.

495a, 496b. Senior Seminar (3-0-3 each semester).

Reading and discussion of topics in advanced economics. Open to seniors with special approval. *Staff*

500a,b. Master's Thesis Research.

Research on an approved topic in partial fulfillment of the requirements for the master's degree. *Staff*

501a. Advanced Microeconomic Theory (3-6-5).

Theory of the firm, the theory of consumer behavior, duopoly, bilateral monopoly, imperfect competition, capital theory, and the theory of income distribution. *Staff*

502a. Advanced Macroeconomic Theory (3-6-5).

Macroeconomic theory of employment, interest, and income. Considers the work of Keynes and subsequent developments. *Mr. Kelly*

504b. Advanced Economic Statistics (3-6-5).

Statistical inference and the testing of hypotheses; multiple and partial correlation analysis; analysis of variance and regression. *Mr. Krzyzaniak*

505b. Monetary Theory (3-6-5).

The nature of a monetary economy; asset choice; the role of financial institutions; inflation. *Staff*

506b. Monetary and Fiscal Policy (3-6-5).

Determination of money supply; tools of monetary policy; effectiveness of monetary and fiscal policy; policymaking under uncertainty. *Staff*

507a. Mathematical Economics I (4-0-5).

Theory of household, firm; activity analysis; set theory, matrix algebra, vector calculus, metric spaces, separation theory, constrained optimization. *Staff*

508b. Mathematical Economics II (4-0-5).

Continuation of Economics 507. Set theoretic approach to general equilibrium; aggregate linear and nonlinear production models; existence, stability, optimality. *Staff*

509a. Theory of Public Finance (3-6-5).

Governmental revenue and expenditures at the federal, state, and local levels; includes welfare economics, project analysis, taxation, incidence, tax reform, and fiscal federalism. *Mr. McCaleb*

510b. Econometrics (3-6-5).

Estimation and testing in econometric models; theoretical and applied econometrics. Prerequisite: Mathematical statistics and linear algebra. *Mr. White*

511b. Applied Econometrics (3-6-5).

Estimation and testing of systems of equations; consumer demand systems, production functions, econometric models. Prerequisite: Economics 510. *Mr. White*

512a. International Trade Theory (3-6-5).

Classical, neoclassical, and modern trade theory; some welfare aspects of trade, including the theory of commercial policy. Applications will be emphasized. *Mr. Smith*

513. Topics in Managerial Economics (3-6-5).†

Theory of investment of the firm; organization theory; problems in applying theory in decision-making.

514b. Industrial Organizations and Control (3-6-5).

Industrial markets and public policy.

Mr. Wright

515. Labor Economics (3-6-5).†

The economics of the labor market and the economic implication of trade unions. Attention is given to major public policy issues.

516. Economic History and Development (3-6-5).†

Historical analysis of economic growth and industrialization of the U.S., Western Europe, and Russia in the last 150 years. Stresses conditions which favored or retarded growth.

517b. History of Economic Analysis (3-6-5).

The development of economic analysis from the scholastics to the neoclassical school.

Mr. Rimlinger

518a. International Finance (3-6-5).

International monetary problems; foreign exchange theory; international investments.

Mr. Huddle

519b. Economic Growth and Development (3-6-5).

Analysis of theory and policy questions relating to the level and rate of economic development.

Mr. Soligo

520b, 521a. Workshop in Economics I, II (3-0-3 each semester).

Intensive study of selected advanced topics.

Mr. Huddle

530a. Comparative Economic Systems (3-6-5).

Analysis of theoretical models of market and centrally planned economies; national economic systems of the Soviet Union, China, Yugoslavia, Western European countries, and the United States.

536b. Government Regulation of Industry (3-6-5).

Advanced analysis of the economics of antitrust and other forms of regulation. *Mr. Butler*

561a. Urban Economics (3-6-5).

Analysis of urban development and such urban problems as housing, land use, transportation, discrimination, and pollution.

Mr. Butler

565a. Health Economics (3-6-5).

Economic aspects of health; production, cost, demand and supply factors; methods of payment and effects of regulation.

Mr. Lairson, Mr. Swint

573. Nonlinear Programming (3-0-3).†

Theory and computational methods for nonlinear programming, including: Kuhn-Tucker conditions, duality theory, methods for constrained optimization of convex and nonconvex problems. Also offered as Mathematical Sciences 573.

577b. Topics in Mathematical Economics I (3-0-3).

Selected topics in advanced mathematical economics. Prerequisite: Economics 508 or Economics/Mathematical Sciences 478.

Staff

578b. Topics in Mathematical Economics II (3-0-3).

Selected topics in advanced mathematical economics. Prerequisite: Economics 508 or Economics/Mathematical Sciences 478.

579b. Topics in Mathematical Economics III (3-0-3).

Selected topics in advanced mathematical economics. Prerequisite: Economics 508 or Economics/Mathematical Sciences 478.

591a, 592b. Topics in Policy and Applied Economics (3-6-5 each semester).

Staff

595a, 596b. Readings in Advanced Topics (3-0-3 each semester).

Staff

600a,b. Doctoral Dissertation Research.

Staff

700c. Summer Graduate Research.

Staff

800b. Degree Candidate Only.

Staff

Education

Professor Wood, Chairman
Lecturers Baum and Duke, Director of Student Teaching

Degrees Offered: Secondary Teaching Certificate in conjunction with B.A. in major field; Master of Arts in Teaching.

Teacher Education and Certification. Rice University seeks to contribute graduates to society able to think and to question, educated to comprehend and to cope with a rapidly changing world. Although professional instruction is not the primary ingredient of undergraduate education, the university's role in preparing students for their future life work cannot be ignored. While maintaining complete institutional integrity, Rice University supports the intention as well as the letter of regulations promulgated by the state governing the development and presentation of teacher preparation and certification programs.

To this end the Rice University Department of Education closely cooperates with departments offering work in subject-matter fields. It is the function of this department to provide rigorous professional courses and to administer the established teacher education programs.

The Rice University teacher education program strives to fit the prospective teacher to perform all the roles which may be expected of a teacher. To accomplish this objective, it gives sustained close attention to the following vitally interrelated components:

1. A sound liberal or general education
2. An extended knowledge of the subject(s) or area(s) to be taught
3. Professional knowledge, as distinguished from professional skills (i.e., relevant historical, philosophical, social, and psychological material)
4. Skills in managing a classroom, in working with children and adults, and in the supervision of the learning process.

Admission to the Undergraduate Teacher Education Program. Students who have satisfied the following requirements may apply to the Education Council for admission to the teacher education program:

1. Junior standing at Rice University
2. Satisfactory completion of History 105, 106 or 211, 212
3. A grade average of 3 or better in at least 75 percent of all semester hours attempted in the teaching field offered for approval
4. Passing grades in freshman and sophomore English courses
5. Evidence of satisfactory speech patterns
6. Evidence of adequate physical vigor and strength and absence of obvious physical conditions which might interfere materially with performance in a classroom as a teacher
7. Approval of a completed Teacher Certification Program form by the appropriate departmental representatives and the Education Council prior to registration for the junior year

8. Approval of the completed form "Application for Admission to the Teacher Education Program" by the Education Council prior to registration for the junior year

Texas State Requirements For Secondary Provisional Certificate (Grades 7-12):

A Provisional Teacher's Certificate is based upon a bachelor's degree, satisfactory completion of an approved teacher-preparatory program, and the recommendation of the university. Rice University is approved to offer the following teacher-preparatory programs: biology, chemistry, earth science, economics, English, French, German, health, history, Latin, mathematics, physical education, physics, political science, psychology, Russian, general science, social studies, sociology, and Spanish.

The approved program shall consist of the following:

1. *Foundations in Arts and Sciences:* Approximately two years including:
 - A. English, twelve semester hours
 American history, six semester hours
 Government, six semester hours
 From two of the following, twelve semester hours
 Science
 Mathematics
 Foreign language
 - B. Other institutional degree requirements
2. *Academic Specialization:*
 - Plan I. Preparation to teach two fields:
 Twenty-four semester hours in each area including twelve semester hours of advanced work in each, with approval of the Rice Education Council
 - Plan II. Preparation to teach related fields:
 Forty-eight semester hours in a composite field (such as general science or social studies) with at least eighteen semester hours of advanced work and with approval of the Rice Education Council
3. *Professional Education:* eighteen semester hours, of which six semester hours shall be in student teaching
4. *Elective courses*
 Requirements for completion of the Teacher Education Program; to be recommended to the Texas Education Agency for certification, a student must satisfy all institutional requirements for a bachelor's degree which will include:
 - A. Completion of History 105, 106 or 211, 212 and Political Science 209, 210 before the junior year
 - B. Twenty-four semester hours of credit in each of two teaching fields or forty-eight semester hours of credit in a composite field
 - C. Completion of the required professional education courses
 - D. Satisfaction of the supervised student teaching requirement (Education 419) as outlined below

Supervised Teaching Experience. Either of two distinct plans may be followed by teacher education candidates. The main difference is the type of supervised teaching experience provided.

1. *The Apprenticeship Plan (Plan A):*

Prerequisite: Education 311, 312

Apprenticeship is designed for students who wish to complete preparation for their teaching careers in four years and two six-week summer sessions. Candidates will enroll for the summer session following their junior year. The apprentice will observe teaching, act as a helping teacher, and perhaps teach as may be appropriate in the Rice Summer School for High School Students.

Education 410 is to be completed during the senior year.

Following graduation from Rice the apprentice will attend the summer session for full-time teaching in the Rice Summer School for High School Students under the supervision and guidance of a Master Teacher and the university staff. While the apprentice spends somewhat less time in student teaching than under the internship plan, he or she is not remunerated for the teaching service. The apprentice is to be recommended for Texas Provisional Teacher's Certificate following successful completion of the second summer session.

2. *The Internship Plan (Plan B):*

Prerequisite: twelve semester hours in education courses

Under this plan students are expected to attend a six-week summer session immediately following their graduation from Rice. Each intern will observe and teach classes under the supervision of a Master Teacher and a university staff member in the Rice Summer School for High School Students. During the following fall semester interns will be assigned to classrooms in a neighboring school system and may select one of two plans dependent upon the availability of a suitable position.

A. Employed on a full-time basis, the intern will teach three classes, be assigned occasionally as a substitute teacher, and perform other school-related tasks as stipulated. The intern will be supervised by a teacher at his assigned school and a staff member from the university. During the half year of their service, interns will be paid a salary commensurate with the salary being paid to substitute teachers by cooperating school systems for their employment as classroom teachers. Upon the successful conclusion of the internship semester and upon the recommendation of the appropriate secondary school principal, the intern will be given preference for a regular teaching position in the spring semester should there be a suitable vacancy and will be recommended for a Texas Provisional Teacher's Certificate. However, there is no guarantee that the intern will be offered a regular teaching position the semester following internship.

B. The intern will be employed for full-time duty and will teach five periods per day under the supervision and guidance of a staff member of the cooperating school system and a staff member from the university. During the half year of service the intern will be paid for employment as a classroom teacher a salary commensurate with the salary being paid a full-time teacher with a degree and an emergency teaching permit by cooperating school systems. Upon successful completion of the internship semester and upon the recommendation of the appropriate secondary school principal, the intern will be offered a regular teaching contract for the spring semester if a suitable vacancy exists and will be recommended for a Texas Provisional Teacher's Certificate.

The Master of Arts in Teaching. The professional education degree is based on one academic year and two summers of satisfactory graduate work

consisting of the program prescribed below:

1. Introductory courses in education (during the first summer session) developed in conjunction with observation and actual teaching in the Rice Summer School for High School Students under the guidance of master teachers and university faculty
2. Courses in secondary school educational theory, teaching strategies, educational objectives, and evaluation
3. Graduate and upper division courses in the candidate's two subject-matter teaching fields and/or related fields, equivalent to a full semester of graduate study
4. Supervised teaching internship for one semester in a cooperating public school system
5. Practicum (second summer session). Supervised full-time teaching in the Rice Summer School for High School Students. Candidates will be responsible for the design and implementation of courses, for teaching, and for evaluation

Normally, the degree program will consist of ten semester courses. However, some candidates may need to remove deficiencies in their teaching or related fields or in state-mandated fields, and may therefore require additional time. Candidates will begin their program in the summer preceding their academic year of residence.

Students in the program will not normally be eligible for Rice Graduate Fellowships or scholarship support since the cooperating school districts will pay a salary for internship teaching.

Please refer to page 94 for additional information regarding admission to the graduate program in education.

Education Courses

304b. Seminar in Teaching (junior-level apprentice teachers only) (1-0-1).

A study of procedures and materials used in teaching various subject areas. Preparation of resource units, orientation to secondary school teaching. *Staff*

311a. The Historical and Philosophical Foundation of Education (3-0-3).

Analysis of contemporary and recent theories useful in planning educative activities of the secondary school. Prerequisite: History 211, 212 or History 105, 106, or consent of instructor, and filing of Teacher Certification Plan. *Mr. Duke, Mr. Wood*

312b. Human Development: The Psychology of Human Learning (3-0-3).

Introduction to theoretical systems of human learning with emphasis on implications for secondary education, introductory tests and measurements. *Mr. Wood, Mr. Duke*

400b. Seminar in Teaching (apprentice English teachers only) (2-0-2).

Same as Education 304.

Mr. Wood

402b. Seminar in Teaching (apprentice social studies teachers only) (2-0-2).

Same as Education 304.

Mr. Baum

404b. Seminar in Teaching (apprentice math and science teachers only) (2-0-2).

Same as Education 304.

Mr. Duke

406b. Seminar in Teaching (apprentice health and physical education teachers only) (2-0-2).

Same as Education 304.

Mr. Duke

408b. Seminar in Teaching (apprentice foreign language teachers only) (2-0-2).

Same as Education 304.

Mr. Wood

409a. Fundamentals of Secondary Education (3-0-3).

Background, purposes and organization of modern secondary education curriculum and current trends in administration of secondary schools. Introductory educational research.

Mr. Baum, Mr. Wood

410b. Seminar in Teaching (English teachers only) (3-0-3).

Same as Education 304.

Mr. Wood

412b. Seminar in Teaching (social studies teachers only) (3-0-3).

Same as Education 304.

Mr. Baum

414b. Seminar in Teaching (math and science teachers only) (3-0-3).

Same as Education 304.

Mr. Duke

415a. Seminar in Teaching: Media Techniques (3-0-3).

Students will explore the existing film literature, explore the creative and orderly processes of film making, produce two films, and complete an advanced individual project.

Staff

416b. Seminar in Teaching (health and physical education teachers only) (3-0-3).

Same as Education 304.

Mr. Baum

418b. Seminar in Teaching (foreign language teachers only) (3-0-3).

Same as Education 304.

Mr. Wood

419a,b; 420c. Principles of Teaching (3-0-3 each semester).

Introduction to teaching in the secondary school and supervised teaching.

Staff

422b. Seminar in Innovative Teaching (3-0-3).

Educational trends such as modified scheduling, personalized instruction, open concept, and interdisciplinary learning. Newspaper-centered materials utilizing the best innovative practices now influencing secondary education.

Mr. Baum

800b. Degree Candidate Only.

Staff

Engineering and Applied Science

The George R. Brown School of Engineering

Rice's engineering programs have been prominent since the early days of the university. The five departments, each of which is strong in teaching and research, now comprise the George R. Brown School of Engineering. The school was dedicated in 1975 at ceremonies honoring the distinguished Rice alumnus, trustee, and benefactor who was a founding partner in Brown & Root, Inc. Professor Alan J. Chapman, professor of mechanical engineering and a member of the faculty since 1949, is dean of the school.

General Undergraduate Information. Curricula in engineering at Rice University lead to either Bachelor of Arts or Bachelor of Science degrees in the fields of chemical engineering, civil engineering, electrical engineering, mechanical engineering, and materials science. These curricula are also part of integrated five-year programs that lead to professional master's degrees in each of the above fields and in environmental science and engineering.

A student taking the B.A. program in engineering is required to pass a total of at least 120 semester hours (forty courses) in order to graduate. The major department may require no more than 80 specific semester hours for the major and may require fewer. Students must complete at least 60 semester hours in addition to the departmental major requirements. Some departments require more than 120 semester hours for graduation.

A student following a B.S. program in engineering (other than chemical engineering) must pass a total of at least 134 semester hours in order to

graduate (137 semester hours for chemical engineering). Except for chemical engineering, which may require up to 104 semester hours in specific course requirements, no department may require more than 92 semester hours in specific courses for the B.S. degree. Each student should get a list of required courses from the appropriate department. Freshmen and sophomores should have their programs approved each semester by an engineering adviser as well as by their college adviser. Before registering for the junior year students must associate themselves with an adviser in the department of their major. Registration for every semester thereafter must be approved by an adviser in their major department.

A program which satisfies the requirements of all engineering departments for the first year is given below. There is enough difference in the second-year requirements so that it is not possible for a student to keep entry into all engineering departments open during the second year. Proper orientation during the first year, however, should make such a plan unnecessary. All courses that are required in the second year by any of the engineering departments are also given below. Not all of the second-year courses shown are essential in the second year; some may be taken in the third or fourth year. There are also some courses that departments recommend but do not require in the second year. Thus it is most important for students to pick up lists of required and recommended courses from departments they are considering for a major. This should be done early enough to plan courses for the second year.

First year

Mathematics 101, 102 (or equivalent honors courses) (required by all engineering departments)
 Physics 101, 102, 132 (required by all engineering departments)
 Chemistry 101, 102, 107
 Electives (four semester courses)
 Basic Health and Physical Education
 ROTC, if elected

Second year

	<i>Required by</i>
Mathematics 211, 212 (or corresponding honors courses)	All departments
Engineering 200	Mechanical Engineering
Engineering 211	Civil Engineering, Mechanical Engineering, Materials Science
Engineering 240	Chemical Engineering, Materials Science, Mechanical Engineering
Engineering 241	Electrical Engineering, Mechanical Engineering, Materials Science
Chemical Engineering 301	Chemical Engineering
Chemistry 211, 212, 213, 214	Chemical Engineering
Civil Engineering 251	Civil Engineering
Civil Engineering 300	Civil Engineering
Civil Engineering 302	Civil Engineering
Civil Engineering 304	Civil Engineering
Electrical Engineering 220	Electrical Engineering
Materials Science 395, 397	Materials Science
Mathematical Sciences 223	Chemical Engineering (substitute for Engineering 240)

The undergraduate courses listed below are offered for the preparation of students majoring in all branches of engineering.

Engineering Courses

101. Introduction to Engineering Design (3-3-4).†

Provides an introduction to engineering design and an orientation to engineering at Rice. The laboratory is devoted to design competition and to visiting engineering firms.

142. Introduction to Engineering Materials (3-0-3).†

The nature of solid materials, their structural, mechanical, physical, electrical, magnetic, and chemical properties. Metallic engineering materials, semiconductors, and insulators are emphasized.

200b. Classical Thermodynamics (3-0-3).

A fundamental exposition of the laws of classical thermodynamics and deductions therefrom. Applications illustrated with particular attention to pure substances. Prerequisite: Physics 101, 102. *Mr. Chapman, Mr. Walker, Mr. Wierum*

201b. Engineering Drawing (2-3-3).

Engineering drawing as a means of communication. Orthographic projection, pictorial projection, dimensioning, lettering, sketching, and computer graphics. *Mr. Sims*

211a. Engineering Mechanics (3-0-3).

Equilibrium of static systems, dynamics of a particle, dynamics of particle systems, and rigid-body dynamics. Elements of vibrational analysis. Prerequisite: Physics 101, 102, Mathematics 101, 102 *Ms. Bayazitoglu, Mr. Picologlou, Mr. Merwin*

240a,b. Digital Computing for Engineering and Science (3-3-4).

Programming; algorithms and flow charts; languages. Fortran programming. Data structures and representation. Numeric and non-numeric computing techniques. Introduction to numerical analysis. Prerequisite: Mathematics 101, 102. *Mr. Holt*

241a,b. Electrical Circuits (3-4-4).

Models of electrical circuit elements. Formulation, solution, and interpretation of network equations. Application to electronic circuits, signal analysis, and general system theory. Prerequisite: Mathematics 101, 102. *Mr. Burrus, Ms. Kazakos*

401. Legal Topics for the Design Professional (3-0-3).†

Contracts, professional liability, intellectual property, business associations, administrative law, employee-employer relationships, governmental regulations, regulation of the design professional.

Chemical Engineering

The George R. Brown School of Engineering

Professor S. H. Davis, *Chairman*; Professors Akers, Armeniades, Deans, Dyson, Hellums, Hightower, Kobayashi, Leland, and McIntire
Adjunct Professors Elliot, G. D. Fisher, and Jackson
Visiting Professor J. M. Davidson

Degrees Offered: B.A., B.S., M.Ch.E., M.S., Ph.D.

Undergraduate Program. A general outline of the first two years of an undergraduate engineering program is given under Engineering and Applied Science. A list of courses specifically required by the department is available from the chemical engineering adviser in each college or from the departmental office, 246 Abercrombie Lab.

The undergraduate curriculum in chemical engineering is designed to provide a sound scientific and technical basis for further professional development. Concurrently, the student has the opportunity of concentration in

a particular technical specialty such as applied mathematics, biomedical engineering, nuclear technology, environmental quality, kinetics and catalysis, engineering economics, or polymer science and engineering.

In the four-year curriculum a student may qualify for either the Bachelor of Arts degree or the Bachelor of Science degree. The Bachelor of Arts program is highly flexible and allows a student to pursue other areas of interest with or without a double major. The Bachelor of Science program has a higher content of scientific and professional courses. On completion of either bachelor's program a student is eligible to apply for a fifth year of specialized study leading to the degree of Master of Chemical Engineering. The curriculum is designed so that outstanding students interested in careers in research and teaching may enter graduate school after either of the bachelor's degrees.

The Chemical Engineering Department requires 77 semester hours in the major for the B.A. degree, prerequisites and laboratory courses included. In addition to these requirements, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements for a total of at least 137 semester hours. For the B.S. major, the department may require up to 104 semester hours, according to the requirements for certification, prerequisites and laboratory courses included. Students seeking the B.S. must also satisfy the distribution requirements and complete no fewer than 33 semester hours outside the departmental requirements for a total of at least 137 semester hours.

Graduate Program. Graduate study in chemical engineering can lead either to the Master of Science or the Doctor of Philosophy. University requirements for these degrees are outlined on pages 91 and 92.

Candidates for the Master of Science degree are required to complete a minimum of twenty-four approved semester hours with high standing. They must also submit and defend the thesis in an oral examination indicating research ability.

Candidates for the Doctor of Philosophy degree must demonstrate competence in one foreign language and in the areas of applied mathematics, thermodynamics, transport processes, and chemical kinetics and reactor design, by passing qualifying examinations, normally during the first year of study. They must also complete a minimum of thirty-six approved semester hours with high standing and submit a thesis which provides evidence of their ability to carry out original research in a specialized area of chemical engineering. The thesis must be defended in a public oral examination.

Chemical Engineering Courses

301b. Chemical Engineering Fundamentals (3-0-3).

The use of basic mathematical concepts, physical laws, stoichiometry, and the thermodynamic properties of matter to obtain material and energy balance for steady and unsteady state systems. Required for sophomores intending to major in chemical engineering.

Mr. Deans, Mr. McIntire

302a. Separation Processes (3-0-3).

A systematic treatment of single and multistage contacting operations involving binary and multicomponent systems. Prerequisite: Chemical Engineering 301.

Mr. Akers, Mr. Kobayashi

344b. Chemical Engineering Laboratory (1-3-2).

Experiments demonstrating the principles presented in Chemical Engineering 301, 302.

Staff

401a, 402b. Introduction to Transport Phenomena (3-0-3 each semester).

The fundamental principles of heat, mass, and momentum transport applied to the continuum; analysis of macroscopic physical systems based on the continuum equations. Prerequisite: Chemical Engineering 302 or permission of instructor. *Mr. Hellums*

403a. Equipment Design I (3-3-4).

Applications of the basic principles of fluid mechanics and thermodynamics to the design and performance of process equipment. A supervised computation laboratory included. *Mr. McIntire, Mr. Dyson*

404b. Equipment Design II (3-3-4).

Continuation of 403 including optimal design of chemical reactors and transfer equipment, and an introduction to process control. Prerequisite: Chemical Engineering 490 or permission of instructor. *Mr. Armeniades, Mr. Dyson*

411a. Fundamentals of Thermodynamics (3-0-3).

Development and application of the first and second laws of thermodynamics. *Mr. Davidson*

427a. Fundamentals of Air Pollution (3-0-3).

Human health effects; sources of air pollution. Properties and processes of the atmospheric medium: stability, turbulence, mixing, transport of pollutants, radiation, photochemistry, aerosol physics, and precipitation. Also offered as Environmental Science and Engineering 405 and Mechanical Engineering 479.

443a, 444b. Chemical Engineering Laboratory (1-3-2 each semester).

Experiments demonstrating transport coefficient measurement, forced and free convection transfer operations, and thermodynamic principles as covered in Chemical Engineering 401, 402, 411. *Staff*

490b. Chemical Reaction Kinetics (3-0-3).

Rates of chemical reactions; the kinetics of complex reaction systems; interactions between chemical rates and transport phenomena; theory of chemical reactors. *Mr. Hightower*

501a. Fluid Mechanics and Transport Processes (3-0-3).

Advanced study in fluid mechanics and transport processes including analytical and numerical approximation methods, boundary layer theory, and hydrodynamic stability. *Mr. Hellums*

503a. Simulation and Design of Chemical Engineering Process I (2-3-3).

A synthesis course applying the principles of staged processes, transport phenomena, kinetics, and economics to the simulation, design, and operation of equipment and processes. *Mr. Deans*

504b. Simulation and Design of Chemical Engineering Processes II (2-3-3).

Continuation of 503, with emphasis on the use of available process design computer programs. *Mr. Kobayashi*

512b. Thermodynamics II (3-0-3).

An advanced treatment of chemical and physical equilibrium in multicomponent systems. A detailed study of non-ideal solutions. *Mr. Leland*

522b. Design with Flowtran (3-3-4).

Description of the Monsanto Flowtran Simulation Program. Use of the simulator to design processes. Prerequisite: Chemical Engineering 403, working knowledge of Fortran Programming. Enrollment limited. *Mr. Dyson*

528b. Air Pollution and Its Abatement (3-0-3).

Atmospheric physics and chemistry of gaseous and particulate pollutants; relationship between emissions and air quality; engineering, economics, and politics of abatement. Also offered as Environmental Science and Engineering 528. *Mr. Deans*

532. Nuclear Engineering Design (3-0-3).†**551a/b. Advanced Separation Processes (3-0-3).**

Multistage calculations for multicomponent systems; digital computer solutions of separation problems; development of mathematical models for real stages. *Mr. Dyson*

571a. Fundamentals of Reservoir Engineering (3-0-3).

Basic reservoir engineering principles — single and two phase flow in porous media. *Mr. Deans*

591a. Kinetics, Catalysis and Reactor Design (3-0-3).

Description of an interpretation of chemical kinetics in heterogeneous reactions; theories of catalysis, diffusion in porous solids, reactor design, and optimization. *Mr. Hightower*

593a. Polymer Science and Engineering (3-0-3).

Basic concepts in macromolecular chemistry and their application in the synthesis and chemical modification of polymers. Prerequisite: Chemistry 211, 212. *Mr. Armeniades*

594b. Structure and Properties of Polymers (3-0-3).

Molecular organization and physical properties of polymeric materials; elastomeric, semi-crystalline, and glassy polymers; processing and technology of polymeric systems. Also offered as Materials Science 594. *Mr. Armeniades*

601a/b. Advanced Topics in Fluid Mechanics and Transport (3-0-3).

Advanced study in several areas of fluid mechanics or transport including tensor analysis continuum mechanics, rheology, and mathematical methods of special interest in fluid mechanics. *Mr. McIntire*

602b. Physico-Chemical Hydrodynamics (3-0-3).

Topics in hydrodynamics including waves on liquid surfaces, diffusion in liquids, motion of drops and bubbles, and electrophoresis. *Mr. McIntire*

611a. Advanced Topics in Thermodynamics (3-0-3).

Methods of predicting the thermodynamic and transport properties of gaseous and liquid mixtures. Special emphasis on fluids encountered in natural gas processing and petroleum refining. *Mr. Leland*

631a, 632b. Nuclear Engineering I, II (3-0-3 each semester).

Introductory course in nuclear properties, nuclear reactions, radioactive decay, neutron diffusion, and fission. Theory design of nuclear reactors using the Fermi Age treatment and introductory reactor kinetics. *Mr. Leland*

660. Heterogeneous Equilibrium and the Phase Rule (3-0-3).†**661a, 662b. Graduate Seminar (1-0-1 each semester).***Staff***671a. Reservoir Engineering (3-0-3).**

The applied mathematics and physics of flow in porous media.

*Staff***672. Special Topics in Applied Mathematics (3-0-3).†***Mr. McIntire***675a/b. Process Dynamics (3-0-3).**

Dynamic equations for discrete and continuous models of chemical systems. Linearization applied to control problems in chemical processes. Simulation techniques using digital computers. Stability and phase plane analysis. *Mr. Davis*

683a, 684b. M.S. Research and Thesis.**685. Molecular Theory of Fluids (3-0-3).†****692b. Advanced Topics in Chemical Reaction Engineering (3-0-3).***Mr. Deans***700c. Summer Research.****720a/b. Advanced Topics in Chemical Engineering (3-0-3).****730a/b. Advanced Topics in Biomedical Engineering (3-0-3).**

Biomechanics and biomaterials: structure and function of extracellular supportive tissue in skeletal and cardiovascular systems; design, development, and evaluation of synthetic polymers for structural tissue replacement. *Mr. Armeniades*

783a, 784b. Doctoral Research and Thesis.**800b. Degree Candidate Only.**

Civil Engineering

The George R. Brown School of Engineering

Professor Austin, *Chairman*; Professors Krahl, Merwin,
Sims, and Veletsos
Associate Professors Holt and Lutes
Lecturer Ghazzaly

Degrees Offered: B.A., B.S., M.C.E., M.S., Ph.D.

Preceptors

George E. Brandow	William J. LeMessurier
Brandow and Johnston Associates	LeMessurier Associates/SCI
Los Angeles, California	Cambridge, Massachusetts
Fazlur R. Khan	E. O. Pfrang
Skidmore, Owings, and Merrill	National Bureau of Standards
Chicago, Illinois	Washington, D.C.
	W. B. Pieper
	Brown and Root, Inc.
	Houston, Texas

The profession of civil engineering is concerned with the development, planning, design, construction, and operation of large facilities and systems. These include buildings, bridges, and other structures of various forms; transportation systems, water supply systems, and systems for waste disposal and pollution control. The planning of new communities and the redevelopment of existing cities are also within the spectrum of civil engineering activities.

Undergraduate Program. The curriculum is designed to provide a sound basis for future professional growth. Two programs are offered, a basic program which has considerable strength in structural engineering and an environmental option given in collaboration with the Environmental Science and Engineering Department. Each is a broad program that includes fundamental courses in mathematics and the engineering sciences and specialized courses in structural engineering and mechanics, geotechnical engineering, transportation engineering, and environmental engineering. Many advanced courses in structural engineering and mechanics and in environmental engineering may be taken as free electives by students interested in more specialization.

The accredited professional degree in civil engineering is the Bachelor of Science in Civil Engineering. A Bachelor of Arts degree with a civil engineering major is also available. The B.A. program has less technical content than the B.S.C.E. program and hence more flexibility with electives.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours for the B.A. and 42 semester hours for the B.S. outside the departmental requirements for a total program of at least 129 semester hours for the B.A. and 134 for the B.S. See Degree Requirements and Majors, pages 50 and 51. Detailed course requirements for each degree may be obtained from the departmental office. The program of each student is formulated in

consultation with an adviser.

The Bachelor of Science in Civil Engineering is a suitable terminal degree for students interested in a professional career, but a master's degree is highly desirable. The Doctor of Philosophy degree is generally required for a career in teaching or in research and development. A student may apply for admission to the graduate program in civil engineering after receiving either bachelor's degree.

Preceptorship Program. A limited number of preceptorships are available on a competitive basis for civil engineering majors. After completing the requirements for a Bachelor of Science in Civil Engineering, a student works for one year in the office of, and under the personal guidance of, a civil engineer who has achieved national or international prominence in the profession. The student is enrolled at Rice during the preceptorship year and then returns to Rice for a year of graduate study. The program is designed to provide the student with an opportunity to experience the professional practice of engineering at its highest contemporary level.

Graduate Program. Programs of study in structural engineering and structural mechanics can lead to the degrees of Master of Civil Engineering, Master of Science, and Doctor of Philosophy. Special attention is given to developing the student's interest in and ability for independent study and research in the M.S. and Ph.D. degree programs.

The requirements for a professional Master of Civil Engineering degree are described on pages 94-95. University requirements for other advanced degrees are described on pages 91-92. Departmental requirements for the M.S. and Ph.D. degrees are as follows: A candidate for the Master of Science degree is required to (1) complete at least twenty-one semester hours of approved semester courses; (2) complete an acceptable thesis; and (3) pass a final oral examination on the thesis. Candidates for the degree of Doctor of Philosophy must satisfy the following requirements: (1) complete at least forty-eight semester hours of approved courses with high standing; (2) pass a comprehensive preliminary examination and a qualifying examination designed to test the candidate's knowledge of the field and ability to think in a creative manner; (3) complete a thesis which shall constitute an original contribution to knowledge; (4) pass a final oral examination on the thesis and related topics; and (5) demonstrate a reading knowledge of one foreign language, usually French, German, or Russian.

The research interests of the members of the civil engineering faculty lie in the areas of structural and foundation dynamics, including earthquake engineering, applications of probability theory to civil engineering problems, particularly random vibrations, behavior of concrete components and structural systems, structural instability, plasticity, optimization of structural design, experimental studies of fatigue in steel structural assemblies, and the design of innovative structural systems.

Civil Engineering Courses

251a. Plane Surveying (2-3-3). experimental techniques; behavior of structural elements.

Mr. Merwin

300b. Introduction to Mechanics of Solids (3-0-3).

Stresses and deformation due to various loads. Study of engineering properties of materials and failure theories. Prerequisite: Engineering 211 or equivalent.

Mr. Merwin

302b. Strength of Materials Laboratory (0-3-1).

Standard tension, compression, and torsion tests of ferrous and nonferrous metals; experimental techniques; behavior of structural elements.

Mr. Merwin

304b. Elementary Structural Analysis (2-0-2).

Analysis of statically determinate structures. Stability and determinacy. Influence lines. Approximate analysis of indeterminate structures. Prerequisite: Engineering 211 and concurrent registration in Civil Engineering 300. *Mr. Holt*

307a. Structural Analysis and Design I (4-0-4).

Stress analysis of statically determinate structures. Design of steel members, connections, and assemblies. Behavior of steel as related to design. Prerequisite: Civil Engineering 300. *Mr. Holt*

308b. Structural Analysis and Design II (4-0-4).

Deflections of statically determinate structures. Analysis of statically indeterminate structures. Prerequisite: Civil Engineering 307. *Mr. Austin*

363a. Applied Fluid Mechanics (3-3-4).

Fluid properties, hydrostatics, and fluid flow equations. Fluid forces, continuity, energy, and momentum principles and applications. Fluid resistance, boundary layer theory, pipe network analysis and drag forces. Also offered as Environmental Science and Engineering 311. *Mr. Bedient*

403a. Structural Analysis and Design III (3-3-4).

Behavior and design of reinforced concrete members and structural assemblies. Introduction to prestressed concrete. Laboratory tests of materials and reinforced concrete members. Prerequisite: Civil Engineering 307. *Mr. Austin*

413b. Design of Structural Systems I (3-0-3).

Structural systems for wood buildings, high-rise buildings, concrete thin-shell roofs, space trusses; also intermediate-span bridges, long-span suspension bridges. For graduate credit a student should register for Civil Engineering 517. Prerequisite or corequisite: Civil Engineering 403. Meets with Architecture 413. *Mr. Krahl*

414. Design of Structural Systems II (3-0-3).†

Structural systems for low-rise buildings, industrialized building systems, cable-supported roofs, inflatables; also short-span bridges, long-span truss bridges. For graduate credit a student should register for Civil Engineering 518. Prerequisite: Civil Engineering 403. Meets with Architecture 414.

451b. Introduction to Transportation (3-0-3).

Operational characteristics of transport modes, elements of transportation planning, and design of stationary elements. *Mr. Lutes*

464b. Hydrology and Watershed Analysis (3-3-4).

Atmospheric processes, precipitation, evaporation, infiltration, ground-water flow and surface runoff. Stream-flow hydrograph techniques; flood routing in open channels and river systems. Hydrologic analysis of a local watershed. Also listed as Environmental Science and Engineering 412. *Mr. Bedient*

470a. Basic Soil Mechanics (3-3-4).

Soil exploration, soil properties and behavior, soil classifications, hydraulics of soil moisture, consolidation and settlement, strength characteristics, soil stabilization, lateral earth pressure, slope stability. *Mr. Sims*

491b. Civil Engineering Professional Practice (3-0-3).

A course to acquaint the students with the professional aspects of engineering work: project financing, elements of contracts and specifications, manuals of professional practice.

495. Design of Civil Engineering Systems (3-0-3).†

The material covered in previous civil engineering courses is integrated along with economic and financial considerations into the synthesis of civil engineering systems.

499a/b. Special Problems (Credit variable).

Study of selected topics including individual investigations, special lectures, and seminars. *Staff*

500a. Advanced Mechanics of Solids (3-0-3).

Advanced topics in stress analysis, curved beams; beams on elastic supports; plates; torsion of noncircular sections; columns; buckling; plate analysis. *Mr. Merwin*

501a, 502b. Preceptorship Program

Student completes nine to fifteen months of full-time internship in a selected professional office under the guidance of an appointed preceptor. *Staff*

503b. Structural Analysis by Matrix Methods (3-0-3).

Flexibility and stiffness of structural elements. Compatibility and equilibrium. Force and displacement methods of analysis. Finite element methods. Nonlinear structures. Prerequisite: Civil Engineering 308 or equivalent. *Mr. Holt*

506. Experimental Stress Analysis (1-6-3).†

Strain measurement methods; mechanical and electrical resistance strain gauges; photo-elastic methods; analogies; instrumentation; analysis of experimental data.

507a. Numerical Methods of Structural Analysis (3-0-3).

Numerical analysis of beams, beam-columns, and beams on elastic foundations; influence lines; buckling loads; natural frequencies. Integration of initial value problems; dynamic analysis. *Mr. Austin*

508. Engineering Analysis (3-0-3).†

Methods of formulating equations for discrete (lumped parameter) and continuous systems. Energy methods, finite difference, discrete element, and series methods for continuous boundary value problems. Eigenvalue problems. Applications in structural mechanics.

511a. Optimality in Design (3-0-3).

Application of optimization techniques, probability theory, and economic analysis to design and operation of civil engineering systems. Topics include problem formulation, linear and nonlinear optimization, and scheduling problems. *Mr. Lutes*

512. Applications of Probability Theory (3-0-3).†

Probability, statistics, and decision theory applied to problems of design and operation of civil engineering systems. Prerequisite: Mathematical Sciences 381.

514a. Theoretical Plasticity (3-0-3).

Formulation of basic laws of isotropic and anisotropic plastic flow; yield and loading surfaces, normality and convexity requirement, and hardening rules; plane plastic flow problems and slip-line field theory; introduction to limit analysis theorems. Also offered as Mechanical Engineering 514. *Mr. Cheatham*

515b. Applied Plasticity (3-0-3).

Problems in limit analysis and design, plastic behavior of structures; flexure and torsion of prismatic members, axially-symmetric problems. Also offered as Mechanical Engineering 515. *Mr. Merwin*

516a. Plates (3-0-3).

Introduction to theories of plates with applications to practical problems. *Mr. Veletsos*

517b. Design of Structural Systems I (3-0-3).

Structural systems for wood buildings, high-rise buildings, concrete thin-shell roofs, space trusses; also intermediate-span bridges, long-span suspension bridges. Prerequisite: Civil Engineering 403. Meets with Architecture 611. *Mr. Krahl*

518. Design of Structural Systems II (3-0-3).†

Structural systems for low-rise buildings, industrialized building systems, cable-supported roofs, inflatables; also short-span bridges; long-span truss bridges. Prerequisite: Civil Engineering 403. Meets with Architecture 612. *Mr. Krahl*

519. Shells (3-0-3).†

Introduction to theories of shells with applications to practical problems. *Mr. Veletsos*

521a. Structural Dynamics I (3-0-3).

Dynamics of force-excited linear structures having from one to an infinite number of degrees of freedom, with application to design. *Mr. Veletsos*

522. Structural Dynamics II (3-0-3).†

Dynamics of ground-excited elastic and inelastic structures. Introduction to earthquake engineering, problems of foundation vibration, and dynamics of foundation-structure systems.

523b. Random Vibration (3-0-3).

Dynamic response of structural systems to excitations characterized as stochastic processes. Prerequisite: Civil Engineering 521. *Mr. Lutes*

524. Stress Waves in Solids (3-0-3).†

Theory of wave propagation with applications to structural engineering.

526b. Structural Stability (3-0-3).

Stability criteria. Flexural and torsional buckling of columns and frames, lateral buckling of beams, plate buckling. Effect of imperfections on strength. Beam-columns. Evaluation of design code provisions. *Mr. Austin*

531. Behavior of Reinforced Concrete Members (3-0-3).†

Strength and behavior of reinforced concrete members under various loadings from first application of load to ultimate load.

532b. Prestressed Concrete (3-0-3).

Methods of prestressing. Behavior and design of prestressed concrete members subjected to axial force, flexure, shear, and torsion. *Mr. Krahl*

570b. Foundation Engineering (3-0-3).

Geotechnical engineering applications to the analysis, design, and construction of shallow and deep foundations and earth retaining structures. *Mr. Ghazzaly*

699a,b. Special Problems (Credit variable).

Study of selected topics including individual investigations under the direction of a member of the civil engineering faculty. *Staff*

700c. Summer Graduate Research.**701a, 702b. Research and Thesis.****800b. Degree Candidate Only.**

Electrical Engineering

The George R. Brown School of Engineering

Professor Pearson, *Chairman*; Professors Bourne, Burrus, de Figueiredo, W. E. Gordon, Leeds, T. W. Parks, Pfeiffer, Rabson, Tittel, and Troelstra
Adjunct Professor Saltzberg

**Associate Professors J. W. Clark, Feustel, Glantz, Jump,
 Kim, and W. L. Wilson**

Adjunct Associate Professor P. M. Stevens

Assistant Professors Hirschberg, D. H. Johnson, and Kazakos

Adjunct Instructor Garcia

Adjunct Lecturer Calfee

Degrees Offered: B.A., B.S., M.E.E., M.S., Ph.D.

Undergraduate Degrees. The first two years of the engineering program are described on pages 150-151. Students contemplating a major in electrical engineering should take Mathematics 101, 102, 211, 212 (or the corresponding honors courses); Physics 101, 102, 132; Electrical Engineering 220; Engineering 241; and three courses plus one laboratory chosen from Chemistry 101, 102, 107 and Physics 211, 212, 231. Other courses of interest are Engineering 101, 142, 200, and 211. Engineering 200 and 211 satisfy the B.S. requirement for an engineering science course from another engineering department.

In addition to the departmental requirements for the major, students seeking the B.A. must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 130 semester hours. For the B.S., no fewer than 42 semester hours outside departmental requirements for a total of 134 semester hours are required. See Degree Requirements and Majors, pages 50 and 51.

The four-year program in electrical engineering leads to either the B.A. or the B.S. in Electrical Engineering. The B.S. program has more technical requirements and the degree is accredited by the Engineering Council on Professional Development, while the B.A. program allows more flexibility with electives. It is possible in either program to satisfy major requirements

of two departments, but only a single degree may be received. Students may take a double major combining electrical engineering with physics, mathematics, economics, languages, or other disciplines. With satisfactory achievement, students may qualify for a fifth year of study leading to the professional degree of Master of Electrical Engineering. This degree is also available, on a part-time or full-time basis, for students other than Rice undergraduates.

Suggested programs and upper level requirements for the Bachelor of Arts, Bachelor of Science, and Master of Electrical Engineering are available from the department. These programs are flexible and may be adjusted to suit individual interests and needs.

Qualified students may, upon recommendation of the department and approval of the Graduate Council, enter a program leading directly to the degree of Doctor of Philosophy after completing the bachelor's degree.

Graduate Degrees. Requirements of a general nature for advanced degrees are outlined on pages 91-92. Students should consult departmental advisers for specific courses of study.

A candidate for the Master of Science degree in the Electrical Engineering Department is required to complete an approved course of study. In addition, the candidate is required to complete an approved research program and submit an acceptable thesis. A semester or more of supervised teaching is required as a valuable part of graduate education.

The granting of the degree of Doctor of Philosophy presupposes academic work of high quality and demonstrated ability to do independent and creative research. To be admitted to candidacy, the student must obtain high standing in an approved course program and perform satisfactorily on qualifying examinations. Normally the candidate completes the requirements for a master's degree as part of the Ph.D. program. The candidate must participate in a program of supervised teaching. Emphasis is placed on research leading to a satisfactory dissertation. Each candidate takes a final oral examination. The doctoral candidate should expect to devote a minimum of three academic years of graduate study in this program.

Although a general program of study may be arranged and some attention is given to professional preparation in breadth, the program in electrical engineering may be described in terms of four major areas of concentration.

Bioengineering

Modern medicine and research in health-related sciences make increasing use of engineering methods and instrumentation. With proper selection of electives, the undergraduate program represents an excellent preparation for medical school.

Two main research areas have been developed, namely: (1) cardiopulmonary-renal systems and (2) neurophysiological systems. For a student interested in clinical applications, close cooperation with faculty at the Texas Medical Center in Houston is possible. At the graduate level, research will be generally in one of these two areas while courses are selected to ensure a sound engineering background and competence in several areas of the life sciences.

Circuits, Control, and Communication Systems

This specialization is composed of three sub-areas: (1) circuits and electronics, (2) dynamics and control, and (3) information processing and communications. These are closely related and generally involve the study of systems of devices to process and communicate signals and information, rather than the study of the devices themselves.

Computer Science and Engineering

This program is divided into the following three topics: (1) hardware engineering; (2) software engineering; and (3) discrete system modeling. Students selecting the computer science and engineering option must complete a broad program of courses from each of these areas.

Lasers, Microwaves, and Solid-State Electronics

This area of concentration permits undergraduate and graduate students to study and participate in several specialties, including laser fusion technology, optical communication systems, application and development of tunable laser devices, semiconductor devices capable of very high frequency oscillations and large gain bandwidth modulation, sensitive and fast millimeter and submillimeter detector devices that can be used in astronomy, bubble computer memories, and integrated optics and circuits.

In addition to the regular graduate programs, there are four interdisciplinary graduate programs designed particularly for those who received their previous degree(s) in mathematics, physics, chemistry, or other sciences, including undergraduate engineering science programs, but who have become interested in the engineering applications appropriate to a particular field of science. These programs are systems theory, solid-state electronics and materials science, computer science, and bioengineering.

Bioengineering*Electrical Engineering Courses***380a. Introduction to Medical Physiology and Biophysics I (3-0-3).**

An introductory course in physiology and biophysics stressing the analytical approach to the study of living systems. *Mr. Clark.*

381b. Introduction to Medical Physiology and Biophysics II (3-0-3).

A continuation of Electrical Engineering 380 covering primarily nervous system control of the internal environment of the body. Prerequisite: Electrical Engineering 380. *Mr. Clark*

482b. Bioengineering Instrumentation and Techniques (3-3-4).

A survey of components, instrumentation systems, and techniques related to bioengineering and selected clinical problems. Prerequisite: Electrical Engineering 380, 381, and 342.

Mr. Clark, Mr. Bourland

580b. Mathematical Modeling of Physiological Systems: Techniques and Applications (4-0-4).

An introduction to mathematical physiology that applies techniques in signal theory, control theory, and numerical analysis to a variety of physiological systems. Prerequisite: Electrical Engineering 380, 381, and 401. *Mr. Clark*

581. Cardiovascular Dynamics (3-0-3).†**587. Computers in Biomedicine (3-0-3).†**

Computer applications in processing clinical signals such as EEG and EKG; characteristics of computerized patient monitoring systems. Clinical engineering aspects and current research.

Circuits, Control, and Communication Systems*Electrical Engineering Courses***301b. Network and Systems Theory (3-0-3).**

Network topology and differential equations; analysis of networks and systems based on state variable and Laplace transform descriptions; frequency domain properties; introduction to filter design. Prerequisite: Engineering 241. *Mr. Johnson*

331a,b. Introduction to Applied Probability (3-0-3).

An introduction to the concepts, interpretations, elementary techniques, and applications of modern probability theory, including a brief introduction to statistical inference. Prerequisite: Mathematics 102 or 103. Also offered as Mathematical Sciences 381. *Mr. Lutes, Mr. Pfeiffer*

342a,b. Electronic Circuits (3-4-4).

Models of transistors, FET's and vacuum tubes. Biasing methods; two-port analysis, single and multistage amplifiers, frequency domain characteristics, feedback, stability, oscillators, power amplifiers. Prerequisite: Engineering 241. *Mr. Wilson, Mr. Leeds*

401a. Signals and Linear Systems (3-0-3).

A unified study of signals and linear systems. Continuous-time and discrete-time analysis. Fourier, Laplace, and Z transforms. Prerequisite: Electrical Engineering 301, 342, Mathematical Sciences 330. *Mr. de Figueiredo*

403a. Electromechanical Systems (3-0-3).

Magnetic circuits and transformers; energy and forces in electric and magnetic field systems; lumped parameter electromechanics; rotating machinery and transducers; dynamics and control of electromechanical systems. Prerequisite: Electrical Engineering 305. Offered alternate years. *Mr. Leeds*

404. Electrical Power Systems (3-0-3).†

Power transmission lines; representation of power systems, transient behavior of machines; faults on power systems; control of power systems. Prerequisite: Electrical Engineering 301. *Mr. Leeds*

430b. Introduction to Communication Theory and Systems (3-0-3).

Introduction to random processes. Baseband transmission. Analog and pulse code modulation. Communication systems design and operation concepts. Prerequisite: Electrical Engineering 331, 401. *Mr. Johnson*

436b. Control Systems I (3-0-3).

The representation, analysis, and design of simple control systems in the frequency domain. Nyquist, Bode diagrams, root locus. Prerequisite: Electrical Engineering 401. *Mr. Pearson*

442a. Advanced Electronic Circuits (3-0-3).

Electronic circuits used in communication and other systems including principles of feedback, modulation, detection, and active filtering. Emphasis on design using integrated circuits. Prerequisite: Electrical Engineering 342. *Mr. Leeds*

501. Advanced Linear Systems (3-0-3).†**502b. Network Synthesis (3-0-3).**

The theoretical and practical aspects of network synthesis and filter design: realizability, one-port synthesis, approximation methods, two-port synthesis and filter design, and active filter synthesis. Prerequisite: Electrical Engineering 401. Offered alternate years. *Mr. Burrus*

504. Introduction to Space Communications Systems (3-0-3).†**530a. Advanced Communication Theory (3-0-3).**

Review of stochastic processes, Gaussian and Poisson processes. Statistical detection theory and digital communication techniques. Channel models. Estimation theory; application to waveform communications. Optimal receivers in communications systems. Prerequisite: Electrical Engineering 430. *Mr. Johnson*

531a. Digital Filtering (3-0-3).

Digital filtering and signal processing. Sampling, quantization, and signal representation, Z transform methods, recursive and nonrecursive filters, frequency and time domain approaches, the Fast Fourier Transform. Prerequisite: Electrical Engineering 401. *Mr. Parks*

532b. Signal Theory (3-0-3).

Finite dimensional signal representation, choice of exponentials — Prony, Pade methods. Spectral estimation-maximum entropy, maximum likelihood. Speech coding, separation of overlapping signals. Interpolation and extrapolation. Prerequisite: Electrical Engineering 401, 531. *Mr. Parks*

533b. Stochastic Processes (3-0-3).

Mathematical foundations for advanced study of applied random processes. Topics such as separability and measurability; analytic properties of sample functions; linear transformation; independent increments; stochastic integrals. Prerequisite: Mathematical Science 482. Also offered as Mathematical Science 582. *Mr. Pfeiffer*

535a. Information Theory (3-0-3).

Introduction to information theory concepts. Measures of information. Noiseless coding. The discrete memoryless channel. Error bounds. Techniques of coding and decoding. Convolutional codes. Source encoding. Also offered as Mathematical Sciences 585. *Ms. Kazakos*

536a. Control Systems II (3-0-3).

Introduction to the theory of linear multivariable control systems. Realization theory, controllability, observability, stabilizability. Topics may include state estimation, compensation, decoupling, model matching, and tracking. Prerequisite: Electrical Engineering 436.

*Mr. Pearson***538b. Detection Theory and Pattern Recognition (3-0-3).**

Statistical detection theory with applications to radar. Principles of statistical pattern recognition. Clustering and syntactic approaches to pattern recognition applications. Prerequisite: Electrical Engineering 534. Also offered as Mathematical Sciences 583. *Ms. Kazakos*

694. Digital Communications (3-0-3).†**695a. Seminar on Communication Networks (3-0-3).**

Statistical and queuing approaches to the design and performance analysis of communication networks. *Ms. Kazakos*

696b. Seminar in Digital Filtering (3-0-3).*Mr. Burrus*

Computer Science and Engineering

Electrical Engineering Courses

220a,b. Introduction to Computer Science and Engineering (3-3-4).

A semi-self-paced introduction to programming in PL/1 for students in computer science and engineering. Also offered as Mathematical Sciences 220. *Mr. Feustel, Mr. Holt*

221a,b. Digital Computing for the Humanities and Social Sciences (3-3-4).

A semi-self-paced introduction to programming in APL and PL/1, with emphasis on problems from the humanities and social sciences. Also offered as Mathematical Sciences 221.

*Ms. Blattner, Mr. Feustel, Mr. Holt***222a,b. Introduction to Business Data Processing (3-3-4).**

A semi-self-paced introduction to programming in PL/1, with emphasis on business applications and problems. Also offered as Mathematical Sciences 222.

*Mr. Feustel, Mr. Holt, Mr. Kennedy***223a,b. Introduction to Computing (3-3-4).**

A semi-self-paced introduction to the computer solution of equations using APL and PL/1. Also offered as Mathematical Sciences 223.

*Mr. Davis, Mr. Feustel***316a. Introduction to Discrete Structures (3-0-3).**

Set theory, relations mappings; algebraic systems such as semigroups, groups, rings, and fields; graph theory, Boolean algebra, and propositional logic. Also offered as Mathematical Sciences 316. *Mr. Thrall*

320a,b. Computer Organization and Software (3-4-4).

Basic computer architecture. System software, including loaders, assemblers and operating systems. Advanced programming techniques. Micro-programming. Input-output. Also offered as Mathematical Sciences 320. Prerequisite: Electrical Engineering 220. *Staff*

321a,b. Advanced Programming (3-3-4).

Advanced programming methods, including structured programming, team programming, data structures, searching and sorting, data management and information retrieval. Also offered as Mathematical Sciences 321. Prerequisite: Electrical Engineering 220.

*Ms. Blattner, Staff***322a. Introduction to Management Information Systems (3-0-3).**

Basic concepts for development and implementation of computer-based management systems. Field assignments in local industry. Prerequisite: Electrical Engineering 222. Also offered as Mathematical Sciences 322. *Mr. Campise*

326a,b. Digital Logic Design (3-3-4).

Gates, flip-flops, combinational and sequential switching circuits, registers, data transfer circuits, logical and arithmetic operators. Prerequisite: Electrical Engineering 220.

Mr. Jump, Staff

416b. Automata and Formal Languages (3-0-3).

Finite automata, regular expressions, regular languages, pushdown automata, context-free languages, Turing machines, recursive languages, computability and solvability. Prerequisite: Electrical Engineering 316. Also offered as Mathematical Sciences 416. *Ms. Blattner*

420b. Algorithms and Data Structures (3-3-4).

The design and analysis of computer algorithms. Models of computation, data structures, and efficiency considerations. Prerequisite: Electrical Engineering 316, 321. Also offered as Mathematical Sciences 420.

Mr. Hirschberg

421a. Systems Programming (3-3-4).

Introduction to the design and construction of important software systems programs including assemblers, compilers, and operating systems. Prerequisite: Electrical Engineering 316, 320 and 321. Also offered as Mathematical Sciences 421.

Mr. Hirschberg

423. Systems Simulation (2-3-3).†**425b. Computer Systems (3-3-4).**

Memory utilization, storage management, addressing, control, and input-output. Comparison of solutions to computer system design problems. Prerequisite: Electrical Engineering 320 and 331.

Staff

426a. Digital System Design (3-3-4).

Digital system organization, microprogrammed control units, bus architectures, microprocessors, memory organizations, and high speed arithmetic. Prerequisite: Electrical Engineering 320 and 326.

Mr. Jump

427a. Pulse and Digital Circuits (3-3-4).

Oscillators, timing circuits, counters, bistable, monostable, and astable circuits. Diode gates and selection matrices. Trigger circuits and blocking oscillators. Emphasis on discrete component solid state technology. Prerequisite: Electrical Engineering 342.

Mr. Cyprus

516. Theory of Parallel Computation and Concurrent Systems (3-0-3).†**517. Topics in Automata Theory (3-0-3).†**

Topics may include algebraic structure of machines, Krohn-Rhodes decomposition, probabilistic automata, a-transducers, and tree automata. Prerequisite: Electrical Engineering 416 or consent of instructor. Also offered as Mathematical Sciences 517.

Ms. Blattner

518b. Analysis Techniques for Combinatorial Algorithms (3-0-3).

Introduction to concepts of problem complexity and analysis of algorithms to find bounds on complexity. Reducibility among combinatorial problems and approximation algorithms for "hard" problems. Prerequisite: Electrical Engineering 416 and 420. Also offered as Mathematical Sciences 518.

Mr. Hirschberg

520a. Operating Systems (3-3-4).

Operating systems as a resource manager; memory management including allocation, virtual memory, and sharing; scheduling; concurrent processes including process synchronization and communication, deadlocks; protection and file systems. Prerequisite: Electrical Engineering 331, 420, 421, 425. Also offered as Mathematical Sciences 520.

Mr. Feustel

521b. Artificial Intelligence (3-3-4).

Techniques for simulating intelligent behavior by machine: problem solving, game playing, pattern perception, theorem proving, semantic information processing, and automatic programming. Programming laboratory projects. Prerequisite: Electrical Engineering 420 and Mathematical Sciences 381. Also offered as Mathematical Sciences 521.

Ms. Blattner

523b. Compiler Construction (3-3-4).

Advanced topics in the design of programming language compilers, including parsing, run-time storage management, code generation and optimization, error recovery. Prerequisite: Electrical Engineering 416 and 421. Also offered as Mathematical Sciences 523.

Staff

524b. Operating System Components (1-6-3).

A projects laboratory in operating systems. Laboratory on a minicomputer system done in teams. Prerequisite: Electrical Engineering 420 and 421.

Mr. Feustel

527b. Advanced Digital Components (3-0-3).

Generation, distribution, and measurement of nanosecond pulses. Structure of high speed arithmetic units, especially pipe line form. Detailed analysis of particular high speed logic elements. Prerequisite: Electrical Engineering 427. *Mr. Cyprus*

528a. Digital System Projects (1-6-3).

Design projects involving the specification design, construction, and testing of micro-processor-based digital systems. Prerequisite: Electrical Engineering 425 and 426. *Mr. Jump*

623b. Syntactic and Semantic Elements of Programming Languages (3-3-4).

Syntactic and meta-syntactic definition of languages. Semantic models and interpreters for languages. Fundamental elements and structures of programming languages and their implementation. Also offered as Mathematical Sciences 623. Prerequisite: Electrical Engineering 523. *Mr. Feustel*

698a, 699b. Seminar on Computer Science (1-0-1 each semester). *Staff***Lasers, Microwaves, and Solid-State Electronics***Electrical Engineering Courses***305a,b. Electromagnetic Fields and Waves (3-3-4).**

Distributed systems. Transmission lines. Smith Charts and impedance matching. Static and oscillatory fields. Maxwell's equations. Interaction of waves with media antennas. *Mr. Tittel, Mr. Kim*

306b. Electromagnetic Field Theory (3-0-3).

Electrostatic fields and boundary value problems. Magnetic fields and interaction with materials. Time dependent electromagnetic fields. Plane waves, waveguides, and resonators. *Mr. Gordon*

308b. Acoustics (3-0-3).

Acoustic theory, atmospheric acoustics, room acoustics, attenuation, nonlinear effects, measurement techniques, transducers, and acoustical standards. Also offered as Mechanical Engineering 378. *Mr. Few*

362b. Quantum Electronic Devices (3-0-3).

Lasers, optoelectronics, integrated optics, and semiconductors. *Mr. Rabson*

459a. Introduction to Quantum Mechanics (3-4-4).

Schrodinger's equation; harmonic oscillators; band theory of solids; hydrogen molecule; spins and angular momentum; interaction of matter with radiation; spectroscopy; scattering processes and nonlinear susceptibility; quantum statistics; transport phenomena. *Mr. Kim*

461a. Electrical Properties of Materials (3-0-3).

Properties and parameters of magnetic, dielectric, conducting, and semi-conducting materials important in the understanding of device characteristic. Corequisite: Electrical Engineering 459. *Mr. Rabson*

462b. Semiconductor Devices (3-4-4).

Physical principles and operational characteristics of semiconductor devices. Prerequisite: Electrical Engineering 461. *Mr. Wilson*

505a. Advanced Electromagnetic Field Theory (3-0-3).

Boundary-value problems in electrostatics and magnetostatics. Propagation of electromagnetic waves in free space, in conducting media, and in anisotropic dielectrics. *Mr. Tittel*

506. Applications of Electromagnetic Field Theory (3-0-3).†

Wave guides and cavities, antennae, diffraction, holography, magnetohydrodynamics, and radiation from moving charges. *Mr. Tittel*

560. Ferromagnetic Theory and Devices (3-0-3).†**561. Electronic Conduction in Materials (3-0-3).†****562a. Microwave Engineering (3-4-4).**

Waveguides and resonant cavities. Scattering matrix, applications to 2-, 3-, and 4-port devices. Broadband transformers, couplers, and filters. Microwave generation. Tensor susceptibility and nonreciprocal devices. Prerequisite: Electrical Engineering 306. *Mr. Wilson*

563a. Introduction to the Solid State (3-0-3).

Fundamental concepts about crystalline solids and basic preparation for further courses in the sequence Electrical Engineering 564-567. Also offered as Chemistry, Materials Science, and Physics 563a. *Mr. Brotzen*

564b. Electron Transport and Superconductivity (3-0-3).

Various aspects of electron transport including semiconductor junction theory. Prerequisite: Electrical Engineering 563 or equivalent. Also listed as Materials Science and Physics 564. *Mr. Dodds*

565. Dielectric and Optical Properties of Solids (3-0-3).†

Static and dynamic models of dielectric media, dielectric dispersion, laser applications, nonlinear interactions between radiation and matter. Also offered as Chemistry, Materials Science, and Physics 565. *Mr. Estle*

566. Imperfections and Mechanical Properties of Crystalline Solids (3-0-3).†

The effect of lattice imperfections, such as point defects, dislocations, phonons, electrons, etc., upon the physical and mechanical properties of crystals. *Mr. Roberts*

567b. Magnetism and Magnetic Resonance (3-0-3).

Magnetic properties of solids: diamagnetism, paramagnetism, ferromagnetism, anti-ferromagnetism, and ferrimagnetism. Magnetic resonance: nuclear magnetic resonance, electron paramagnetic resonance, and ferromagnetic resonance. Prerequisite: Electrical Engineering 563 or equivalent. Also listed as Materials Science and Physics 567. *Mr. Estle*

568b. Quantum Electronics Engineering (3-0-3).

Quantum theory of optical lasers involving photon statistics and nonlinear spectroscopy. Generation of optical laser pulses. Light scattering experiments. Parametric interaction of radiation with the plasma medium. *Mr. Kim*

591a. Optics (3-0-3).

A one-semester survey covering important aspects of classical optical theory, wave properties of light, and the Fourier analysis approach to physical optics. Holography, integrated optics, and fiber optics. *Mr. Tittel*

592b. Topics in Quantum Optics (3-0-3).

Latest developments in lasers, optical pumping, Raman and Brillouin spectroscopy, and mode locking. *Mr. Rabson*

692. Advanced Topics in Microwave Engineering (1-0-1).†**697. Seminar on Magnetics (3-0-3).†**

Research and Projects

Electrical Engineering Courses

490a,b. Electrical Engineering Projects (Credit variable).

Theoretical and experimental investigations under staff direction.

590a,b. Electrical Engineering Projects (Credit variable).

Theoretical and experimental investigations under staff direction.

690a,b. Research and Thesis (Credit variable).**700c. Summer Graduate Research.****800b. Degree Candidate Only.**

Environmental Science and Engineering

The George R. Brown School of Engineering

Professor C. H. Ward, *Chairman*; Professors Akers, Characklis, and Leeds
Adjunct Professors Chambers and Stallones
Associate Professor Few
Adjunct Associate Professors Gesell, Pier, and Severs
Assistant Professors Bedient and Tomson

Degrees Offered: B.A., M.E.E., M.E.S., M.S., Ph.D.

The Undergraduate Program. The major in environmental science (offered only as a double major with other fields of science or engineering), is intended for students wishing academic training oriented toward the solution of technical environmental problems, and leads to the B.A. degree.

General requirements during the first two years include: two years of mathematics, two years of chemistry, and one year of physics. Specific courses to satisfy these requirements vary somewhat and should be determined in consultation with a departmental adviser. For the B.A. degree, a minimum of twelve semester hours of environmental science and engineering courses are required during the junior and senior years. The undergraduate B.A. double major curriculum has been designed with maximum flexibility and minimum specific requirements to encourage interdepartmental study with all other fields of science and engineering. A list of suggested electives in various fields of science, engineering, humanities, and social science is available for students desiring additional guidance or specialization.

The total number of semester hours required for the B.A. with a double major will depend on departmental requirements for the other major. Generally, however, in addition to the departmental requirements for the majors, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Undergraduates interested in environmental engineering should contact the Department of Civil Engineering for information on their B.S. degree program with an environmental option.

The introductory course, Environmental Science 201, is intended for both majors and nonmajors. Humanities majors are encouraged to consider this course for science distribution requirements.

Successful completion of the four-year curriculum leading to the Bachelor of Arts with environmental science as part of a double major qualifies the student for possible admission to a fifth year of specialized study leading to the degree of Master of Environmental Science. Completion of a four-year curriculum leading to the Bachelor of Science in any field of engineering (civil and chemical preferred) qualifies the student for possible admission to a fifth year of specialized study leading to the degree of Master of Environmental Engineering. These recognized professional degrees in the environmental field are differentiated on the basis of science or engineering orientation. Outstanding students wishing to pursue careers in teaching and research are qualified for graduate study after the B.A., B.S., M.E.S., or M.E.E. degrees.

The Graduate Program. The graduate program in environmental science and environmental engineering are interdepartmental activities and

lead to the Master of Science and Doctor of Philosophy degrees. Applicants for admission to the environmental science program may hold the baccalaureate or master's degree in any of the sciences or mathematics. Applicants for the environmental engineering program must hold accredited baccalaureate or master's degree in an area of engineering. Although the main research activities in the department are concerned with water and wastewater engineering, water resource management, and applied water chemistry, the program serves as the focal point for university-wide study and research in the broad man-environment problem spectrum. Faculty members from the departments of Chemical and Electrical Engineering, Architecture, Biology, Geology, Economics, and Psychology participate in this interdisciplinary research. Graduate students enrolled in any of these departments and interested in environmental problems for thesis topics may use facilities of the Environmental Science and Engineering Department and are eligible for financial assistance in the form of graduate traineeships.

Candidates for the Master of Science or Doctor of Philosophy may pursue course programs designed both to complement and supplement their backgrounds, through major and minor emphasis areas. However, formal minors are not required. University requirements for the advanced degrees are presented on pages 91 and 92.

Graduate students in environmental science or engineering take the majority of their courses in other departments. A candidate for the Master of Science degree must complete a minimum of eight approved semester courses and present and defend, in oral examination, a research thesis. Normally two academic years and the intervening summer are required for the degree.

Candidates for the Doctor of Philosophy must demonstrate their competence in three areas through qualifying examinations. The areas of competence may correspond to the candidate's areas of major and minor course emphasis. The thesis must document and be defensible evidence of the candidate's ability to do original research in a specialized phase of environmental science or engineering.

Environmental Science and Engineering Courses

201a. Introduction to Environmental Systems (3-3-4).

The chemical, physical, and biological components of the environment and the effects of pollution on their maintenance and utilization.

Mr. Ward

311a. Applied Fluid Mechanics (3-3-4).

Fundamental principals of fluid statics and fluid flow in closed conduits; laboratory exercises. Also offered as Civil Engineering 363.

Mr. Bedient

401a. Measurements in Environmental Systems (2-6-4).

The various analytical and instrumental techniques for measurement of the physical and chemical properties of air and water.

Mr. Tomson

402b. Laboratory Study of Environmental Processes (2-6-4).

Unit process experiments demonstrate the use of natural and modulated water pollution control.

Mr. Tomson

403a. Urban Water Systems (3-0-3).

The municipal water cycle, including water supply, distributions, and consumption and wastewater collection, treatment, and disposal.

Mr. Characklis

405a. Fundamentals of Air Pollution (3-0-3).

Human health effects; sources of air pollution. Properties and processes of the atmospheric medium; stability, turbulence, mixing, transport of pollutants, radiation, photochemistry, aerosol physics, and precipitation. Also offered as Mechanical Engineering 479 and Chemical Engineering 427.

Staff

406b. Introduction to Environmental Law (3-0-3).

The legal techniques used by societies to plan and regulate the use of environmental resources. *Mr. Leeds*

412b. Hydrology and Watershed Analysis (3-3-4).

Fundamentals of the hydrologic cycle, hydrograph techniques, flood routing, and open channel flow; local watershed application. Also offered as Civil Engineering 464. *Mr. Bedient*

443a. Introduction to Atmospheric Science (3-0-3).

The fundamentals of meteorology and climatology, and predictive meteorology and climatology. Also offered as Space Physics 443 and Mechanical Engineering 477. *Mr. Few*

444b. Atmospheric Dynamics (3-0-3).

Hydrodynamic equations of motion on a rotating planet will be derived and used to study meso-scale and macro-scale weather systems on the Earth and other planets. Also offered as Space Physics 444 and Mechanical Engineering 478. *Mr. Few*

490b. Special Study and Research for Undergraduates (0-9-3).

Open to environmental science or engineering majors with superior records and with permission of the chairman. Written thesis required. *Staff*

511a, 512b. Environmental Physiology and Toxicology (3-0-3 each semester).

The physical and chemical environment as it affects the physiology and population dynamics of organisms (including man). Stability and maintenance of biogeochemical cycles. *Staff*

517a. Water Resource Systems (3-0-3).

Theories of urban hydrology, stream pollution analysis, and water quality simulation. *Mr. Bedient*

521, 522. Environmental Engineering Processes (3-0-3 each semester).†

Design and control of industrial systems to satisfy water quality demands for cooling water and steam production. Corrosion, scaling, and fouling problems considered in depth. *Mr. Characklis*

528b. Air Pollution and Its Abatement (3-0-3).

Atmospheric physics and chemistry of gaseous and particulate pollutants; relationship between emissions and air quality; engineering, economics, and politics of abatement. Also offered as Chemical Engineering 528. *Mr. Deans*

536b. Microbial Engineering (3-0-3).

The synthesis of water and waste water treatment systems. Biological processes as applied to industrial waste treatment. *Mr. Characklis*

545. Modeling in Design and Resource Management (3-0-3).†

The use of models in design and resource management. *Mr. Leeds*

550b. Applied Water Chemistry (3-0-3).

Designed to provide a theoretical basis for considering the chemistry of natural and waste waters and treatment processes. *Staff*

601a, 602b. Seminar (3-0-3 each semester).

A continuing seminar on environmental research.

621, 622. Experimental Design (3-0-3 each semester).†

Analysis of variance and regression techniques. Emphasis on problem solving, primarily with chemical and biological data. Introduction to experimental design. *Mr. Characklis*

641a, 642b. Advanced Topics (3-0-3 each semester).

Discussion and interpretation of current literature and research relevant to the environmental sciences in a seminar setting. *Staff*

645a, 646b. Problems in Environmental Planning (3-0-3 each semester).

An important current environmental problem will be studied by students functioning as members of a consulting panel. *Staff*

651a, 652b. Research and Thesis (Credit variable).

For the Master of Science.

700c. Summer Research (Credit variable).

751a, 752b. Research and Thesis for the Doctorate (Credit variable).
800b. Degree Candidate Only.

Mechanical Engineering and Materials Science

The George R. Brown School of Engineering

Professor W. F. Walker, *Chairman*

Professors Beckmann, Bowen, Brotzen, Chapman, Cheatham,
McLellan, Miele, J.M. Roberts, Wierum, and Wilhoit

Assistant Professors Bayazitoglu and Picologlou

Adjunct Assistant Professors Harkins and Krawitz

Degrees Offered: B.A., B.S., M.M.E., M.M.S., M.S., Ph.D.

Requirements for baccalaureate, professional, and graduate degrees in mechanical engineering and in materials science are summarized on pages 50, 92, and 95. A list of representative courses and their normal sequence during the student's undergraduate year is available from the department. By proper choice of electives in the senior and fifth years, the student can specialize in one of several options as part of the mechanical engineering degree programs: thermal sciences and energy conversion, gasdynamics, hydrodynamics and ocean engineering, stress analysis and mechanical behavior of materials, aerospace engineering, and air pollution.

In addition to the departmental requirements for the major, students seeking the B.A. must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of a least 135 semester hours. The B.S. degree program requires 42 semester hours outside departmental requirements and a total of 134 semester hours. See Degree Requirements and Majors, pages 50 and 51.

After completing the requirements for the Bachelor of Science degree or the Bachelor of Arts degree, the student is eligible to apply for the fifth-year program leading to the professional degrees Master of Mechanical Engineering or Master of Materials Science.

Graduate degrees within this department are the Master of Science and the Doctor of Philosophy. These degree programs are open to students who have demonstrated outstanding performance in their undergraduate studies. The general university requirements for these degrees are outlined on pages 91-92. Specific course requirements are variable, depending upon preparation, performance on qualifying examinations, etc. The granting of a graduate degree presupposes superior quality academic work and demonstrated ability to do original research. For both the M.S. and the Ph.D. degrees, the thesis must be defended in public oral examination.

The research interests of the faculty and the laboratory research equipment available provide the following areas of specialization: (1) engineering mechanics; (2) materials science; (3) fluid dynamics, gas dynamics, heat transfer, physical oceanography; (4) aero-astronautics; (5) bioengineering.

Mechanical Engineering Courses

311a. Mechanics of Deformable Solids (3-0-3).

Mr. Cheatham

312b. Advanced Mechanics of Deformable Solids (3-0-3).

Mr. Cheatham

331a. Junior Laboratory I (0-3-1).

Static and impact testing of engineering materials. Beam deflection and shear center experiments are included. Strain gages are applied and tested. *Mr. Cheatham*

332b. Junior Laboratory II (0-3-1).

Laboratory instruction in fluid mechanics and thermodynamics. *Mr. Wierum, Staff*

340a,b. Industrial Process Laboratory (0-3-1).

A laboratory providing practical experience in and observation of selected industrial processes. *Mr. Guidry*

371a. Fluid Mechanics I (3-0-3).

Introduction to fluid statics and dynamics; the development of the fundamental equations and their solution for classical viscous flows and high Reynolds number flows. *Mr. Walker*

372b. Fluid Mechanics II (3-0-3).

A continuation of Mechanical Engineering 371 devoted to airfoil theory, lubrication, boundary layers, and turbulence. *Mr. Picologlou*

378b. Acoustics (3-0-3).

Acoustic theory, atmospheric acoustics, room acoustics, attenuation, nonlinear effects, measurement techniques, transducers, and acoustical standards. Also offered as Electrical Engineering 308. *Mr. Few*

402b. Mechanical Engineering Design (2-3-3).

Prerequisite: Mechanical Engineering 311 or equivalent. *Mr. Cheatham*

411a. Advanced Engineering Mechanics (3-0-3).

Application of energy methods in the study of particle and rigid-body dynamics, electric circuits, electro-mechanical systems, and continuous dynamic systems. Prerequisite: Engineering 211. *Mr. Cheatham*

412b. Vibrations (3-0-3).

Analysis of discrete and continuous linear, mechanical, vibrating systems with particular emphasis upon multi-degree-of-freedom systems. Approximate methods are included. Prerequisite: Mechanical Engineering 411. *Staff*

431a. Senior Laboratory I (0-3-1).

Laboratory instruction in gasdynamics, heat transfer, applied thermodynamics, and engine cycles. *Mr. Wierum, Staff*

432b. Senior Laboratory II (0-3-1).

An independent laboratory design, performance of research project of the student's choice. *Mr. Wilhoit*

434b. Laboratory Project (0-9-3).

A course designed for students who wish to pursue a special mechanical engineering design or laboratory project. *Staff*

463a. Minimization of Functions (3-0-3).

Theory of maxima and minima. Analytical methods. Numerical methods. Also offered as Mathematical Sciences 463. *Mr. Miele*

464b. Minimization of Functionals (3-0-3).

Optimal control theory. Calculus of variations. Analytical methods. Numerical methods. Also offered as Mathematical Sciences 464. *Mr. Miele*

471b. Applications of Thermodynamics (3-0-3).

Applications of thermodynamics to various systems of interest in mechanical engineering with particular attention to energy conversion, refrigeration, and psychrometrics. *Mr. Chapman*

475a. Modeling and Model Testing (3-0-3).

Modeling laws for different flow phenomena are derived and accuracy of test data is established. *Mr. Beckmann*

476b. Fluid Machinery (3-0-3).

Emphasis on continuous flow mechanism, such as turbines and ship propellers, etc. *Mr. Beckmann*

477. Introduction to Atmospheric Science (3-0-3).†

Fundamentals of meteorology and climatology including radiation transfer. *Mr. Few*

478. Atmospheric Dynamics (3-0-3).†

The hydrodynamic equations of motion on a rotating planet will be derived and solutions demonstrated for static, stable, perturbed, and unstable flows. *Mr. Few*

479a. Fundamentals of Air Pollution (3-0-3).

Human health effects; sources of air pollution. Properties and processes of the atmospheric medium: stability, turbulence, mixing, transport of pollutants, radiation, photochemistry, aerosol physics, and precipitation. Also offered as Environmental Science and Engineering 405 and Chemical Engineering 427. *Mr. Few*

481a. Heat Transfer (4-0-4).

A general study of the principles of heat transfer by conduction, convection, and radiation and their application to problems of engineering practice. *Mr. Chapman*

482. Thermal Environmental Engineering (3-0-3).†**508. Perturbation Methods (3-0-3).†**

Approximate solutions of nonlinear equations using perturbation techniques. *Mr. Wilhoit*

511a. Elements of Continuum Mechanics I (3-0-3).

A presentation of the concepts and general principles common to all branches of solid and fluid mechanics. Applications include non-Newtonian fluid mechanics and nonlinear elasticity. *Mr. Bowen*

512. Elements of Continuum Mechanics II (3-0-3).†

Applications of the concepts developed in Mechanical Engineering 511. Topics selected from thermoelasticity, electroelasticity, viscoelasticity, nonequilibrium thermodynamics, and porous media theories. *Mr. Bowen*

513b. Theory of Elasticity (3-0-3).

Fundamentals of linear elasticity and thermoelasticity. Applications include static and dynamic problems. Prerequisite: A first course in the mechanics of deformable bodies. *Mr. Wilhoit*

514a. Theoretical Plasticity (3-0-3).

Isotropic and anisotropic plastic flow; yield and loading surfaces, normality and convexity requirement, and hardening rules; plane plastic flow problems and slip-line field theory. Also offered as Civil Engineering 514. *Mr. Cheatham*

515b. Applied Plasticity (3-0-3).

Problems in limit analysis and design; plastic behavior of structures; flexure and torsion of prismatic members. *Mr. Merwin*

516. Advanced Dynamics (3-0-3).†

Dynamics of a particle and systems of particles.

517a. Finite Element Methods in Engineering (3-0-3).

An introduction to the finite element analysis with applications to problems in fluid and solid mechanics. *Mr. Picologlou*

521. Flight Mechanics (3-0-3).†

General principles of kinematics and aerodynamics necessary for the derivation of the equations of motion for rocket and jet powered vehicles. *Mr. Wierum*

530a. Heat Exchanger Design (3-0-3).

Description and calculation of various types of present day heat exchangers. *Mrs. Bayazitoglu*

531b. Solar Power (3-0-3).

Solar Collector design and performance — heat storage systems and power production. *Mrs. Bayazitoglu*

563a. Minimization of Functions (3-0-3).

Same as Mechanical Engineering 463, with one exception: emphasis is placed on computer methods. Also offered as Mathematical Sciences 563. *Mr. Miele*

564b. Minimization of Functionals (3-0-3).

Same as Mechanical Engineering 464, with one exception: emphasis is placed on computer methods. Also offered as Mathematical Sciences 564. *Mr. Miele*

571a. Ocean Fluid Dynamics and Meteorology I (3-0-3).

An introductory course on the fundamentals of ocean motion. Prerequisite: Mechanical Engineering 371, Chemical Engineering 401, or Civil Engineering 463. *Mr. Beckmann*

572b. Structural Ocean Engineering (3-0-3).

A continuation of Mechanical Engineering 571 with applications to the static and dynamic response of structures. Prerequisite: Mechanical Engineering 571. *Mr. Beckmann*

575. Energy Technology (3-0-3).†

Energy utilization patterns and resources; conventional conversion systems, central station power from fossil fuels; power plant design; alternative fuels; nuclear fission and fusion; energy conversion systems.

576. Propulsion (3-0-3).†

Basic principles of gasdynamics, thermodynamics, and chemistry applied to prediction of the behavior of airbreathing and rocket propulsion devices. *Mr. Wierum*

578b. Combustion (3-0-3).

A study of physical and chemical processes of combustion and application to mobile and stationary systems. *Mr. Wierum*

584b. Biomechanics and Fluid Mechanics of Physiological Systems (3-0-3).

Topics include flow situations in living organisms; blood flow in capillaries, arterioles and arteries; flow in the urinary, gastrointestinal and reproductive tract, etc. Prerequisite: A first undergraduate course in fluid mechanics. *Mr. Picologlou*

591a. Gasdynamics (3-0-3).

Fundamentals of compressible, one-dimensional gas flows with area change, normal shocks, friction, and heat addition; oblique shocks and Prandtl-Meyer flows. *Mr. Wierum*

592b. Advanced Gasdynamics (3-0-3).

Principles of one-dimensional unsteady and two-dimensional steady gasdynamics applied to the study of aerodynamics and physical acoustics. Prerequisite: Mechanical Engineering 591. *Mr. Wierum*

593a,b. Mechanical Engineering Problems (Credit variable).

With approval, mechanical engineering students may elect at least nine hours a week in approved investigation or design under the direction of a member of the staff. *Staff*

594a. Advanced Aerodynamics (3-0-3).

Application of engineering principles and aerodynamic theory to the design and analysis of flight vehicles. Prerequisite: Mechanical Engineering 591. *Mr. Wierum*

600a,b. Research and Thesis (Credit variable).*Staff***601a,b; 602a,b; 603a,b; 604a,b; 605a,b. Special Topics (Credit variable).***Staff***617, 618. Continuum Mechanics I, II (3-0-3 each semester).†**

Advanced topics in continuum mechanics.

626. Theory of Elasticity II (3-0-3).†

Special topics in the linear theory of elasticity.

627b. General Theory of Shells (3-0-3).

General linear theory of bending of elastic shells of arbitrary shape. Solution of problems of technical interest by exact and approximate methods. *Mr. Cheatham*

671, 672. Nonequilibrium Thermodynamics I, II (3-0-3 each semester).†

Foundations of the thermodynamics of irreversible processes. *Mr. Bowen*

673a, 674b. Advanced Fluid Mechanics I, II (3-0-3 each semester).

Conservation equations for viscous compressible fluids. Applications to viscous and inviscid flows. Simple flows of non-Newtonian fluids. *Mr. Walker*

675. Special Applications of Fluid Dynamics (3-0-3).†

Geostrophic flows in meteorology and oceanography investigated and applied to secondary flow phenomena of laminar and turbulent character.

682. Convective Heat Transfer (3-0-3).†

A vigorous study of the transfer of heat by free and forced convection. *Mrs. Bayazitoglu*

683a. Radiative Heat Transfer I (3-0-3).

A rigorous study of the transfer of heat by radiant exchange in the absence of absorbing media. *Mr. Chapman*

684. Radiative Heat Transfer II (3-0-3).†

Radiative transfer in the presence of absorbing, emitting, and scattering media; combined radiation, conduction, and convection. Heat transfer in furnaces, fire propagation, and air pollution problems.

685b. Conduction Heat Transfer (3-0-3).

Formulation of steady, unsteady, and multidimensional conduction in different geometries.
Mrs. Bayazitoglu

697. Hypersonic Gasdynamics (3-0-3).†**698. Physical Gasdynamics (3-0-3).†**

Equilibrium and nonequilibrium phenomena in the dynamics of high temperature gases.
Mr. Wierum

700c. Summer Graduate Research.*Staff***800b. Degree Candidate Only.***Staff**Materials Science Courses***245a. Thermodynamics of Engineering Materials (3-0-3).**

An introduction to the kinetics and thermodynamics of engineering materials.

*Mr. McLellan***295. Introduction to Materials Technology Design (2-3-3).†**

An introductory project course utilizing the scanning electron microscope and other analytical tools to explore the nature of metallic, ceramic, polymeric and other materials.

395a,b. Materials Science (3-0-3).

Introduction to the science of solid materials covering metals, ceramics, plastics, and semiconductors. The properties of solid materials from atomic and macroscopic points of view.

*Mr. Brotzen, Mr. McLellan***397a,b. Materials Science Laboratory (0-3-1).**

An introductory laboratory course composed of experiments which complement the lecture material of Materials Science 395.

*Mr. Roberts, Mr. McLellan***401a. Thermodynamics and Transformations in Alloys (3-0-3).**

Thermodynamics applied to systems of solid solutions and intermetallic compounds. Phase law and phase equilibrium. Determining free energies in binary systems. Simple models for transformations.

*Mr. McLellan***402a. Mechanical Properties of Materials (3-0-3).**

Basic, fundamental properties of dislocations in crystals. Applications to mechanical behavior: creep, work hardening, internal friction, fracture, and other structure sensitive phenomena of materials.

*Mr. Roberts***404b. Materials Engineering and Design (2-3-4).**

The technological aspects of materials selection, design, failure and analysis. Laboratory time is spent in an industrial setting.

*Mr. Roberts***406b. Physical Properties of Solids (3-0-3).**

A survey of electrical, magnetic, and optical properties of metals, semiconductors, and dielectrics based upon elementary band theory concepts.

*Mr. Brotzen***411b. Metallography and Phase Relations (3-0-3).**

Microstructures which may be observed in metals and alloys; optical metallography in addition to more sophisticated techniques.

*Staff***415. Ceramics and Glasses (3-0-3).†**

Fundamentals of ceramic and glassy materials including phase relations, theoretical properties, structure, and bonding.

*Staff***453b. Extractive and Chemical Metallurgy (3-0-3).**

Survey of nonclassical beneficiation, reduction, oxidation, and refining processes for the preparation of research and reactor grade metals.

*Mr. Harkins***502b. Imperfections in Solids (3-0-3).**

Point, line, and planar defects in ionic, homopolar, and metallic solids.

Mr. Roberts

535a. Introduction to X-Ray Diffraction and Electron Microscopy (3-0-3).

The study of crystals by x-ray and electron diffraction and electron microscopy. Basic diffraction theory and methods for characterization of structure and constitution of materials. *Mr. Krawitz*

537a. X-Ray Diffraction and Electron Microscopy Laboratory (0-3-1).

Selected laboratory experiments to complement the lecture material of Materials Science 535. *Staff*

541b. Physical Metallurgy (3-0-3).

The fundamentals of solidification, alloying, and heat treatment. The mechanical and non-mechanical properties of metallic systems from atomic and electronic theory. *Mr. Roberts, Mr. Brotzen*

543b. Physical Metallurgy Laboratory (0-3-1).

Laboratory experiments to complement the course work of Materials Science 541. *Mr. Roberts*

545. Applied Physical Metallurgy (3-0-3).†

Materials processing. Casting and welding of metallic materials, from a fundamental point of view. Nondestructive testing by ultrasonic, magnetic, and other techniques. *Staff*

561a, 562b. Advanced Metallurgical Laboratory I, II (0-4-1 each semester).

Students whose interest lies primarily in the field of materials and metallurgy are given the opportunity for research in these fields. *Staff*

563a. Introduction to the Solid State (3-0-3).

Fundamental concepts about crystalline solids, preparation for further courses in the sequence Materials Science 564-567. Prerequisite: introductory background in wave mechanics and statistical mechanics, enrollment in a graduate level quantum mechanics course. Also offered as Chemistry, Electrical Engineering, and Physics 563. *Mr. Brotzen*

564b. Electron Transport in Solids and Superconductivity (3-0-3).

Various aspects of electron transport, primarily from a microscopic viewpoint. Prerequisite: Materials Science 563 or equivalent. Also offered as Chemistry, Electrical Engineering, and Physics 564. *Mr. Dodds*

565. Dielectric and Optical Properties of Matter (3-0-3).†

Polarization and the static model of a dielectric medium in an electric field; extension of the above model to the dynamic case and dielectric dispersion in solids. *Mr. Estle*

566. Imperfections and Mechanical Properties of Crystalline Solids

(3-0-3).†

Point defects in crystals, geometrical description of dislocations and the mathematical theory of lattice imperfections. *Mr. Roberts*

567b. Magnetism and Magnetic Resonance (3-0-3).

Magnetic properties of solids. Diamagnetism, paramagnetism, ferromagnetism, anti-ferromagnetism, and ferrimagnetism. Nuclear magnetic resonance, electron paramagnetic resonance and ferromagnetic resonance. Also offered as Chemistry, Electrical Engineering, and Physics 567. *Mr. Rorschach*

569b. Corrosion Science and Engineering (3-0-3).

A survey of surface activity and corrosion processes on metals, semiconductors, and insulating materials. *Mr. Harkins*

593a, 594b. Polymer Science and Engineering I, II (3-0-3 each semester).

Basic concepts in macromolecular chemistry and physics, and their application in the production, processing, and use of synthetic polymers. Also offered as Chemical Engineering 593, 594. *Mr. Armeniades*

604b. Defect Structure of Synthetic and Biological Polymers (3-0-3).

Theory of disclinations in solids. Application of the theory to organic polymers, liquid and Mobias crystals, and insect muscle. *Mr. Roberts*

609b. Fracture Mechanics (3-0-3).

Theory of elasticity and theory of plasticity pertinent to fracture mechanics. *Mr. Brotzen*

615a,b. Special Topics (3-0-3).

Detailed course offering will be based upon graduate student interest. *Staff*

634a. Thermodynamics of Alloys (3-0-3).

Relation between classical thermodynamics and statistical mechanics applied to understanding solid and liquid alloys. Solid-solid, liquid-solid, and gas-solid equilibria in metallurgy.

Mr. McLellan

635b. Transformations in Alloys (3-0-3).

Diffusion in metals and alloys. Mechanism and phenomenology of diffusion-controlled transformations. Precipitation from saturated alloys and liquid solutions. Transformations in heat treated alloys.

Mr. McLellan

636. Diffraction of Nonideal Crystals (3-3-4).†

Advanced x-ray diffraction theory and experimental methods. Applications include crystal structure determination, order-disorder, thermal vibration, mechanical deformation, structure of amorphous materials, and others.

646a. Mechanical Metallurgy (3-0-3).

Elastic, plastic, and viscous behavior of metallic and nonmetallic solids. The interpretation of mechanical behavior in terms of lattice-imperfection theory. Prerequisite: Materials Science 402 or 566.

Mr. Roberts

649. Ferromagnetic Theory and Devices (3-0-3).†

Theory of magnetism. Magnetostatics. Dynamic behavior of magnetic materials. Magnetic thin films. Magnetic tape cores. Device characteristics. Prerequisite: an introductory course in solid-state theory. Also offered as Electrical Engineering 560.

English

Professor Isle, Chairman

**Professors Dowden, Grob, Meixner, Minter, Parish, Patten, Piper,
Spears, and J. A. Ward**

Visiting Professor Schneidau

**Associate Professors Apple, S. A. Baker, Doody, Doughtie, Huston,
Morris, and Nitzsche**

Assistant Professors Driskill and Skura

Degrees Offered: B.A., M.A., Ph.D.

Requirements for a Major in English. A major in English requires thirty-six semester hours in English (twelve courses); at least twenty-four semester hours (twelve courses) must be courses at or above the 300 level. A double major requires thirty semester hours (ten courses) in English, with at least eighteen hours (six courses) at the advanced level. All English majors must take Masters of English Literature (English 251, 252) as a preparatory survey.

An English major must also take advanced courses in the following categories: (1) six semester hours (two courses) in English literature before 1800, of which one course must be Chaucer, Shakespeare, or Milton; (2) three semester hours (one course) in English literature after 1800; (3) three semester hours (one course) in American literature.

It is recommended that all English majors take some formal instruction in English and American history, and, especially if they plan to do graduate work, at least six semester hours (two courses) at the advanced level in Latin, German, or French.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Requirements for the Degree of Master of Arts. Though no students are admitted who seek a terminal M.A. degree, Ph.D. candidates may take the master's degree if they wish. They are expected to pass at least twenty-four semester hours in English in addition to "Introduction to Graduate Study: Bibliography and Criticism" on a pass-fail basis, satisfactorily complete a thesis (of approximately fifty pages), and defend the thesis in an oral examination. The foreign language requirement is to be satisfied either by the passing of a reading test or by the successful completion of one literature course (at least three semester hours) offered by a foreign language department at Rice or another accredited institution.

Requirements for the Degree of Doctor of Philosophy. A candidate for the doctoral degree must successfully complete (or have completed before enrolling) six semester hours in the literature of a foreign language at the junior or senior level. The courses may be taken at Rice or another accredited institution and must be approved by the departmental graduate committee; if possible, the courses should directly relate to the student's period of specialization in English or American literature.

The student must complete a minimum of thirty-six semester hours in English. "Introduction to Graduate Study: Bibliography and Criticism" is the only course required of all new students.

Usually in the beginning of the sixth semester students take the preliminary examination, which consists of three three-hour examinations in fields other than that in which they choose to write their dissertations, and one four-hour examination in the field of specialization. A student with adequate course coverage may take a more specialized preliminary examination: a six-hour examination in a field of specialization and three-hour examinations in (1) a literary genre and (2) either a major writer or a related field outside of literature.

The remaining requirements are the completion of a dissertation (of approximately 150 pages) which demonstrates the candidate's capacity for independent work in either traditional scholarship or critical interpretation, and the passing of a final oral examination on the thesis and related fields. To receive continuing financial aid, a student must have candidacy for the Ph.D. approved by the beginning of the seventh semester of graduate work at Rice. To secure such approval, the student must have completed three requirements: (1) foreign language courses, (2) preliminary qualifying examinations, (3) prospectus for dissertation, prepared in consultation with the prospective director and approved by the departmental graduate committee.

English Courses

101a. Critical Reading and Writing (3-0-3).

Analysis and discussion of literary texts: poetry, drama, prose fiction. Students submit frequent essays. *Staff*

102b. Critical Reading and Writing (3-0-3).

Continuation of English 101, with sections giving special emphasis to individual genres: fiction, drama, and poetry. *Staff*

103a, 104b. Basic Composition (3-0-3 each semester).

Intended primarily for students whose English Competency Examination is below standard. *Ms. Driskill*

231a. European Drama to 1880 (3-0-3).

Readings of major plays from ancient drama and from the English and French stage prior to 1880. Includes Aeschylus, Sophocles, Aristophanes, Shakespeare, Marlowe, and Molière.

Mr. Baker

232b. European and American Drama: 1880 to the Present (3-0-3).

Readings from major playwrights of the modern era, including Chekhov, Ibsen, Shaw, Brecht, Giraudoux, Anouilh, Pirandello, O'Neill, Beckett, Miller, and Albee. *Mr. Baker*

241a. Modern and Ancient Narrative in Prose, Verse, and Drama (3-0-3).

World narrative (Homer to *The Aeneid*): reading in modern English versions of *The Iliad*, *The Odyssey*, *The Aeneid*, and representative Greek plays. *Mr. Huston*

242b. Modern and Ancient Narrative in Prose, Verse, and Drama (3-0-3).

A survey of modern fictional narrative. This course provides an introduction to the origin and development of English and Continental fiction. *Mr. Apple*

245. Humor and Satire (3-0-3).†**251a. Masters of English Literature (3-0-3).**

Readings in the major authors representative of the various periods (from Chaucer through Pope). *Mr. Baker*

252b. Masters of English Literature (3-0-3).

Representative works by the major English authors of the Romantic and Victorian Periods and of the twentieth century. Lectures and discussion. *Mr. Grob*

271a, 272b. Aspects of Modern Literature (3-0-3 each semester).

Formal and historical modernist literature in short story, drama, poetry, novel, and non-fiction, drawn from American, British, and European sources of the nineteenth and twentieth centuries. *Mr. Doody, Mr. Isle*

304b. Images of Women in Literature (3-0-3).*Ms. Nietzsche***305, 306. Studies in a Major Writer (3-0-3 each semester).†****307a. Science Fiction (3-0-3).**

A study of modern science fiction in its relation to fantasy and satire.

*Mr. Spears***308b. Detective Fiction (3-0-3).***Mr. Huston***321a. Approaches to Modern Drama (3-0-3).**

Ibsen and the well-made play; revivals of drama in Great Britain, Russia, and America.

*Mr. Meixner***322b. Approaches to Modern Drama (3-0-3).**

Strindberg; O'Neill, Williams, and Miller; French moderns; absurdism and recent trends.

*Ms. Skura***324. Modern British Poetry (3-0-3).†**

Survey from 1890 to the present; emphasis on Hopkins, Yeats, Lawrence, Graves, Auden, Larkins, and Hughes; opportunity for papers and reports on other poets.

*Mr. Spears***325. Conrad and His Contemporaries (3-0-3).†**

Conrad's major works and selected novels of Hardy and Ford.

*Mr. Dowden***326b. Twentieth-Century British Novels (3-0-3).**

Novels by D. H. Lawrence, E. M. Forster, Virginia Woolf, Elizabeth Bowen, Doris Lessing, and others. Class discussion. Examination, by way of lecture, of James Joyce's *Ulysses*.

*Mr. Meixner***327. Twentieth-Century Irish Literature (3-0-3).†****331a, 332b. Fiction Writing (3-0-3).***Mr. Apple***333b. Expository Writing (3-0-3).**

Permission of instructor.

*Mr. Piper***336. Technical Writing (3-0-3).†****338b. Poetry Writing (3-0-3).***Mr. Meixner***341. The English Novel in the Eighteenth Century (3-0-3).†**

A study of the early development of the novel.

342b. The English Novel in the Nineteenth Century (3-0-3).

From Austen to Hardy.

*Mr. Patten***351a. The Romantic Period (3-0-3).**

Blake, Wordsworth, and Coleridge.

Mr. Dowden

- 352b. The Romantic Period (3-0-3).**
Byron, Keats, and Shelley. *Mr. Dowden*
- 355. Victorian Literature (3-0-3).†**
- 356b. Victorian Literature (3-0-3).**
Poetry and nonfiction prose. *Mr. Grob*
- 358b. Late Nineteenth-Century and Early Twentieth-Century English Literature (3-0-3).†** *Mr. Morris*
- 360. Restoration Literature (3-0-3).†**
- 365a. The Eighteenth Century (3-0-3).**
A study of Pope, Swift, Johnson, and other writers who practiced literature as a form of public address. *Mr. Piper*
- 369a. Survey of Sixteenth-Century Literature (3-0-3).**
A survey of nondramatic literature. *Mr. Doughtie*
- 370. Spenser's *Faerie Queene* (3-0-3).†**
- 371. The English Lyric before 1700 (3-0-3).†**
- 372. Ballad and Folk Song (3-0-3).†**
British and American ballads and folk songs and their social implications. *Mr. Doughtie*
- 373a. The Bible and Literature (3-0-3).** *Mr. Schneidau*
- 375a, 376b. Shakespeare (3-0-3 each semester).**
Selected representative plays including tragedies, comedies, histories, and romances. *Mr. Grob, Mr. Huston*
- 377b. Elizabethan and Jacobean Drama (3-0-3).**
Close critical reading of Elizabethan and Jacobean plays with particular emphasis on the works of Marlow and Jonson. *Ms. Skura*
- 381a. Literature of the Later Renaissance (3-0-3).**
After brief consideration of the sonnets of Sidney, Spenser, and Shakespeare, chief focus is on Herrick, Donne, Herbert, Carew, Waller, and Marvell. *Mr. Parish*
- 382b. Milton and the Classical Tradition (3-0-3).** *Mr. Parish*
- 385a. Chaucer (3-0-3).** *Ms. Nietzsche*
- 386. Middle English Literature (3-0-3).†**
- 389a. American Literature to 1860 (3-0-3).** *Mr. Minter*
- 390b. American Literature 1860-1910 (3-0-3).**
A study of Mark Twain, Emily Dickinson, Stephen Crane, and others, but especially Henry James. *Mr. Ward*
- 391a. American Fiction 1910-1940 (3-0-3).** *Mr. Ward*
- 392b. American Fiction 1940 to the Present (3-0-3).**
Survey with emphasis on the work of Bellow, Mailer, Barth, Pynchon, and others. Narrative technique and social context provide two approaches to the literature. *Mr. Isle*
- 393a. American Poetry Since 1915 (3-0-3).**
A study of Frost, Pound, Eliot, and Stevens with some attention to the other poets of the twentieth century. *Mr. Isle*
- 395. Literature of American Ethnic Minorities (3-0-3).†**
- 397. History of Literary Criticism to 1900 (3-0-3).†**
- 398. History of Literary Criticism Since 1900 (3-0-3).†**
- 402a. Critical Approaches to Literature (3-0-3).** *Mr. Morris*
- 409a, 410b. The Teaching of Basic Composition (3-0-3 each semester).**
Open only to students who are proctoring in English 103 and 104. *Ms. Driskill*

432. **Advanced Creative Writing (3-0-3).**†
Prerequisite: English 331 or permission of instructor.
440. **History of the English Language (3-0-3).**†
451. **Literary Types (3-0-3).**†
- 452b. **Literary Types: Theory of the Novel (3-0-3).** *Mr. Isle*
455. **Shakespeare: Major Plays (3-0-3).**†
461. **Modern Literature (3-0-3).**†
- 462b. **Modern Literature: Recent American Poetry (3-0-3).** *Mr. Spears*
- 481a, 482b. **Directed Reading (3-0-3 each semester).** *Staff*
- 491a, 492b. **Senior Thesis (3-0-3 each semester).** *Staff*
- 501a, 502b. **Topics in English and American Literary History (Credit variable).** *Staff*
Graduate research and thesis for the degree of Master of Arts.
- 503a. **Introduction to Graduate Study (3-0-3).**
Designed to acquaint students with bibliographical guides, aids to research, and methods of preparing scholarly papers. *Mr. Morris, Mr. Patten*
504. **Pro-Seminar in Middle English Literature (3-0-3).**†
505. **Pro-Seminar in Renaissance Non-Dramatic Literature (3-0-3).**†
507. **Pro-Seminar in Renaissance Dramatic Literature (3-0-3).**†
510. **Pro-Seminar in the Restoration and Eighteenth-Century Literature (3-0-3).**†
512. **Pro-Seminar in Romantic Literature (3-0-3).**†
515. **Pro-Seminar in Victorian Literature (3-0-3).**†
517. **Pro-Seminar in Twentieth-Century British Literature (3-0-3).**†
520. **Pro-Seminar in American Literature to 1900 (3-0-3).**†
522. **Pro-Seminar in Twentieth-Century American Literature (3-0-3).**†
525. **Pro-Seminar in Literary Criticism (3-0-3).**†
- 541a. **Old English (3-0-3).** *Ms. Nietzsche*
542. **Old English: *Beowulf* (3-0-3).**†
551. **Seminar in Middle English Literature (3-0-3).**†
553. **Seminar in Sixteenth-Century Literature: Spenser (3-0-3).**†
- 554b. **Seminar in Renaissance Non-Dramatic Literature: Shakespeare's Sonnets (3-0-3).** *Mr. Piper*
555. **Seminar in Renaissance Drama, Excluding Shakespeare (3-0-3).**†
- 556a. **Seminar in Shakespeare (3-0-3).** *Ms. Skura*
560. **Seminar in Restoration and Eighteenth-Century English Literature, Excluding Fiction (3-0-3).**†
561. **Seminar in the Eighteenth-Century Novel (3-0-3).**†
563. **Seminar in Romantic Literature (3-0-3).**†
565. **Seminar in Victorian Literature, Excluding Fiction (3-0-3).**†
- 566a. **Seminar in the Victorian Novel: Dickens (3-0-3).** *Mr. Patten*

- 568b. Seminar in Twentieth-Century British Novel: Conrad (3-0-3).
Mr. Dowden
569. Seminar in Twentieth-Century British Poetry (3-0-3).†
- 570b. Seminar in American Literature to 1900 (3-0-3). *Mr. Ward*
572. Seminar in Modern American Poetry (3-0-3).†
573. Seminar in Modern American Fiction (3-0-3).†
574. Seminar in Modern Drama (3-0-3).†
- 575a. Seminar in Literary Criticism: Post-Structuralist Criticism (3-0-3).
Mr. Schneidau
- 576b. Seminar in the Theory of Language: From Plato to Derrida (3-0-3).
Mr. Morris
- 577a. Seminar in Literary Types: Psychological Approaches (3-0-3).
Mr. Spears
- 581a, 582b. Directed Reading in English and American Literature (3-0-3 each semester).
Staff
- 591a, 592b. The Teaching of Literature (0-0-1 each semester). *Mr. Doody, Staff*
- 593a, 594b. The Teaching of Composition (1-0-1 each semester). *Ms. Driskill*
- 601a, 602b. Topics in English and American Literary History (Credit variable).
Graduate research and thesis for the degree of Doctor of Philosophy. *Staff*
- 700c. Summer Graduate Research. *Staff*
- 800b. Degree Candidate Only. *Staff*

French and Italian

**Professor Raaphorst, *Chairman*; Professors P. Brady,
Lecuyer, and Topazio
Associate Professors Alcover and Carrington
Assistant Professors Aresu and D.H. Nelson**

Degrees Offered: B.A., M.A., Ph.D.

French

Undergraduates may major in French, and there is a graduate program in French leading to the degrees of Master of Arts and Doctor of Philosophy. A fully equipped language laboratory is in operation, and laboratory work is an important part of the elementary courses in French.

Undergraduate Majors. A minimum of thirty semester hours (ten courses) in advanced French courses is required for the major in French. However, only twenty-four semester hours (eight courses) of advanced study are required for double majors or area majors. The following courses are required unless the student is exempted by his or her major adviser: French 311, 312, 390, and 391. Students who have taken French 300-400 level courses cannot enroll simultaneously or afterwards in French 200-level courses for credit.

Students are urged to take some work in European history, English,

another European literature, or other courses closely related to French literature and culture. All majors and prospective majors must have their programs approved by a representative of the department.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

The French Department offers various courses conducted entirely in English which do not count toward a major in French or a double teaching major. These are French 303, 304, 315, and 316. They may be accepted for an area major when approved by the departments involved.

An honors program in French is available to qualified students. French majors who have taken French 311 and 312 in their freshman or sophomore years are eligible to apply for admission to the program. For detailed information they should consult their French instructor or the departmental adviser. A \$1,500 summer travel scholarship is presented to a Rice student each year by the Alliance Francaise. The Rice chapter of Pi Delta Phi, the national French honor society, maintains a file of information about jobs abroad, both summer and permanent positions. Members of the department are available for discussion of the numerous programs of study and travel in France sponsored by both American and French institutions.

Graduate Programs. Admission to graduate study in French will be granted to a limited number of qualified students. A distinguished undergraduate record in the study of French literature and a capacity for independent work are considered essential. The award of advanced degrees is not based solely on accumulation of credits or compliance with formal requirements. Candidates are expected to attain a wide general knowledge of the appropriate history and literature and to demonstrate their command of the French language. In most cases two years will be required for the completion of work for the degree of Master of Arts. All courses are given in French.

Requirements for the Degree of Master of Arts in French:

1. Completion with high standing of a program approved by the department: normally this will include twenty-four semester hours in advanced courses plus thesis work (six semester hours)
2. Satisfactory performance on a reading examination in one language other than French approved by the department
3. Satisfactory performance on preliminary written and oral examinations in French on the French authors indicated in a reading list provided
4. Completion of an acceptable thesis
5. Satisfactory performance on a final oral examination

Requirements for the Degree of Doctor of Philosophy in French:

1. Completion with high standing of a program approved by the department: normally this will include fifty-four semester hours (including those required for the degree of Master of Arts) plus thesis work (six semester hours)
2. Satisfactory performance on a reading examination in two languages other than French approved by the department
3. Satisfactory performance on a preliminary written and oral examination on the authors indicated in a reading list provided, and on the literature, culture, and civilization of France. The oral examination may be taken only after the successful completion of the written examination. Students have a

choice between passing a preliminary examination in a second field of literature or taking one or two courses in a closely related field approved by the graduate faculty. If the student chooses to take two courses in such a "minor" field, only three semester hours will count toward the requirements for the Ph.D.

Note: Requirements 2 and 3 must be fulfilled one year before the submission of a dissertation.

4. Completion of a dissertation approved by the department; the dissertation is expected to represent an original contribution
5. Satisfactory performance on a final oral examination on the dissertation and related fields

Note: Regardless of the type of appointment held by the graduate student, he or she may be required to undertake research or teaching assignments, depending upon the background of the graduate student and the needs of the department.

French Courses

101a,b; 102a,b. Elementary French (3-2-4 each semester).

Introductory French. The course will be supplemented by films and language laboratory work. *Mrs. Nelson, Staff*

103a. Accelerated Elementary French (6-0-6).

Accelerated review of French for those wishing to enter French 201 in the spring semester. *Mrs. Nelson, Staff*

110a,b. French for Graduate Students. (3-0-0).

French grammar; emphasis on written language. Restricted to graduate students preparing for graduate language examination. With approval of student's department, passing of final examination will satisfy foreign language reading knowledge requirement.

201a,b; 202a,b. Intermediate French (3-0-3 each semester).

An introduction to some main currents in French literature. Reading of significant texts, composition, dictation, and conversation; grammar review. *Staff*

203a, 204b. Intermediate French Conversation and Composition (3-0-3 each semester).

Practice of oral French at the intermediate level; dictation and composition. *Staff*

303, 304. French Literature in Translation (3-0-3 each semester).† *Mr. Brady*

309. French Civilization (3-0-3).†

The development of French culture. The historical, scientific, social, and artistic achievements of the French through the nineteenth century. This course is given in French. Prerequisite: French 202 or placement exam. Open to freshmen. *Ms. Alcover*

310b. French Civilization (3-0-3).

A thorough study of the manners, culture, and institutions of France from the nineteenth century to the present. This course is given in French. *Mrs. Raaphorst*

311a. Introduction to French Literature (3-0-3).

The main currents in French literature from its beginning to the nineteenth century. Required for French majors. Taught in French. Prerequisite: French 202, 204, or placement examination. *Staff*

312b. Introduction to French Literature (3-0-3).

The main currents in French literature from the nineteenth century to the present. Required for French majors. Taught in French. Prerequisite: French 202, 204, or placement examination. *Staff*

315, 316. The French and World Novel (3-0-3 each semester).† *Mr. Brady*

318. The Middle Ages and Renaissance (3-0-3).† *Mr. Carrington*

321b. The Seventeenth Century (3-0-3).

The 1979 topic will be "Classical Theatre."

Ms. Alcover

322. The Seventeenth Century (3-0-3).†**331. The Eighteenth Century (3-0-3).†**

The evolution of the "esprit philosophique" and of the literary genres during the century. Selected readings of Montesquieu, Voltaire, Rousseau, Diderot, Beaumarchais, Marivaux.

Mrs. Raaphorst

340. Expression of French Society Through Its Cinema (3-0-3).†

Topic will change yearly. In English with separate discussions in French for majors.

Mrs. Raaphorst

351. French Romanticism (3-0-3).†**353. The Romantic Drama (3-0-3).†**

Mr. Brady

390b. French Conversation and Composition (3-0-3).

Study of spoken French. Practice in advanced conversation and composition. Prerequisite: Placement examination which will be given the first day of class, or French 204.

Staff

391a. French Phonetics and Grammar (3-0-3).

Practical application of the study of phonetics; practice in pronunciation and intonation. Grammar in review. Some laboratory work required. Open to freshmen.

Staff

403a, 404b. Directed Study and Honors Thesis (0-0-3 each semester).

Departmental approval required.

411. Introduction to Old French (3-0-3).†

Presentation of the phonology and syntax of Old French. Selected readings from the principal literary genres of the medieval period. Prerequisite: French 311 or 312.

Mrs. Nelson

451. Nineteenth-Century Poetry (3-0-3).†**452a. French Realism and Naturalism (3-0-3).**

A study of significant novels by Flaubert, Maupassant, Zola, Daudet, etc. Discussions and essays in French. Prerequisite: French 312.

Mr. Brady

480. Modern French Drama (3-0-3).†

Contribution of the French playwrights Claudel, Giraudoux, Anouilh, Genet, Ionesco, Beckett, and others to the contemporary theater in Europe and America. Prerequisite: French 311 and 312.

Mr. Lecuyer

482a. Modern French Novel (3-0-3).

Major novels of Proust, Malraux, Sartre, Robbe-Grillet, and Le Clezio. Detailed study, discussion and written analysis, in French.

Mr. Lecuyer

483b. Twentieth-Century French Literature (3-0-3).

Appollinaire, Eluard, Pieyre de Mandiargues, Teilhard de Chardin, Claude Levy-Strauss. This course is given in French. Prerequisite: French 312.

Mr. Lecuyer

488b. Advanced Conversation, Composition, and Translation (3-0-3).

Prerequisite: French 390, with permission of the instructor.

Staff

491a,b. Special Topics (3-0-3).

Qualified students may, on the recommendation of the department, undertake a special research assignment. May be repeated for credit with additional topic.

Staff

501a,b. Graduate Research (0-0-6).

Graduate research and thesis in partial fulfillment of the requirements for the degree of Master of Arts.

512. Topics in Medieval Literature (3-0-3).†**517. Seminar in Renaissance Literature (3-0-3).†****518b. Seminar in Renaissance Literature (3-0-3).**

The 1978-1979 topic will be "Lyric poetry to 1549."

Mr. Carrington

526. Seminar in Seventeenth-Century Literature (3-0-3).†**527b. Seminar in Seventeenth-Century Literature (3-0-3).**

Les moralistes: Montaigne, Pascal, Le Rochefoucauld, La Bruyere.

Ms. Alcover

535a. Seminar in Eighteenth-Century Literature (3-0-3).

The 1978-1979 topic will be "Montesquieu and Diderot."

*Mr. Topazio***536. Seminar in Eighteenth-Century Literature (3-0-3).†****555. Seminar in Romanticism (3-0-3).†****568a. Seminar in Realism and Naturalism (3-0-3).**

The topic will be "Realism and Historicism: Stendal, Balzac, Dumas, Mérimée, and Flaubert."

*Mr. Brady***571. Seminar in Modern Literature (3-0-3).†***Mrs. Raaphorst***572b. Seminar in Modern Literature (3-0-3).**

The topic will be "Theatre in France from Maeterlink to Anouilh."

*Mr. Lecuyer***577. Seminar in Contemporary Literature (3-0-3).†**Modern approaches to the *Explication de texte*.*Mr. Lecuyer***578. Seminar in Contemporary Literature (3-0-3).†**

Contemporary French poetry, with emphasis on Surrealism: Apollinaire, Aragon, Eluard and Prévert.

*Mr. Lecuyer***579a. Studies in French Poetry (3-0-3).**

The 1978-1979 topic will be "Symbolism."

*Mrs. Raaphorst***592a. French and English Stylistics (3-0-3).**

A study of the characteristics of the French and English languages and of their differences; application to the problems of composition and translation.

*Mr. Lecuyer***595. Special Topics in French Literature (0-0-3).**

On recommendation of the French faculty, a final-year candidate may be allowed to take this course to fill a particular lacuna.

601a,b. Graduate Research (0-0-6).

Graduate research and dissertation.

700c. Summer Graduate Research.**800b. Degree Candidate Only.**

Italian

Italian Courses

101a, 102b. Elementary Italian (3-2-4).

Emphasis on the development of audio-lingual skills. Graded readings introduce basic elements of Italian culture and civilization. Language laboratory work required.

*Staff***201a, 202b. Intermediate Italian (3-0-3).**

Emphasis on intensified oral and written practice. Review of grammar. An introduction to the culture and civilization of Italy.

Staff

Geology

**Professor D.R. Baker, *Chairman*; Professors J.A.S. Adams, DeBremaecker
Heymann, Warme, and J.L. Wilson
Adjunct Professor Worzel
Associate Professors Avé Lallemand, Casey, and H.C. Clark
Assistant Professors J. Anderson, Leeman, and Oldow
Adjunct Assistant Professor Schwarzer
Lecturer Powell**

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Requirements. The following courses are required for completion of the degree of Bachelor of Arts with a major in geology:

Geology 101, 111, 102, 112, which constitute a one-year sequence in introductory geology with credit of four semester hours each semester. It is advisable to take Geology 101 and 102 in sequence; the laboratories 111 and 112 should be taken concurrently with Geology 101 and 102.

Geology 311, 312, 331, 332, 390, 401 (or 404), and 441.

Four additional courses in geology at the 300 level or higher.

The following supporting courses are also required:

Mathematics 101, 102, or equivalent (not 107, 108)

Chemistry 101, 102, 107

Physics 101, 102 or 111, 112 or 121, 122; Physics 132

At least three semester hours (one course) in mathematics, science, or engineering approved by the Geology Department.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 137 semester hours. See Degree Requirements and Majors, pages 50 and 51.

The Department of Geology offers an approved curriculum leading to certification in earth science as a second teaching field. The curriculum consists of twenty-five semester hours of introductory courses which would most benefit a secondary school teacher: i.e. physical and historical geology; study of minerals, rocks, and fossils; some work in astronomy, meteorology, and oceanography; and a three-week field course.

Graduate Degrees. Students with a bachelor's degree in geology or related sciences from Rice University, or an equivalent degree from another institution of similar standing, are considered for admission to graduate work.

Graduate work is conducted in those specialties that are compatible with the equipment available and with the interests of the staff. At present, the Department of Geology is prepared to offer advanced work in geochemistry, geophysics, igneous and metamorphic petrology, marine geology-oceanography, meteoritics and planetology, stratigraphy, sedimentation, sedimentary petrology, structural geology and rock mechanics, paleontology, micropaleontology, and paleoecology. Graduate work in geology is oriented toward the theoretical and fundamental aspects of the subject rather than directly toward its many applied aspects.

Requirements for advanced degrees in geology are:

1. Completion at a high level of an approved program in geology and related subjects
2. Satisfactory performance on a basic examination in geology. In addition, a Ph.D. qualifying examination administered by the thesis committee is required of all doctoral candidates.
3. For the Ph.D. degree, demonstration of competence in one approved foreign language
4. Completion for publication of a thesis which represents an original contribution to the science
5. Oral defense of the research work and conclusions of the thesis
6. Satisfactory performance in teaching a laboratory in some basic course regardless of type of graduate appointment

Most graduate students can expect to spend two years beyond the bach-

elor's degree in order to complete requirements for the master's degree and an additional two years for the Ph.D. degree. Some students of very high ability may be allowed to bypass the master's degree and work directly for the Ph.D.

Geology Courses

101a. The Earth (3-0-3).

Nature of the earth and the physical processes that control and change it: plate tectonics to the central core, from ocean deep to mountains. Also offered as Geography 101. *Mr. Clark*

102b. Heritage of the Earth (3-0-3).

Introduction to earth history, tracing the origin and development of Earth, atmosphere, hydrosphere, and life, and of the movement of continents through time. Also offered as Geography 102. *Mr. Warme*

104b. The Earth (3-0-3).

A course on major Earth processes. Topics include: origin, chronology, plate tectonics, mineralogy, weathering, sedimentation, volcanism, plutonism, geophysics, geochemistry, and structural geology. *Mr. Heymann*

111a. Laboratory Study of the Earth (0-3-1).

Study of rocks and minerals, maps, and air photos. Also offered as Geography 111.

Mr. Clark

112b. Laboratory for Heritage of the Earth (0-3-1).

Study of sedimentary rocks, fossils, and geologic maps with application toward unravelling earth history. Also offered as Geography 112.

Mr. Warme

311a. Mineralogy (3-3-4).

Basic introduction to crystallography, crystal chemistry, systematics and classification, physical and chemical properties, distribution, occurrence and genesis of minerals, and optical mineralogy.

Mr. Leeman

312b. Petrology (3-6-5).

Description and interpretation of igneous, metamorphic, and sedimentary rocks. Laboratory work emphasizes study of rock thin section with petrographic microscope.

Mr. Powell

321a. Environmental Geology (3-0-3).

Study of evolutionary mechanisms by which life has adjusted to terrestrial conditions and man's impacts on these adjustments.

Mr. Adams

322b. Mineral Resources (3-0-3).

Study of geologic, legal, economic, and political interrelationships that create the energy and material mixes.

Mr. Adams

331a. Structural Geology (3-3-4).

Introduction to deformation mechanics, structural analysis of faults and folds, igneous and metamorphic rocks. Laboratory emphasizes practical use of structural theory.

Mr. Oldow

332b. Sedimentation (3-3-4).

Properties of sedimentation, includes both classic and carbonate rocks.

Mr. Anderson

333a. Structural Geology (3-0-3).

Same course as Geology 331 except no laboratory. For nonmajors only.

Staff

334b. Introduction to Field Mapping Techniques (0-6-2).

Beginning field techniques taught in approximately seven field days plus class meetings. Geologic map and report to be completed. Recommended as a prerequisite for Geology 390.

Staff

341a. The Oceans (3-0-3).

Introduction to science of oceanography; survey of the geological, physical, and biological aspects. Mainly for nonscience majors.

Mr. Anderson

343a. Laboratory Study of the Oceans (0-3-1).

An investigation in the laboratory and field of topics covered in Geology 341.

Mr. Anderson

352b. Engineering Geology (3-3-4).

Analysis, in terms of engineering and environmental applications, of earthquakes, faults, landslides, shorelines, ground water, subsidence, and other geologic phenomena. Techniques of engineering geology investigation.

Mr. Clark

390. Field Geology (1-9-4).

Summer field course taken at any of several approved camps operated by various universities, or Rice University Field Course.

401a. Stratigraphy and Advanced Historical Geology (3-3-4).

Principles of stratigraphy and environmental interpretation of stratigraphic sequences.
Mr. Wilson

402. Paleontology (3-3-4).†

Introduction to morphology and geologic record of major animal groups characterized by significant fossil representation; principles of evolution, paleoecology, correlation, and taxonomy.
Mr. Warne

403a. Advanced Studies in Physical Geology (1-0-1).

Introduction to current research in geology. Each faculty member in department participates by describing his research and some of the techniques involved.
Staff

404b. Advanced Historical Geology — North America, North Africa, and Middle East (3-3-4).

Staff

405. Micropaleontology (2-6-4).†

Study of microfossils, emphasis on identification, ecology, paleoecology and biostratigraphy of Radiolaria and Foraminifera. Prerequisite: Geology 402 or consent of department. *Mr. Casey*

412b. Igneous and Metamorphic Petrology (3-3-4).

Development of geologic, petrologic, mineralogic, physical, chemical, and experimental principles of petrology; origin and evolution of major rocks emphasized.
Mr. Avé Lallemant, Mr. Baker, Mr. Leeman

417. Physical and Chemical Oceanography (3-3-4).†

Study of physical and chemical aspects of oceanography, especially water masses, circulation, waves, and their effect on geological and biological oceanography.
Mr. Casey

418b. Marine Geology (3-3-4).

Study of geological aspects of oceanography, including geomorphology, nearshore processes, seafloor spreading, plate tectonics, marine geophysics, marine sediments, and paleo-oceanography.
Mr. Anderson, Mr. Clark

419. Biological Oceanography (3-3-4).†

Study of the biological aspects of oceanography emphasizing planktonic organisms; nektonic and benthonic organisms and paleoceanography also considered.

441a. Introduction to Geophysics (3-3-4).

Gravity, magnetism, paleomagnetism, heat flow, and seismology; geophysical measurements interpreted in terms of plate tectonics, the earth's interior, and surface geology.
Mr. DeBreaecker

442. Introduction to Exploration Geophysics (3-0-3).†

Basic principles and field procedures of geophysical prospecting including recording, processing, and interpretation of seismic data and gravity, magnetic and well logging methods.

455a, 456b. Geochemistry (3-3-4 each semester).

Study of terrestrial mechanisms governing the distribution of the chemical elements. Laboratory in geochemical techniques. *Mr. Adams, Mr. Baker, Mr. Heymann, Mr. Leeman*

461a. Geophysics (3-3-4).

Use of present gravity and magnetic fields in determining Earth's internal structure, magnetic field in past and its use; heat flow measurements at the surface. Prerequisite: Mathematics 211 or equivalent.
Mr. Clark

462b. Geophysics (3-3-4).

Seismology — a study of elastic waves in infinite and layered media. Determination of the internal structure of the earth from surface observations. Prerequisite: Mathematics 211 or equivalent.
Mr. DeBreaecker

481a, 482b. Research in Geology (Credit variable).

Advanced work adapted to the needs of the individual student. *Staff*

491a, 492b. Special Studies (Credit variable).

A study of recent research in specific fields under the guidance of a staff member. *Staff*

501a, 502b. Special Studies (Credit variable).

Advanced work in certain phases of geology adapted to the needs of individual graduate students. Registration permitted only with consent of department. *Staff*

504. Environmental Stratigraphy (3-3-4).†

Principles of stratigraphy and stratigraphic analysis taught through analysis of various depositional environments to ascertain controls exercised by tectonics, geography, and climate in formation of rock strata. *Mr. Wilson*

505a. Carbonate Geology (3-3-4).

Study of recent carbonate sediments, their depositional environments, and diagenesis; application of such principles to ancient strata. *Mr. Wilson*

511a-528b. Seminars in Geology (3-0-3).

Courses covering subjects listed under Geology 581-598. Individual seminars cover different topics in different years and may be taken more than once. *Staff*

531. The Interior of the Earth (3-0-3).†

Methods and results of seismology, gravity, magnetism, and heat flow will be used in the framework of plate tectonics to obtain evidence about the earth's interior.

535b. Stable Isotope Geochemistry (3-0-3).

Review of basic principles of isotope fractionation mechanisms and distributions of isotopes with focus on significance to major geological problems. *Mr. Baker*

536a. Organic Geochemistry (3-0-3).

Principles and procedures of organic geochemistry applied to important geological problems, petroleum evolution, physical and chemical history of sediments. *Mr. Baker*

537a. Advanced Sedimentary Geology I (3-3-4).

Lecture, lab, and field problems focusing on sedimentology and sedimentary petrography. *Mr. Anderson, Mr. Baker*

538b. Advanced Sedimentary Geology II (3-3-4).

Lecture, lab, and field problems focusing on stratigraphic sequences and paleoenvironmental analysis. *Mr. Warme, Mr. Wilson*

539a, 540b. Advanced Petrology (3-3-4 each semester).

Advanced topics in igneous and metamorphic petrology with emphasis on interests of the staff. Modern developments are rigorously examined in physiochemical terms. *Staff*

551a. Chemical Geology I (3-3-4).

Application of physical chemistry to geology. Includes basic thermodynamics, phase and mineral equilibria, solution chemistry, chemical bonding. *Mr. Heymann*

552. Chemical Geology II (3-3-4).†

An advanced survey of solution chemistry, chemistry of ocean water, hydrothermal solutions, brines, interaction of solids and aqueous solutions. *Mr. Heymann*

555a. Advanced Topics in Geochemistry (3-3-4).

Study of selected topics, particularly geochronology, radiometry, isotope and trace element analysis. *Mr. Adams*

556b. Radiogeology (3-3-4).

The determination of natural and artificial radioactivities, emphasizing the mobilization, transportation and fixation in the lithosphere, hydrosphere, atmosphere, and biota. *Mr. Adams*

561a. Advanced Topics in Geophysics (3-3-4).

Content varies from year to year: Convection, advanced wave propagation, tectonophysics, etc. *Mr. DeBremaecker*

562b. Advanced Topics in Geophysics (3-0-3).

Folding and faulting will be studied from three points of view: laboratory data, field data, and computer models. *Mr. DeBremaecker*

563a. Advanced Tectonics I (3-3-4).

Mechanics of rock deformation in theory, in experiments, and in nature. *Mr. Avé Lallemant*

564b. Advanced Tectonics II (3-3-4).

Regional tectonic analysis. *Mr. Oldow*

566. Experimental Structural Geology (2-3-3).†

Selected topics, such as elasticity and plasticity of minerals and rocks. Laboratory work includes experimental rock deformation. *Mr. Avé Lallemant*

568b. Structural Analysis of Deformed Rocks (2-3-3).

Studies of structures, textures, and petrofabrics of deformed rocks; stress and strain analysis. *Mr. Avé Lallemant*

574a. Electron Microprobe Scanning Electron Microscope (1-0-1).

Examination of fundamental principles, techniques of analysis and applications of Electron Microprobe/SEM. Emphasis on geological problems. *Mr. Powell*

576b. Electron Microprobe Scanning Electron Microscope Laboratory (0-2-1).

Practical instruction and experience in analytical techniques using the Electron Microprobe/SEM. *Mr. Powell*

581a, 582b. Research in Physical and Structural Geology (0-9-3 each semester). *Staff***583a, 584b. Research in Sedimentology (0-9-3 each semester).** *Staff***585a, 586b. Research in Petrology (0-9-3 each semester).** *Staff***587a, 588b. Research in Geochemistry and Meteoritics (0-9-3 each semester).** *Staff***589a, 590b. Research in Geophysics (0-9-3 each semester).** *Staff***591a, 592b. Research in Paleontology and Stratigraphy (0-9-3 each semester).** *Staff***593a, 594b. Research in Economic Geology (0-9-3 each semester).** *Staff***595a, 596b. Research in Regional Geology (0-9-3 each semester).** *Staff***597a, 598b. Research in Marine Geology and Oceanography (0-9-3 each semester).** *Staff***700c. Summer Graduate Research.** *Staff***800b. Degree Candidate Only.***Geography Courses***101a. The Earth (3-0-3).**

Nature of the earth and the physical processes that control and change it: plate tectonics to the central core, from ocean deep to mountains. Also offered as Geology 101. *Mr. Clark*

102b. Heritage of the Earth (3-0-3).

Introduction to earth history, tracing the origin and development of Earth, atmosphere, hydrosphere, and life, and of the movement of continents through time. Also offered as Geology 102. *Mr. Warne*

111a. Laboratory Study of the Earth (0-3-1).

Study of rocks and minerals, maps, and air photos. Also offered as Geology 111.

112b. Laboratory for Heritage of the Earth (0-3-1).

Study of sedimentary rocks, fossils, and geologic maps with application toward unraveling earth history. Also offered as Geology 112.

310b. World Ethnography (3-0-3).

Introduction to cultural geography through survey of geographical and cultural areas of the world. Emphasis on the interrelationships between human societies and their physical environments. No prerequisite. Also offered as Anthropology 310.

German and Russian

German

Professor Weissenberger, *Chairman*; Professor Winkler
Associate Professors S.L. Clark, Copeland, Eifler, and J.B. Wilson

Degrees Offered: B.A., M.A., Ph.D.

Requirements for an Undergraduate Major in German. Students majoring in German may pursue either of two options: German literature or German studies.

For an option in **German literature** the requirements are:

1. Completion of a program approved by the department
2. The equivalent of at least twenty-four semester hours (eight courses) numbered 300 or higher
3. Collateral courses in other literatures, history, and philosophy as recommended by the department

For an option in **German studies** the requirements are:

1. Completion of a program which has been defined in close cooperation with the departmental undergraduate adviser
2. The equivalent of at least eighteen semester hours (six courses) in courses numbered 300 or higher
3. At least twelve semester hours (four courses) in courses relating to the field of German in other departments. Courses in translation offered by the German Department pertaining to German culture and civilization count toward the fulfillment of the area requirement.

This option in German studies, which permits maximum flexibility within a frame of clearly defined objectives, allows an interdisciplinary approach to German affairs. The student can incorporate into the study of German language and literature subject-related courses in political science, history, musicology, art history, philosophy, and economics. The option in German studies is designed for students who are preparing for a career in international law, business, banking, or diplomacy, and for graduate study in a variety of fields such as history, political science, library science, art history, etc.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Honors Program. The department offers a special program for outstanding students consisting of independent readings and research which must lead to a substantial honors essay under the supervision of a departmental faculty member. Admission is decided in the second semester of a student's sophomore year.

German Literature in Translation. Courses in German literature in translation (designated "Germanics" with course number) are open to undergraduate students from all disciplines and of all classes. Readings and discussions are in English. These courses may be repeated for credit.

Requirements for the Degree of Master of Arts in German:

1. Completion with high standing of a program approved by the department; normally this will include twenty-four semester hours at the graduate level
2. Satisfactory performance on a reading examination in one foreign language other than German approved by the department
3. Completion of an acceptable thesis
4. Satisfactory performance on a final oral examination on the thesis and related topics

Requirements for the Degree of Doctor of Philosophy in German:

1. Completion with high standing of a program approved by the department; normally this will include forty-five semester hours at the graduate level, including those required for the degree of Master of Arts
2. Satisfactory performance on a reading examination in two foreign languages other than German approved by the department
3. Satisfactory performance on a preliminary written and oral examination on the general field of German studies; this examination will be based in part on a reading list provided by the department
4. Completion of a dissertation approved by the department; the dissertation is expected to represent an original contribution to knowledge
5. Satisfactory performance on a final oral examination on the dissertation and related fields

Note: Requirements 1 and 2 must be met at least a year before the submission of a dissertation.

As part of their training, graduate students, regardless of the type of appointment, will be required to perform some duties, such as assisting in classes, the language laboratory, research, and other activities suggested by the department.

*German Courses***101a,b; 102a,b. Elementary German (3-2-4 each semester).**

Introductory German with emphasis on speaking and reading. The course will be supplemented by language laboratory work. *Staff*

103a. Accelerated Beginning German (6-4-8).

The equivalent of German 101 and 102 in one semester. Permission of instructor required. *Mr. Copeland, Staff*

111a, 112b. German for Graduate Students (3-0-0 each semester).

A concise introduction to the reading of German for research purposes. A noncredit course, restricted to graduate students. *Staff*

201a,b. Intermediate German (3-0-3).

Grammar, conversation, and extensive reading supplemented by films and language laboratory work. *Mr. Copeland, Mr. Wilson, Mr. Winkler*

202a,b. Intermediate German (3-0-3).

Intermediate language skills with readings, discussion of literary texts, and related materials. Prerequisite: German 201, 203, or equivalent. *Mr. Copeland, Staff*

203a, 204b. Intermediate German: Scientific (3-0-3 each semester).

Language skills based on readings from German scientific books and journals, some from the student's own field, films, and radio. *Mr. Wilson*

206. Accelerated Intermediate German (6-2-6).†

Increases fluency in speaking and reading; introduces short works of German literature. Permission of instructor. *Mr. Copeland, Staff*

301a, 302b. Advanced Scientific German I, II (3-0-3 each semester).

Continuation of German 204. Open to all students with second-year competency. *Mr. Wilson*

303b. Intermediate German: Commercial (3-0-3).

Introduction to general business practices and terminology useful in a subsequent business career. Prerequisite: Second-year competency or consent of instructor. *Ms. Eifler*

305a, 306b. Composition and Conversation I, II (3-0-3 each semester).

A variety of reading materials serve as the basis for discussions and compositions. Prerequisite: second-year competency. *Mr. Weissenberger*

311a. Survey of German Literature I (3-0-3).

Introduction to the historical development of German literature: description, interpretation, analysis of literature, and literary trends through the nineteenth century.

312. Survey of German Literature II (3-0-3).†

German literature from the late nineteenth century to the present. Continuation of German 311. *Staff*

322b. Reading Dutch and Scandinavian (3-0-3).

A good reading knowledge of German and English is applied toward at least a fair reading ability in Dutch and Swedish, Afrikaans, Danish, Norwegian. *Mr. Wilson*

341a. The Age of Goethe (3-0-3).

German classical literature (1770-1820); emphasis changes from year to year. May be repeated for credit. *Mr. Winkler*

342b. Romanticism and Realism (3-0-3).

Nineteenth-century literary tendencies related to social, political context. May be repeated for credit. *Mr. Winkler*

371a. German Literature from 1900 to 1945 (3-0-3).

Concentrates on the literature of German Expressionism and the Weimar Republic.

372b. German Literature Since 1945 (3-0-3).

Authors who began their careers after 1945; for example, Böll, Grass, Dürrenmatt, Weiss. *Mr. Winkler*

375a. Germany Today: East and West (3-0-3).

A comparative study of the two German states. Readings include documentary and literary texts. *Ms. Eifler*

381. Major Authors of German Literature (3-0-3).†**391, 392. Special Topics (3-0-3 each semester).†****401a, 402b. Independent Work in German Literature or Philology (3-0-3 each semester).**

Qualified students will work on projects of their choice under the supervision of individual instructors. May be repeated for credit. *Staff*

403, 404. Introduction to Germanic Linguistics (3-0-3 each semester).†

May be repeated for credit. Introductory linguistic concepts and aspects of German phonology and syntax. *Mr. Copeland*

405. Introduction to Gothic and Old High German (3-0-3).†

Basic readings in language and literature. Open to graduate students for credit. *Mr. Wilson*

411a. Introduction to Middle High German Language and Literature (3-0-3).

Middle High German language and representative works from literature of the courtly period (twelfth and thirteenth centuries). Open to graduate students for credit. *Ms. Clark*

412. Middle High German Lyric and Epic Poetry (3-0-3).†

Literature of the first high point of German literary development. Texts are read in the original. Prerequisite: German 411. Open to graduate students for credit. *Ms. Clark*

421. German Literature of the Renaissance and Reformation (3-0-3).†

The course deals with major aspects of German literature from 1400 until 1600. Open to graduate students for credit. *Ms. Clark*

422. German Literature of the Baroque (3-0-3).†

The course discusses German literature of the seventeenth century. Open to graduate students for credit.

431. Advanced Stylistics (3-0-3).†

For advanced students, to achieve oral and written proficiency in German, using tape recordings, films, and current newspaper articles. Prerequisite: German 305 or permission of instructor. *Mr. Weissenberger*

500a,b. Graduate Research.

Graduate research and thesis in partial fulfillment for the degree of Master of Arts. *Staff*

511a, 512b. Independent Graduate Study in German Literature or Philology (3-0-3 each semester). *Staff***521b. Gothic (3-0-3).**

The Gothic language, its significance in the Germanic subfamily, readings from the Bible translation of Bishop Ulfilas (fourth century). *Mr. Wilson*

522. Old High German (3-0-3).†

Language and literature of the Old High German period (eighth to eleventh centuries); texts from the pagan and the monastic traditions. *Mr. Wilson*

523. Old Saxon (3-0-3).†

Early North German language and literature, chiefly the long epic poem *Heliand* in Germanic alliterative verse. *Mr. Wilson*

524. Old Icelandic (3-0-3).†

The earliest Scandinavian language and literature: runic inscriptions, the prose sagas of the Viking era, the Eddic poetry of Germanic gods and heroes. *Mr. Wilson*

526b. Seminar in Medieval Literature (3-0-3).

Specific aspects and problems of medieval literature. The topic may vary from year to year. Spring topic: Wolfram von Eschenbach. *Ms. Clark*

531. Linguistic Structure of German (3-0-3).†**532. Special Topics in German Linguistics (3-0-3).†**

The topics change from year to year: may be repeated for credit.

Mr. Copeland

561. Seminar in Literary Criticism (3-0-3).†

An introduction into the major modes of literary historiography, interpretation, and evaluation since Dilthey. *Mr. Winkler*

562. Seminar in Literary Theory (3-0-3).†

Historical studies of poetic theories and literary aesthetics.

Mr. Winkler

563. Seminar in Literary Genres (3-0-3).†

May be repeated for credit.

Mr. Winkler

565, 566. Special Topics in German Literature (3-0-3 each semester).†**571a. Seminar in the Eighteenth and Nineteenth Centuries (3-0-3).**

The course deals with specific aspects, problems, and authors of the period. May be repeated for credit. Fall topic: 1820-1850. *Mr. Weissenberger*

572a. Seminar in the Nineteenth and Twentieth Centuries (3-0-3).

This course deals with specific aspects, problems and authors of the period. May be repeated for credit. *Mr. Winkler*

591. Selected Problems in Modern Literature (3-0-3).†

May be repeated for credit.

592b. Selected Problems in Modern Literature (3-0-3).

May be repeated for credit. Spring topic: the German novel from 1900 to 1933. *Ms. Eifler*

600a,b. Graduate Research.

Graduate research and dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

700c. Graduate Summer Research.**800b. Degree Candidate Only.**

German Literature in Translation

Germanics Courses

- 311, 312. German Ideology** (3-0-3 each semester).† *Mr. Winkler*
- 321. Viking Literature in Translation** (3-0-3).†
The literature of medieval Scandinavia: runic inscriptions, laws, sagas, Eddic poetry, skaldic poetry. *Mr. Wilson*
- 351, 352. Great German Authors of the Twentieth Century in Translation** (3-0-3 each semester).†
- 361, 362. Special Topics in Modern German Literature, in Translation** (3-0-3 each semester).†
The topic will change from year to year; may be repeated for credit.
- 401a. Major Trends in German Literature from the Middle Ages Through the Enlightenment** (3-0-3).
Fall topic: Medieval women. Examination of the role of women in the Middle Ages from a theoretical and literary-historical viewpoint. *Ms. Clark*
- 402b. German Literature of the Middle Ages** (3-0-3).
Spring topic: introduction to Medieval symbolism and allegory. Examines the fundamentals of medieval figurative expression. *Ms. Clark*
- 403a. Germany Today: East and West** (3-0-3).
A comparative study of the two German states. Reading materials will include documentary and literary texts. In English. *Ms. Eifler*

Russian

Associate Professors R.G. Jones, E.M. Thompson,
and Ushinsky

Degree Offered: B.A.

Undergraduate Major. At least twenty-four semester hours (eight courses) offered in fulfillment of major requirements must be numbered 300 or higher. Double majors may be allowed to take eighteen semester hours (six courses numbered 300 or higher) with the approval of the department and should consult with the Russian staff to arrange a program compatible with the other major. Four of the courses must be language courses and the remainder in literature, which may be chosen by the student with the adviser's consent. All departmental majors must have their programs approved by the representative of the department.

Russian Courses

- 101a, 102b. Elementary Russian I, II** (3-2-4 each semester).
Fundamentals of Russian grammar. Pronunciation, reading, oral practice, and translation. *Staff*
- 110. Russian for Graduate Students** (3-0-0).†
- 201a, 202b. Intermediate Russian I, II** (3-0-3 each semester).
Grammar review, reading of selected texts, conversation, and composition. *Mr. Jones, Ms. Thompson*
- 301a, 302b. Reading, Composition, and Conversation** (3-0-3 each semester).
Emphasis on composition and conversation with reading of relevant texts. *Mr. Jones*
- 311, 312. Advanced Conversation** (3-0-3 each semester).†
Intensive practice in Russian conversation. Wide variety of topics drawn from everyday life, newspapers, contemporary short stories. Prerequisite: second-year competence or permission of instructor. *Mr. Ushinsky*

331a. Survey of Russian Literature I (3-0-3).†

A comprehensive survey of the best known Russian literature up to 1860. The emphasis is on the classic works of the nineteenth century. *Mr. Ushinsky*

332b. Survey of Russian Literature II (3-0-3).†

A comprehensive survey of Russian literature from 1860 to the Soviet period. *Mr. Ushinsky*

341a, 342. Studies in Nineteenth Century Literature (3-0-3 each semester).

Writers and literary trends of the nineteenth century. Fall topic: Dostoevsky. Readings and lectures in English; majors will do part in Russian. *Ms. Thompson*

401a, 402b. Russian Stylistics I, II (3-0-3 each semester).

Designed to improve the spoken and written language with emphasis on syntactic and idiomatic structures. *Mr. Ushinsky*

410. Russian Soviet Literature in European Perspective (3-0-3).†

The currents in Soviet letters with a look at the parallel or opposite tendencies in Western Europe at the same time. *Staff*

441a, 442b. Special Topics in Russian Literature (3-0-3 each semester).

Fall topic: The Russians; an introductory survey of Russian culture. Spring topic: Women in Russian Literature. Readings in English; Russian majors will do some reading and discussion in Russian. *Ms. Thompson*

450a,b. Independent Study (3-0-3 each semester).

Qualified students may conduct research and write a paper on a topic of particular interest. *Staff*

Health and Physical Education

Professor Bearden, *Chairman*; Professor Spence

Visiting Professor Poindexter

Adjunct Professor Skaggs

Associate Professors Barker and Bland

Assistant Professors Disch, Hampton, and Lee

Lecturers Bordelon and Eggert

Instructors Carr and McFall

Degrees Offered: B.A. with major in Physical Education; Health Education as teaching field only.

A minimum of 128 semester hours is required for the Bachelor of Arts with a major in physical education. The university distribution and skills requirements described on pages 50 and 51 must be satisfied. Physical education majors, including students planning physical education as a teaching field, must complete at least twenty-four semester hours of physical education courses plus eight semester hours selected from the following list of laboratories: Physical Education 125, 126, 221, 225, 226, 325, 326, 327, 328, 425, 426. Physical Education 105, 120, and 126 are required courses and should be taken as early as possible.

Both physical education and health education are offered as fields for teacher certification. Students wishing to qualify for teacher certification by the Texas Education Agency must complete twelve semester hours of English, six semester hours of American History, six semester hours of federal and state government, eighteen semester hours of education, twenty-four semester hours in another teaching field, and twenty-four semester hours of health

education courses or physical education courses, according to which is selected for the teaching field.

Health education courses **cannot** be used to fulfill the requirements for a major in physical education but may be taken as electives by **all students**.

Physical Education Courses

101a. Basic Health and Physical Education (0-2-0).

Includes a variety of physical education activities with emphasis on team sports. Required for the baccalaureate. *Staff*

102b. Basic Health and Physical Education (0-2-0).

Includes a variety of physical education activities with emphasis on individual sports. Required for the baccalaureate. *Staff*

105a. Foundations of Physical Education (3-0-3).

Study of contributions of history, philosophy, biology, physiology, anthropology, sociology, and psychology to the nature and structure of physical education. *Ms. Poindexter*

120b. Scientific Foundations of Physical Education (3-0-3).

An introduction to the scientific areas of physical education: anatomy, physiology, bio-mechanics, motor learning, evaluation and research. *Mr. Disch, Staff*

125a. Laboratory (0-3-1).

Methods of teaching and coaching the following team sports: soccer, volleyball, lacrosse, team handball, speedball, and rugby. *Mr. Hampton*

126b. Laboratory (0-3-1).

This course will certify students as water safety instructors. *Mr. Bland*

201a. Intramural Sports and Community Recreation Programs (3-0-3).

Study of the organization and administration of intramural sports programs and community recreation programs. *Mr. Barker*

221a. Laboratory (0-3-1).

The Red Cross multi-media standard first aid course including CPR (a prerequisite to Health 308). *Mr. Carr*

225a. Laboratory (0-3-1).

Methods of teaching and coaching the following physical education activities: handball, racquetball, squash, tennis, and badminton. *Mr. Barker*

226b. Laboratory (0-3-1).

Introduction to gymnastics including activities on tumbling, trampoline, parallel bars, balance beam, vaulting, and uneven parallel bars. *Mr. Hampton*

250b. Anatomy and Physiology (3-0-3).

Introduction to human anatomy and physiology, with emphasis on gross structure and basic concepts of function in man. *Mr. Spence*

301a. Kinesiology (3-0-3).

A review of applied anatomy, mechanical analysis of selected physical activities, and physical principles of body mechanics. Prerequisite: Physical Education 250 or consent of instructor. *Mr. Disch*

305a. Physical Education for Exceptional Children (3-0-3).

Areas of exceptionality displayed by children within the school or institution relative to the physical educator's role. *Mr. Bearden*

310b. Methods, Materials, and Curriculum Construction in Physical Education (3-0-3).

Study of methods of teaching physical education. Special emphasis on teaching techniques and the learning process. *Ms. Lee*

312b. Motor Learning (3-0-3).

Perceptual motor development from childhood through adulthood. Consideration of physiological and psychological factors affecting skill acquisition and development. *Ms. Poindexter*

319a. Tests and Measurements (3-0-3).

Introduction to basic statistics, test construction and evaluation as related to physical education. *Mr. Hampton*

321a. Physiology of Exercise (3-0-3).

Considers physiologic response of the circulatory, respiratory, and muscular systems to exercise stress. Prerequisite: Physical Education 250. *Mr. Spence*

323a. Laboratory (0-3-1).

Measuring physiologic response to exercise stress. (For students enrolled in Physical Education 321). *Mr. Spence*

325a. Laboratory (0-3-1).

Physical education activities included are recreational games, elementary rhythms, golf, archery, and fencing. *Mr. Bearden, Ms. Karff*

326b. Laboratory (0-3-1).

Techniques and responsibilities of the athletic trainer. *Mr. Eggert*

327a. Officiating Team Sports (0-3-1).

Laboratory to teach rules, mechanics and philosophy of officiating team sports. *Mr. Disch*

328b. Laboratory (0-3-1).

Modern and folk dance laboratory experience designed to improve teaching competency in contemporary and folk dance. *Ms. Karff*

400b. Organization and Administration of Health and Physical Education (Including Athletics), Secondary Schools (3-0-3).

Administrative policies and procedures, personnel, budgets, facilities, and equipment; office management, schedules, public relations, and publicity. Prerequisite: junior or senior standing. *Mr. Bearden*

411a. Concepts and Techniques of Athletic Coaching (3-0-3).

Coaching techniques, concepts, and problems in the major athletic sports. *Mr. Bland*

425a. Laboratory (0-3-1).

Methods of teaching and coaching the following sports: basketball and football. *Mr. Bland*

426b. Laboratory (0-3-1).

Methods of teaching and coaching the following sports: baseball and track. *Mr. Bland*

*Health Education Courses***101a. Nutrition (3-0-3).**

Designed to bring an understanding of the concepts underlying the science of nutrition: food composition, calories and needs for energy, special nutrients and nutritional deficiencies. *Mr. Awapara*

107a. Concepts in Health Science (3-0-3).

Designed to acquaint prospective health educators with the structure and function of health in our society. *Staff*

201a. Environmental Systems (3-3-4).

A study of the sociologic, economic, political, legal, scientific and engineering aspects of pollution and pollution abatement. *Mr. Ward*

208b. Chemical Alterations of Behavior (3-0-3).

Investigates the use, abuse, and misuse of alcohol, tobacco, and psycho-active drugs. *Mr. Hampton*

221a. Standard First Aid/Multi-Media (0-3-1).

The Red Cross multi-media standard first aid course (a prerequisite to Health 308). *Mr. Carr*

306b. Human Sexuality (3-0-3).

The role of the school and the family in relation to mental health, family life education, geriatrics, and death. *Staff*

308b. Emergency Care/Advanced First Aid Instructor (2-0-3).

Emergency care procedures of illness and traumatic injuries. Prerequisite: Health 221. *Mr. Carr*

356b. Sociology of Health and Illness (3-0-3).

Social and cultural factors that influence physical and mental disorders; behaviors that underlie the course of illness, and delivery of health care within American society. *Mr. Kaplan*

370a. History of Medicine (3-0-3).

Changing concepts of diseases and health developments in public health and the emergence of the modern health care profession. *Mr. Van Helden*

407a. Diseases of the Human Organism (3-0-3).

A study of communicable, noncommunicable, and sexually transmitted diseases affecting man. *Staff*

410b. Program Development in Health Education (3-0-3).

Content and methods in teaching health education, materials of the program and curriculum construction in secondary school health education programs. Prerequisite: junior or senior standing. *Staff*

History

**Professor Drew, *Chairman*; Professors Garside, Gruber,
Higginbotham, Hyman, Loewenheim,
Matusow, Rath, and Vandiver
Associate Professors Haskell, Stokes, Van Helden, and Wiener
Assistant Professors Miller and R. J. Smith**

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Major. A student majoring in history must take a minimum of thirty semester hours (ten courses) in history, of which eighteen semester hours (six courses) must be on the advanced level (300's or 400's). At least six semester hours (two courses) must be taken in American history, and at least six semester hours (two courses) in fields other than American history. Students are advised to acquaint themselves with humanistic disciplines other than history (for example, literature, fine arts, and philosophy), and also with social sciences such as political science, sociology, economics, and anthropology, whose contributions to historical studies are of increasing importance. Some foreign language proficiency is recommended for the potential traveler, researcher, or graduate student (most graduate schools require a reading knowledge of French and German for the Ph.D. degree).

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Study. Graduate students in history are accepted for study leading to either the M.A. or Ph.D. Holders of the B.A. degree (or its equivalent) from an acceptable institution are eligible to apply. The graduate program is designed to train a limited number of carefully selected students. Both the M.A. and the Ph.D. degrees are offered in limited areas of American and European history. Further information about the fields may be obtained on request from the department.

Graduate fellowships as well as graduate scholarships within the limits of available funds are awarded to qualified students with demonstrated ability. Fellowships include a stipend and a waiver of tuition; scholarships provide a

waiver of tuition only. As a part of their training all graduate students are expected to render limited services to the department as tutorial instructors, as research assistants, or as assistants to the editors of the *Journal of Southern History*, the *Austrian History Yearbook*, or *The Papers of Jefferson Davis*, all of which are sponsored by Rice University.

Requirements for the M.A. Candidates for the M.A. are expected to complete a certain amount of formal class or seminar work, usually twenty-four semester hours (eight courses); pass a reading examination in one foreign language (usually French or German); and write a thesis under the direction of an advisory committee of the department headed by a professor having special competence in the subject area of the thesis. An oral defense of the thesis is also required. Completion of these requirements usually take two years. Not more than three years may elapse between the time the student is admitted to graduate study and the completion of the degree, unless an extension is approved by the departmental graduate committee. An alternate M.A. degree is available to doctoral students who fulfill the special requirements set by the department.

Requirements for the Ph.D. Candidates for the Ph.D. degree are expected to prepare themselves for a qualifying examination in four fields, at least two of which must be in the major area of concentration (either European or American history). If the major area is European history, one field must be in American history; if the major is in American history, one field must be in European history. The fourth field may be outside the department if approved by the departmental graduate committee. Preparation for this qualifying examination (the passing of which qualifies the student for formal admission to candidacy for the Ph.D. degree) will normally include course work, seminars, directed reading, and a substantial amount of independent reading. The examination will usually be oral, though it may be written or both written and oral at the discretion of the department. It is given only after the student has completed all necessary course and seminar work and passed reading examinations in two foreign languages (usually French and German). Students should take the qualifying examination before the beginning of their sixth semester and must take it by the end of the sixth semester. In addition to the foreign language examinations and the qualifying examination, the Ph.D. candidate must present a dissertation embodying the results of original research and defend it in a public oral examination. This dissertation must be completed within three calendar years after passing the qualifying examination, unless an extension is granted by the departmental graduate committee.

History Courses

101a, 102b. The Essentials of European History (3-0-3 each semester).

Why has the world been so thoroughly reshaped by the European experience? A comprehensive attempt to answer that question.

Mr. Stokes, Staff

105a, 106b. Varieties of the American Experience (3-0-3 each semester).

Interpretive approaches to American history.

Mr. Gruber, Mr. Higginbotham, Mr. Matusow, Staff

201a. Ancient History (3-0-3).

History of the ancient Near East, Greece, the Roman Republic, and the Early Empire.

Mrs. Drew

202b. Medieval History (3-0-3).

A study of the late Roman Empire and the Middle Ages.

Mrs. Drew

211, 212. American Thought and Society (3-0-3 each semester).†

A topical introductory survey of American history, primarily concerned with intellectual and social developments underlying surface events.

Mr. Haskell

223a, 224b. History of Science (3-0-3 each semester).

A broad survey of the development of scientific ideas and methods from the ancient Greeks to the beginning of the twentieth century.

Mr. Van Helden

250b. Chinese Culture: Past and Present (3-0-3).

An introduction to the philosophy, religion, literature, arts, and social customs of China.

Mr. Smith

293b. The Art of War from Alexander to Napoleon (3-0-3).

The theory and practice of warfare from the classical age to the early nineteenth century.

Mr. Gruber

297a, 298b. Constitutional and Legal History of the United States (3-0-3 each semester).

Major questions in the historical development of American law and governing institutions.

Mr. Hyman

303a, 304b. Independent Readings (3-0-3 each semester).

Independent reading under the supervision of a faculty member. Open to a limited number of advanced students with special permission.

Staff

309, 310. American Thought and Society (3-0-3 each semester).†

An enriched version of History 211, 212. Students may not receive credit for both 211, 212 and 309, 310.

Mr. Haskell

312. Readings in the History of the Black American (3-0-3).†

Discussion, written and oral reports of selected reading.

Mr. Higginbotham

317. America's Alternatives (3-0-3).†

Major public policy decisions from the beginning of the national period to the present.

Mr. Hyman

319a. America in the Sixties (3-0-3).

An examination of the major social, political, and economic developments of the sixties.

Mr. Matusow

333. Martin Luther and the Reformation in Germany, 1517-1555 (3-0-3).†

An analysis of the Protestant Reformation as one of the decisive events in German history.

Mr. Garside

334. Calvin and Geneva, 1509-1564 (3-0-3).†

The intellectual and religious development of Calvin and the Reformation in Geneva.

Mr. Garside

337. History of the Ancient and Medieval Law (3-0-3).†

Ancient law focusing on imperial Roman law and the various forms of medieval law: vulgar Roman law, barbarian Germanic law, and English common law.

Mrs. Drew

338b. English Legal History (3-0-3).

Major topics in English legal history since the Middle Ages. The law as a mirror of social and political developments.

Mr. Wiener

341a. History of China to 1800 (3-0-3).

Survey of Chinese history from antiquity to about 1800, highlighting salient aspects of China's heritage.

Mr. Smith

342b. History of China Since 1800 (3-0-3).

China's revolutionary transformation in the nineteenth and twentieth centuries — from Ch'ing dynasty to People's Republic.

Mr. Smith

345. Medieval and Early Modern Russia (3-0-3).†

The history of Russia from the ninth century to the Crimean War.

Mr. Stokes

346a. The Russian Revolution (3-0-3).

The history of the Russian Revolution in its broadest sense, Marx through 1984.

Mr. Stokes

349. Nineteenth-Century Europe (3-0-3).†

An advanced survey of European history from the Congress of Vienna until World War I.

Mr. Rath

350a. Twentieth-Century Europe (3-0-3).

An advanced survey of European history from the outbreak of World War I to the present.

Mr. Rath

353a. The Comparative Modernization of China and Japan (3-0-3).

A comparative study of social, political, and intellectual change in China and Japan from 1800 to 1945. *Mr. Smith*

361a. The History of England to 1776 (3-0-3).

A survey of English history: England's change from a medieval backwater into the most advanced country in the world. *Mr. Wiener*

362b. The History of England Since 1776 (3-0-3).

England as the world's first industrial society and the political, social, and intellectual implications. *Mr. Wiener*

367a. History of British Cities (3-0-3).

The evolution of urban life in the world's first urban nation, especially during the past 200 years. *Mr. Wiener*

370a. The History of Medicine (3-0-3).

Changing concepts of health and disease from antiquity to the present and the rise of the modern health-care profession. *Mr. Van Helden*

371a. France from the Enlightenment to the Third Republic (3-0-3).

The place of the French Revolution in the evolution of French history from the mid-eighteenth century to 1870. *Mr. Miller*

372b. France from the Third Republic to the Present (3-0-3).

A study of continuity and change as France enters the twentieth century. *Mr. Miller*

375. Germany from the Middle Ages to the Nineteenth Century (3-0-3).†

A survey of German history from the decline of the Holy Roman Empire to the emergence of Bismarck. *Mr. Loewenheim*

376. Germany from Bismarck to the Present (3-0-3).†

A survey of German history from the Prussian constitutional conflict to a reassessment of German politics, culture, and society after World War II. *Mr. Loewenheim*

382. History of American Cities (3-0-3).†

Aspects of American urban development, eighteenth century through the present, with stress on constitutional, institutional, and social considerations. *Mr. Hyman*

384. Readings in the History of Science (3-0-3).†

Major problems in the history of science and their treatment by historians of science. *Mr. Van Helden*

386. The Scientific Revolution (3-0-3).†

Developments in science between 1500 and 1800. *Mr. Van Helden*

392. Europe in the Age of the Democratic Revolution (3-0-3).†

Ideas, politics, and international relations in Europe from George III to Congress of Vienna, with emphasis on England and France. *Mr. Gruber*

393b. The Art of War from Alexander to Napoleon (3-0-3).

An enriched version of History 293. Students may not receive credit for both 293 and 393. *Mr. Gruber*

395. A History of the South (3-0-3).†

The life and economy of the Southern people from the Colonial period. *Staff*

397a, 398b. Constitutional and Legal History of the United States (3-0-3 each semester).

An enriched version of History 297, 298. Students may not receive credit for both 297, 298 and 397, 398. *Mr. Hyman*

403a, 404b. Senior Thesis (0-0-3 each semester).

Open to well qualified students with special permission. Students must take both History 403 and 404 to gain credit. *Staff*

412b. The Early Republic (3-0-3).

The development of the United States from 1789 to 1848 with particular emphasis on political ideas and practices. *Mr. Higginbotham*

421. Chinese Communism (3-0-3).†

Development of Marxism in China from 1911 through the Great Proletarian Revolution of 1966-1969. *Mr. Smith*

425a. Crises in American Foreign Policy: The United States and Vietnam (3-0-3).

Research seminar on both the American role in the Vietnamese civil war since 1945 and the impact of the war on American society. *Mr. Matusow*

426b. America in the 1960's — Seminar (3-0-3).

Research seminar on political, economic, and social topics. Open to all undergraduates. *Mr. Matusow*

428. Problems in American Social and Intellectual History (3-0-3).†

Mr. Haskell

433a. Renaissance Humanism: From Petrarch to Machiavelli (3-0-3).

Studies in the transmission of the classical tradition in Italy in the fourteenth, fifteenth, and early sixteenth centuries. *Mr. Garside*

434b. Humanism in the Sixteenth Century (3-0-3).

The classical tradition in Northern Europe and its relationship to religious reform and the origins of modern science. *Mr. Garside*

440a. Social and Economic History of Europe in the Middle Ages (3-0-3).

Seminar covering selected problems in the social and economic history of medieval Europe. *Mrs. Drew*

442b. History of Astronomy and Cosmology (3-0-3).

History of astronomy and cosmology from antiquity to about 1850. *Mr. Van Helden*

446a. Twentieth-Century Military Biography (3-0-3).

Biographies of selected world military leaders from the 1890s through World War II. *Mr. Vandiver*

448. Military History of the United States (3-0-3).†

American Wars from the Revolution through World War II. *Mr. Vandiver*

450b. Chinese Culture: Past and Present (3-0-3).

An enriched version of History 250. Students may not receive credit for both History 250 and 450. *Mr. Smith*

453. Balkan History (3-0-3).†

Rumania, Yugoslavia, Bulgaria, Albania, Greece, and Turkey from the Byzantine period to the present. *Mr. Stokes*

455a. Europe from Bismarck to the First World War (3-0-3).

Aspects of Europe, 1871-1914, with special attention to Mazzini, Gladstone, Bismarck, and Burckhardt. *Mr. Loewenheim*

456. Europe and World Politics from Sarajevo to Pearl Harbor (3-0-3).†

Europe from 1914 to 1945 with special attention to the historic role of the United States in world affairs. *Mr. Loewenheim*

458b. Problems in Russian and East European History (3-0-3).

Selected topics from nineteenth and twentieth-century Russia and Eastern Europe. Pre-requisite: Russian or Balkan history or consent of instructor. *Mr. Stokes*

460. Europe and World Politics from Pearl Harbor to the Present (3-0-3).†

The aftermath of World War II, the Cold War, the era of Vietnam, and after. Special attention to role of the United States in world affairs. *Mr. Loewenheim*

461. The Age of Bismarck (3-0-3).†

The man and his time; ways he changed the course of Prussian, German, and European history. *Mr. Loewenheim*

462b. Hitler, Europe, and the World (3-0-3).

How and why Hitler and National Socialism took over Germany, conquered most of Europe, and finally met defeat and destruction. *Mr. Loewenheim*

463a, 464b. Truman, Stalin and the World: From Yalta to Korea; I, II (3-0-3 each semester).

The turbulent world from the death of F.D. Roosevelt to Korean War. *Mr. Loewenheim*

465a. Colonial America to 1754 (3-0-3).

The growth of society, thought, and politics in the English colonies of North America. Lectures, discussions, and papers. *Mr. Gruber*

466b. The American Revolution, 1754-1789 (3-0-3).

The origins and implications of the American Revolution, emphasizing constitutional, social, and political developments. *Mr. Gruber*

471a. Change and Conflict in an Industrialising Setting (3-0-3).

The industrialising experience and working class response in nineteenth-century Western Europe. *Mr. Miller*

475. The History of Central Europe Before 1815 (3-0-3).†

A survey of the main phases of the history of Central Europe from ancient times to 1815. *Mr. Rath*

476. The History of Central Europe Since 1815 (3-0-3).†

Main trends in the history of Central Europe from 1815 to the present. *Mr. Rath*

478. Nationalism (3-0-3).†

Pro-seminar in historical problems related to nationalism. *Mr. Stokes*

480b. History of the Modern Business Enterprise (3-0-3).

The emergence of big business in America and Western Europe. *Mr. Miller*

482. Modernization in Historical Perspective (3-0-3).†

The rise of industrial society in Europe, America, and the non-Western world since 1800. *Mr. Wiener*

493. Comparative Studies in Russian and Chinese History (3-0-3).†

Investigation of problems common to Chinese and Russian experience with emphasis on modernization. Prerequisite: Russian or Chinese history. *Mr. Smith, Mr. Stokes*

495b. Civil War and Reconstruction (3-0-3).

A study of the background of the War, the course of the War itself, and the economic and social consequences of the War. *Mr. Vandiver*

496. Civil War and Reconstruction (3-0-3).†

A continuation of History 495. *Mr. Vandiver*

501a, 502b. Historical Research (Credit variable).

Master's thesis. Students must take both History 501 and 502 in order to gain credit. *Staff*

511a, 512b. Directed Reading in American History I (0-0-3 each semester).

For graduate students only. *Staff*

513a, 514b. Directed Reading in American History II (0-0-3 each semester).

For graduate students only. *Staff*

517a, 518b. Directed Reading in History of Science, Technology, and Medicine (0-0-3 each semester).

For graduate students only. *Staff*

521a, 522b. Directed Reading in Medieval History (0-0-3 each semester).

For graduate students only. *Staff*

527a, 528b. Directed Reading in Non-Western History (0-0-3 each semester).

For graduate students only. *Staff*

529a, 530b. Directed Reading in Modern European History I (0-0-3 each semester).

For graduate students only. *Staff*

531a, 532b. Directed Reading in Modern European History II (0-0-3 each semester).

For graduate students only. *Staff*

533a. Colloquium in Nineteenth- and Twentieth-Century European History. (3-0-3).

A critical examination of the chief historical trends and main literature in the field. *Mr. Rath*

- 534. Colloquium in Nineteenth- and Twentieth-Century European History (3-0-3).†**
Continuation of History 533. *Mr. Rath*
- 545. Historiography (3-0-3).†**
Seminar in historical method and issues. Undergraduates admitted with special permission. *Mr. Haskell*
- 555, 556. Seminar in German History (3-0-3 each semester).†**
Frederick the Great, Bismarck, and Hitler. Studies in the history of the German political tradition. *Mr. Loewenheim*
- 565a. Seminar in Nineteenth- and Twentieth-Century European History (3-0-3).**
Selected topics in nineteenth- and twentieth-century European history. Qualified undergraduates admitted by special permission. *Mr. Rath*
- 566. Seminar in Nineteenth- and Twentieth-Century European History (3-0-3).†**
Continuation of History 565. *Mr. Rath*
- 571a, 572b. Seminar in First World War (3-0-3 each semester).**
Studies in the causes of World War I and the course of the war itself. Open to properly qualified graduate students after consultation with the instructor. *Mr. Vandiver*
- 573, 574. War and Society (3-0-3 each semester).†**
War as a perennial agent of major social change.
- 585a, 586b. Seminar in United States Constitutional and Legal History (3-0-3 each semester).**
Significant constitutional and legal questions stressing civil liberties, criminal law, civil-military relations, race relations, urban problems. *Mr. Hyman*
- 601a, 602b. Historical Research (Credit variable).**
Doctoral dissertation. May be repeated for credit. *Staff*
- 700c. Summer Graduate Research.** *Staff*
- 701a, 702b. Historical Research.**
Doctoral dissertation. For students not in residence. *Staff*
- 800b. Degree Candidate Only.** *Staff*

Legal Studies

Degree offered: B.A.

Requirements for the Undergraduate Major in Legal Studies. Students majoring in legal studies are required to take the following eight courses: Economics 438; History 297 or 397, 298 or 398; Philosophy 307, 316; Political Science 309, 326, 310 or 321. In addition, students must take four of the following electives: Anthropology 371; Economics 436, 461, 483; Environmental Science and Engineering 401; History 337, 338; Legal Studies 201, 202, 401, 402; Philosophy 101, 314; Political Science 315, 321, 325, 337, 410; Psychology 444; Sociology 321.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

*Legal Studies Courses***201a, 202b. Introduction to Legal Studies I, II (3-0-3 each semester).**

An introduction to the interdisciplinary study of the law as a fundamental social institution and of the values it embodies. *Staff*

401a, 402b. Senior Seminar I, II (3-0-3 each semester).*Staff*

Linguistics

Associate Professor Copeland, *Chairman*; Professor Tyler
Associate Professors P. W. Davis, R. G. Jones, and Urrutibéheity

Requirements for the Undergraduate Major in Linguistics. Students majoring in linguistics are required to take a total of thirty semester hours (ten courses) in linguistics, of which twenty-four semester hours (eight courses) must be on the 300 level or above. All majors are required to take Linguistics 201, 202, or the equivalent. With the approval of the major adviser, related courses offered by other departments may be taken for credit toward fulfillment of the requirements in linguistics.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

*Linguistics Courses***201a. Introduction to General Linguistics (3-0-3).**

The study of language and linguistics including basic synchronic concepts and techniques: phonetic transcription, phonological, grammatical, and semantic systems. Also offered as Anthropology 207. *Mr. Davis*

202b. Introduction to General Linguistics (3-0-3).

A continuation of the above with an introduction to diachronic linguistics and methods in linguistic prehistory. Also offered as Anthropology 208. *Mr. Davis*

300. Language and Communication Codes (3-0-3).†

Language and its relation to animal communication; human social codes; propaganda, politics and exploitation; artistic expression; sex; pathological states; myth.

301b. Phonological Analysis (3-0-3).

Techniques, assumptions of phonological analysis; various phonological theories current in modern linguistics. Prerequisite: Linguistics 201, 202 or consent of instructor. Also offered as Anthropology 304. *Mr. Davis*

302. Syntactic Analysis (3-0-3).†

The theory and techniques of syntactic analysis. Prerequisite: Linguistics 201, 202 or consent of instructor. Also offered as Anthropology 302.

303a. Modern Linguistic Theory (3-0-3).

A survey of the development of linguistic theory from de Saussure to the present. Prerequisite: Linguistics 201, 202 or consent of instructor. Also offered as Anthropology 303. *Mr. Davis*

305. Historical Linguistics (3-0-3).†

Language change in terms of transformational generative grammar, social and geographical context, and process of language acquisition. Also listed as Anthropology 305.

310. Language and Culture (3-0-3).†

Investigates the systematic relations between linguistic form and expression and culture. Also offered as Anthropology 313.

401a, 402b. Independent Study in Linguistics (3-0-3 each semester). *Staff*

405. Applied Linguistics (3-0-3).†

The relation of structural linguistics to the teaching of modern languages. Prerequisite: Linguistics 201, 202, or consent of instructor.

406. Field Methods and Analytic Techniques (4-0-4).†

The techniques of observation, analysis, and recording of human language. Prerequisite: Linguistics 201, 202, or consent of instructor. Also offered as Anthropology 403.

409a. Special Topics in Linguistics (3-0-3).

Topics will change from year to year, to include such subjects as mathematical and computational linguistics, transformational grammar, stratificational theory, pragmatic theory, the history of linguistics, acoustic phonetics. May be repeated for credit. Prerequisite: Linguistics 201, 202, or consent of instructor. *Mr. Copeland*

410b. Cognitive Anthropology (3-0-3).

Relations between thought, language, and culture. Systems of folk classification and the logical principles underlying them. Also offered as Anthropology 406. *Mr. Tyler*

412b. Linguistic Anthropology (3-0-3).

Linguistic theory and method in the analysis of cultural materials. Also offered as Anthropology 508. *Mr. Tyler*

466. Philosophy of Language (3-0-3).†

Nature and use of language; such notions as analyticity, meaning, reference, speech act. Also offered as Philosophy 466. Prerequisite: two courses in linguistics or philosophy.

Mathematical Sciences

Professor Tapia, *Chairman*; Professors Bowen, S. H. Davis, de Figueiredo, Kilpatrick, Michel, Miele, Pfeiffer, Rachford, Schum, Thrall, J. R. Thompson, Wang, Wilhoit, and Young
Adjunct Professors B.W. Brown, Cardus, Downs, Frankowski, Gehan, Gorry, Jansson, Sperling, and Zimmerman
Associate Professors Kennedy, Lutes, and Wheeler
Adjunct Associate Professors Forthofer, Hacker, Hsi, and Kapadia
Assistant Professor Blattner
Adjunct Assistant Professors Herson, Johnston, and Thames
Lecturer Campise

Degrees Offered: B.A., M.A.Ma.Sc., M.A., Ph.D.

The **Undergraduate Program** allows students considerable freedom to plan a course of study consistent with their particular interests in mathematics and its applications. Available courses provide foundations for applications to many fields of engineering, physical sciences, life sciences, behavioral and social sciences, and computer science.

Within the flexible framework of university requirements, the program consists of three parts: (1) basic courses in mathematics and computer science, (2) introductory courses in appropriate areas of mathematical sciences, and (3) electives for which major credit is given.

1. Students normally take eight basic courses, as follows:

Elementary analysis: Mathematics 101, 102 or honors equivalent

Differential equations: Mathematics 211 or more advanced introduction

Multivariable calculus: Mathematics 212

Linear algebra: Mathematics 355 or Mathematical Sciences 310

Algebraic structures: Mathematics 356 or 463 or Mathematical Sciences 316 or 411.

Computer science: Mathematical Sciences 220 or 222 or 223 or approved alternate

Model building: Mathematical Sciences 300 or 301 or approved alternate

2. Students also take one course in three of the following areas:

Computer science: Mathematical Sciences 320 or 321

Numerical analysis: Mathematical Sciences 353, 451, or 452

Operations research and optimization: Mathematical Sciences 460, 463, 464, 471, 472, or 476

Physical mathematics: Mathematical Sciences 330, 340, or 343 or Mathematics 381 or 382 or approved alternate

Probability and statistics: Mathematical Sciences 380 or 381

3. Students also take seven elective courses for credit toward the mathematical sciences major, as follows:

Two additional courses in one of the areas selected above, but not limited to the courses listed above

At least one additional course in mathematics or mathematical sciences

At least four courses in fields where mathematics may be applied

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

A student contemplating work in mathematical sciences is encouraged to contact any member of the department, particularly the members of its undergraduate committee, who will help the student explore possible programs suited to individual needs and interests.

The Department of Mathematical Sciences participates in the inter-departmental program in managerial studies. More information may be obtained from the description on page 55. Interested students may consult with the departmental adviser for this program.

The Graduate Program. Admission to graduate study in mathematical sciences is open to qualified students holding bachelor's or master's degrees (or their equivalent) in engineering, mathematics, or physical, biological, mathematical, or behavioral sciences. The credentials of each applicant will receive individual evaluation by the faculty of the department. An applicant holding only a bachelor's degree should submit quantitative and verbal scores from the Graduate Record Examination when requesting application forms.

The graduate program is designed for students seeking the professional degree of Master in Applied Mathematical Sciences or the research degrees of Master of Arts or Doctor of Philosophy. It normally takes one or two years to obtain a master's and three or four years to obtain a Ph.D. degree. A master's degree is not a prerequisite for the Ph.D. degree.

The professional degree emphasizes the applied aspects of the mathematical sciences. This degree is intended for persons who plan careers as practitioners rather than primarily as researchers. Presently this degree emphasizes the following areas, singly or in combination: (1) computer science, (2) statistics, (3) operations research, (4) numerical analysis. Further information about this degree may be obtained from the department.

The granting of a research degree presupposes demonstrated ability to do advanced original research. Students are encouraged to initiate research activities at the earliest possible time in their graduate study. Presently the research interests of the faculty are in the following five major areas: (1) computer science and numerical analysis, (2) statistics and probability, (3) operations

research and game theory, (4) systems and control theory, (5) mathematical models in physical, biological, or behavioral sciences. Further information about these areas may be obtained from the department.

Graduate fellowships, research assistantships, and graduate scholarships are available and are awarded on the basis of merit to qualified students. Current practice in the department is for most doctoral students of good standing to receive some financial aid. As an integral part of their scholastic programs, all graduate students are expected to attain some proficiency in teaching by engaging in instructional assignments of the department.

The Master in Applied Mathematical Sciences requires satisfactory completion of at least thirty semester hours approved by the department.

Requirements for the Master of Arts Degree:

1. Satisfactory completion of at least thirty semester hours (including thesis) at the graduate level. Normally five courses must be in mathematical sciences. Specific courses of study should be formulated in consultation with the student's adviser and must be approved by the department.
2. An original thesis acceptable to the department; note, however, that successful performance on the qualifying examination fulfills the master's thesis requirement for a student working toward the Ph.D. degree
3. Satisfactory performance on a public oral examination on the thesis; the procedure for the public oral examination is given in the general rules of the university

Requirements for the Ph.D. Degree:

1. Satisfactory completion of courses of study approved by the department. At least two courses outside the department are required.
2. Satisfactory performance on preliminary and qualifying examinations and reviews
3. Satisfactory completion of two semester courses or a reading examination on an approved foreign language
4. An original thesis acceptable to the department
5. Satisfactory performance on a final public oral examination on the thesis. The procedure is given in the general rules of the university.

Mathematical Sciences Courses

Note: Only one of the courses Mathematical Sciences/Electrical Engineering 220, 221, 222, 223, or Engineering 240 may be taken for credit.

220a,b. Introduction to Computer Science and Engineering (3-3-4).

A semi-self-paced introduction to programming in PL/1 for students in computer science and engineering. Also offered as Electrical Engineering 220. *Staff*

221a,b. Digital Computing in the Humanities and Social Sciences (3-3-4).

A semi-self-paced introduction to programming in PL/1 with emphasis on problems from the humanities and social sciences. Also offered as Electrical Engineering 221. *Staff*

222a,b. Introduction to Business Data Processing (3-3-4).

A semi-self-paced introduction to programming in PL/1, with emphasis on business applications and problems. Also offered as Electrical Engineering 222. *Staff*

223a,b. Introduction to Computing (3-3-4).

A semi-self-paced introduction to computer solution of equations using APL and PL/1. Also offered as Electrical Engineering 223. *Staff*

280a,b. Elementary Applied Statistics (3-0-3).

A noncalculus introduction to statistics for students with interests in the social sciences.
Mr. Scott, Mr. Thompson

300b. Model Building (3-0-3).

Examples to illustrate mathematical formulation (modeling) of scientific problems, their solution and interpretation. Emphasis on physical science models. *Staff*

301a. Model Building (3-0-3).

Same as Mathematical Sciences 300 except emphasis is on behavioral science models. *Staff*

310b. Linear Algebra (3-0-3).

Concepts and results of linear algebra useful in a variety of fields of application.

Mr. Thrall, Staff

316a. Introduction to Discrete Structures (3-0-3).

Set theory, relations, mappings; algebraic systems such as semigroups, groups, rings, fields, graph theory, Boolean algebra, and propositional logic. Also offered as Electrical Engineering 316. *Mr. Thrall*

320a,b. Computer Organization and Software (3-3-4).

Basic computer architecture. System software, including loaders, assemblers, and operating systems. Advanced programming techniques. Micro-programming. Input-output. Also offered as Electrical Engineering 320. *Staff*

321a,b. Advanced Programming (3-3-4).

Advanced programming methods, including structured programming, team programming, data structures, searching and sorting, data management, and information retrieval. Prerequisite: Mathematical Sciences 220. Also offered as Electrical Engineering 321.

Ms. Blattner, Staff

322a. Introduction to Management Information Systems (3-0-3).

Basic concepts for development and implementation of computer-based management systems. Field assignments in local industry. Prerequisite: Mathematical Sciences 222. Also offered as Electrical Engineering 322. *Mr. Campise*

330a,b. Complex Variables (3-0-3).

Discussion of the basic concepts of complex variable theory, and applications to the solution of physical problems. Prerequisite: Mathematics 211. *Mr. Wang, Mr. Davis*

340b. Partial Differential Equations for Engineers and Scientists (3-0-3).

Elementary methods for the solution of partial differential equations and boundary value problems in engineering and physical sciences. Prerequisite: Mathematics 211. *Mr. Wilhoit*

343a. Partial Differential Equations and Complex Variables for Engineers and Scientists (4-0-4).

Standard methods of solution for partial differential equations of mathematical physics. Introduction to functions of a complex variable and Laplace transform. Prerequisite: Mathematics 211. *Mr. Bowen*

353a,b. Topics in Computational Numerical Analysis with Computer Laboratory (3-1-3).

An introductory course in numerical analysis with computer applications. Prerequisite: Mathematics 211. *Staff, Mrs. Wheeler*

376a. Quantitative Analysis in Managerial Decisions (3-0-3).

Mathematical models in deterministic and stochastic situations, including linear programming, inventory theory, decision theory, waiting line theory. Prerequisite: one year of college mathematics and statistics course. Also offered as Accounting 376. *Mr. Thrall*

380a. Introduction to Probability (3-0-3).

An introduction to probability for students in the behavioral, social, and biological sciences. Prerequisite: Mathematics 102 or 103. *Mr. Schum*

381a,b. Introduction to Applied Probability (3-0-3).

An introduction to the concepts, interpretations, elementary techniques, and applications of modern probability theory, including a brief introduction to statistical inference. Prerequisite: Mathematics 102. Also offered as Electrical Engineering 331. *Mr. Lutes, Mr. Pfeiffer*

400a,b. Advanced Model Building (3-0-3).

Continuation of Mathematical Sciences 300 or 301, with an increased emphasis on the mathematical solution phase. Prerequisite: permission of instructor. *Staff*

411a. Group Theory for Chemists and Physicists I (3-0-3).

Symmetries of physical laws and structures and associated transformation groups. Applications to problems in atomic, solid state, and molecular physics and chemistry. Prerequisite: Linear algebra and elementary quantum mechanics. *Mr. Kilpatrick*

412. Group Theory for Chemists and Physicists II (3-0-3).†

Continuation of Mathematical Sciences 411.

416b. Automata and Formal Languages (3-0-3).

Finite automata, regular expressions, regular languages, pushdown automata, context-free languages, Turing machines, recursive languages, computability, and solvability. Prerequisite: Mathematical Sciences 316. Also offered as Electrical Engineering 416. *Ms. Blattner*

417. Combinational Analysis (3-0-3).†

Solution of enumeration problems, using the methods of inclusion and exclusion and generating functions, distributions, permutations, graphical enumeration. *Mr. Kilpatrick*

420b. Algorithms and Data Structures (3-3-4).

The design and analysis of computer algorithms. Models of computation, data structures, and efficiency considerations. Prerequisite: Mathematical Sciences 316, 321. Also offered as Electrical Engineering 420. *Mr. Hirschberg*

421a. Systems Programming (3-3-4).

Introduction to the design and construction of important software systems programs, including assemblers, compilers, and operating systems. Prerequisite: Mathematical Sciences 316, 320, 321. Also offered as Electrical Engineering 421. *Mr. Hirschberg*

422b. Case Studies in Management Information Systems and Data Processing (3-0-3).

Case studies. Semester project includes building a decision model and making computer runs to obtain recommended policy decisions. *Mr. Campise*

432b. Tensor Analysis (3-0-3).

Review of linear algebra. Tensor algebra. Tensor analysis on Euclidean spaces. Applications to particle mechanics, continuum mechanics, and electromagnetic theory. Prerequisite: Linear algebra. *Mr. Wang*

440a. Mathematical Methods in Physics and Engineering (3-0-3).

Application of linear operator theory and transform techniques in the solution of ordinary and partial differential equations of engineering and mathematical physics. Prerequisite: Mathematical Sciences 330. *Mr. Hill*

451a. Computational Methods and Analysis in Numerical Linear Algebra (3-0-3).

A study of numerical methods in linear algebra. *Mr. Rachford*

452b. Computational Methods for Differential Equations with Computer Laboratory (3-3-4).

Finite difference, variational, and collocation methods for approximating numerically solutions of ordinary and partial differential equations. Computer implementation to verify convergence to the solution. *Mrs. Wheeler*

453. Methods and Analysis in Ordinary Differential Equations (3-0-3).†

Several popular methods for solving systems of differential equations, including analysis of methods of quadrature and methods for integral equations. Prerequisite: Mathematics 211. *Staff*

454b. Computational Methods in Nonlinear Systems (3-0-3).

Analysis and computer applications of modern methods for solving nonlinear algebraic systems and nonlinear constrained optimization problems in R^n . Prerequisite: Mathematics 211, 212, and linear algebra. *Mr. Tapia*

460a. Foundations of Optimization Theory (3-0-3).

Derivation and application of necessity conditions and sufficiency conditions for constrained optimization problems. Prerequisite: Mathematics 212. *Mr. Tapia*

463a. Minimization of Functions (3-0-3).

Theory of maxima and minima. Analytical methods. Numerical methods. Also offered as Mechanical Engineering 463. *Mr. Miele*

464b. Minimization of Functionals (3-0-3).

Optimal control theory. Calculus of variations. Analytical methods. Numerical methods. Also offered as Mechanical Engineering 464. *Mr. Miele*

471a. Linear Programming (3-0-3).

Formulation of managerial and technical problems; simplex method; revised simplex method; duality theory and applications; transportation problems; decomposition techniques. Also offered as Economics 471. *Mr. Young*

472. Game Theory (3-0-3).†

Matrix games; the minimax theorem; relation to linear programming. Continuous games; multi-stage games. Differential games. *Staff*

475. Operations Research, Deterministic Models (3-0-3).†

Optimization problems in a managerial and economic context. Familiarity with linear programming and microeconomic theory is strongly recommended. Also offered as Economics 475. *Mr. Young*

476b. Operations Research, Stochastic Models (3-0-3).

Decision theory, waiting-in-line theory. Markov chains, inventory models, replacement models, simulation. Prerequisite: Mathematical Sciences 380 or 381. Also offered as Economics 476. *Staff*

477b. Mathematical Structure of Economic Theory I (3-0-3).

Exposition of the theory of competitive economies from a mathematical perspective, unifying calculus, matrix algebra, and set-theoretic approaches. Prerequisite: Economics 211, Mathematics 212, Mathematical Sciences 310. Also offered as Economics 477. *Mr. Brito*

478. Mathematical Structure of Economic Theory II (3-0-3).†

Continuation of Economics/Mathematical Sciences 477, which is a prerequisite. Also offered as Economics 478. *Mr. Pomeroy*

480b. Introduction to Statistical Method (3-0-3).

A survey of distribution theory, estimation theory, and hypothesis testing. Prerequisite: Mathematical Sciences 380 or 381. *Mr. Scott*

481a. Introduction to Mathematical Statistics (3-0-3).

Intended for students contemplating advanced study in statistical theory. Prerequisite: Mathematical Sciences 380 or 381. *Mr. Thompson*

482a. Introduction to Mathematical Probability (3-0-3).

Measure-theoretic foundations of probability theory for students who need access to advanced mathematical literature in applied probability. *Mr. Pfeiffer*

483a. Markov and Related Processes (3-0-3).

Conditional expectation and conditional independence; Poisson processes; Markov chains; continuous-parameter Markov processes; renewal processes. Prerequisite: Mathematical Sciences 380 or 381. *Mr. Pfeiffer*

484b. Second-order Random Processes (3-0-3).

An introduction to second-order random processes. Covariance analysis; spectral representation; mean-square calculus; Hilbert space ideas and linear estimation. Prerequisites: Mathematics 211, 212, and Mathematical Sciences 380 or 381. *Mr. Pfeiffer*

The following three courses are offered occasionally by CAMS (Houston Council for Applied Mathematical Sciences).

486a. Linear Models (3-0-3).

Univariate distribution theory and inference. Multivariate normal distribution. Multiple and partial correlation. Wishart distribution. Prerequisite: Linear algebra and one year of probability and statistics. *Staff*

487b. Multivariate Analysis (3-0-3).

Continuation of Mathematical Sciences 486. Hotelling's T^2 . Fisher's linear discriminant function. Principal component analysis. Multivariate analysis of variance. Multivariate non-normal distributions. *Staff*

488. Bayesian Foundations of Statistical Inference (3-0-3).†

Bayes' theorem; vague prior knowledge; inference for multivariate distributions; approximation methods; natural conjugate priors; likelihood principle. *Staff*

490a, 491b. Independent Study in Mathematical Sciences (Credit variable). *Staff*

492a/b, 493a/b. Computer Science Special Projects (1-6-3 each semester).

Independent and group work on large software systems. Complete implementations, including programming, debugging, verification, and documentation. Prerequisite: permission of instructor. *Mr. Kennedy, Ms. Blattner*

516. Theory of Parallel Computation and Concurrent Systems (3-0-3).†

Computer graphs, computational schemata, Petre nets, asynchronous and concurrent control structures, determinism deadlock, and synchronization problems. Prerequisite: Mathematical Sciences 416. Also offered as Electrical Engineering 516. *Mr. Jump*

517. Topics in Automata Theory (3-0-3).†

Topics such as algebraic structure of machines. Krohn-Rhodes decomposition, probabilistic automata, a-transducers, and tree automata. Prerequisite: Mathematical Sciences 416. Also offered as Electrical Engineering 517. *Ms. Blattner*

518a. Analysis Techniques for Combinatorial Algorithms (3-0-3).

Introduction to concepts of problem complexity and analysis of algorithms to find bounds on complexity. Reducibility among combinatorial problems and approximation algorithms for "hard" problems. Prerequisite: Mathematical Sciences 416, 420. Also offered as Electrical Engineering 518. *Mr. Hirschberg*

520a. Operating Systems (3-3-4).

Procedure implementation, processes, synchronization and communication, memory management, name management, protection, resource allocation, and pragmatic aspects of systems building. Prerequisite: Mathematical Sciences 381; 420. Also offered as Electrical Engineering 520. *Mr. Feustel*

521b. Artificial Intelligence (3-3-4).

Techniques for machine simulation of intelligent behavior: problem solving, game playing, pattern perception, and automatic programming. Prerequisite: Mathematical Sciences 420 and 381. Also offered as Electrical Engineering 521. *Ms. Blattner*

523b. Compiler Construction (3-3-4).

Advanced topics in the design of programming language compilers, including parsing, run-time storage management, code generation and optimization, error recovery. Prerequisite: Mathematical Sciences 416, 421. Also offered as Electrical Engineering 523. *Staff*

533, 534. Advanced Tensor Analysis I, II (3-0-3 each semester).†

Differential and integral calculus on manifolds. Riemannian geometry. Calculus of variations. Hamilton-Jacobi theory. Applications to analytical mechanics, relativity, and continuum mechanics. Prerequisite: Mathematical Sciences 423. *Mr. Wang*

535, 536. Mathematical Theory of Nonlinear Elasticity I (3-0-3 each semester).†

Representation theory for the constitutive relations for elasticity; homogeneous and inhomogeneous bodies; wave propagation; second-order elasticity and approximations. Prerequisite: Mechanical Engineering 511, 512, or Mathematical Sciences 432. *Mr. Wang*

537. Mathematical Theory of Non-Newtonian Fluids (3-0-3).†

Constitutive relations for materials with memory effects, simple fluids, viscometric flows, motions with constant stretch history, fluid crystals, second-order fluids, and other approximation methods. *Mr. Wang*

540b. Applied Functional Analysis (3-0-3).

Applications of basic concepts and theorems in functional analysis to mechanics, quantum mechanics, and/or optimal control problems. *Mr. Bowen*

541. Partial Differential Equations I (3-0-3).†

Selected topics from first-order partials; characteristics and classifications; initial value problems; boundary-value problems for elliptic equations; Riemann's, Green's, and Neumann's functions; and applications. *Mr. Bowen*

542b. Partial Differential Equations II (3-0-3).

Selected topics, arranged in such a way that Mathematical Sciences 541 is not a prerequisite. *Mr. Wang*

544b. Mathematical Methods of Physics (3-0-3).

Selected mathematical techniques useful in the solution of problems in physics and space physics. Prerequisite: Physics 301, 302, Mathematical Sciences 440 is desirable. Also offered as Space Physics 544.
Mr. Hill

551. Analysis of Numerical Methods for Partial Differential Equations (3-0-3).†

Analysis of modern methods, including finite-difference methods, finite-element methods, collocation methods, and associated algebraic problems. Also offered as Mathematics 438.
Mr. Wang

552b. Approximation Theory (3-0-3).

Least-squares, Chebyshev, and rational approximations; splines and finite-element subspaces; degree of approximation and related concepts.
Mr. de Figueiredo

553, 554. Advanced Topics in Numerical Analysis I, II (3-0-3 each semester).†

The content of the course will vary from year to year at the discretion of the instructor. Neither course is a prerequisite for the other.
Mrs. Wheeler, Mr. Wang

563a. Minimization of Functions (3-0-3).

Same as Mathematical Sciences 463, with one exception: emphasis is placed on computer methods. Also offered as Mechanical Engineering 563.
Mr. Miele

564b. Minimization of Functionals (3-0-3).

Same as Mathematical Sciences 464, with one exception: emphasis is placed on computer methods. Also offered as Mechanical Engineering 564.
Mr. Miele

571. Topics in Linear Programming (3-0-3).†

Continuation of Mathematical Sciences 471. Schema and duality; double description of classes of convex linear sets; algorithms for problems with special structures; illustrations from managerial and technical problems.
Mr. Thrall

572. Topics in Theory of Games (3-0-3).†

Utility theory; theory of 2-person general-sum games; bargaining and threats. Theory of n -person games; solution concepts and extensions. Optional topics.
Staff

573. Nonlinear Programming (3-0-3).†

Theory and computational methods for nonlinear programming, including: Kuhn-Tucker conditions, duality theory, methods for constrained optimization of convex and non-convex problems. Also offered as Economics 573.
Staff

574b. Integer Programming (3-0-3).

Applications theory, and computational methods in pure and mixed integer programming. Special problem structures.
Mr. Young

580a,b. Introduction to Statistical Inference (3-0-3).

A methods course for graduate students with limited mathematical background. Not open to mathematical sciences majors.
Staff

581. Estimation Theory (3-0-3).†

Concepts and criteria in estimation; theory and applications of linear and nonlinear estimation; Wiener and Kalman filtering; linear and nonlinear system identification. Prerequisite: Mathematical Sciences 481.
Mr. de Figueiredo

582. Stochastic Processes (3-0-3).†

Mathematical foundations for advanced study of applied random processes. Topics such as separability and measurability; analytic properties of sample functions; linear transformations; independent increments; stochastic integrals. Prerequisite: Mathematical Sciences 482.
Mr. Pfeiffer

583b. Detection Theory and Pattern Recognition (3-0-3).

Decision theory; detection of stochastic signals in colored noise; parametric and nonparametric approaches to detection and pattern classification. Also offered as Electrical Engineering 538.
Ms. Kazakos

585a. Information Theory (3-0-3).

Introduction to information theory concepts. Measures of information. Noiseless coding. The discrete, memoryless channel. Error bounds. Techniques of coding and decoding. Convolutional codes. Source encoding. Also offered as Electrical Engineering 535.
Ms. Kazakos

Advanced Topics in Theoretical Statistics I, II, III, IV.

This two-year sequence (Mathematical Sciences 586a, 587b, 588a, 589b will vary from year to year. Subjects may include: Monte Carlo techniques, time series analysis, non-parametric statistics, hypothesis testing, regression theory. Prerequisite: Mathematical Sciences 480 or 481.

Mr. Thompson, Mr. Scott

590a, 591b. Topics in Operations Research (3-0-3 each semester). *Staff*

592a, 593b. Topics in Applied Mathematics (3-0-3 each semester). *Staff*

596a, 597b. Special Topics in Mathematical Sciences (3-0-3 each semester).
Independent study. *Staff*

599a,b. Pro-Seminar (3-0-3).

For predoctoral students in mathematical sciences. Seminar meets weekly for entire year and carries total of three hours credit. *Mr. Wang*

600a, 601b. Thesis. *Staff*

617. Continuum Mechanics I (3-0-3).†

Advanced topics in continuum mechanics. Theory of constitutive equations. Theories of fading memory. Thermodynamics of materials with memory. Prerequisite: Mechanical Engineering 511, 512. Also offered as Mechanical Engineering 617.

618. Continuum Mechanics II (3-0-3).†

Recent developments in continuum mechanics. Typical topics: irreversible thermodynamics; electromagnetic interaction with general materials; theories of mixtures; continuum dislocation theories. Prerequisite: Mathematical Sciences 617. Also offered as Mechanical Engineering 618.

623b. Syntactic and Semantic Elements of Programming Languages (3-3-4).

Syntactic and metasyntactic definition of languages. Fundamental elements and structures of programming languages and their implementation. Prerequisite: Mathematical Sciences 523. Also offered as Electrical Engineering 623. *Mr. Feustel*

641, 642. Topics in Experimental Design I, II (3-0-3 each semester).†

Discussion and interpretation of current literature and research relevant to the environmental sciences. Also offered as Environmental Science and Engineering 641, 642.

686a, 687b, 688a, 689b. Advanced Topics in Applied Statistics I, II, III, and IV (3-0-3 each semester).

This two-year sequence will vary from year to year. Topics will include bioassay, sampling theory, survival studies, experimental design, analysis of variance, data analysis. The courses are arranged so that none is a prerequisite to any other, unless noted otherwise.

700c. Summer Graduate Research (Credit variable).

800b. Degree Candidate Only.

Mathematics

Professor Wells, *Chairman*; Professors Bochner, Curtis, Harvey, Hempel, Jaco, B. F. Jones, Polking, Rachford, Taylor, and Veech
Visiting Professor Weinstein

Visiting Associate Professors Berthier and Calderon

Assistant Professors Shalen and Stanton

Instructors Beatrous, Dadok, and Fegan

Degrees Offered: B.A., M.A., Ph.D.

Requirements for the Undergraduate Major. It is possible to major in mathematics in either the science, engineering, or humanities program. There are two major programs.

1. *Regular major.* Mathematics 101, 102, or 121, 122 and 211, 212 or 221, 222 and at least twenty-four semester hours (eight courses) in courses numbered

300 or above in the Mathematics Department. A student can receive advanced placement credit for Mathematics 101 by achieving a score of 4 or 5 on the AP AB level test or for Mathematics 101 and 102 by achieving a score of 4 or 5 on the BC level test. Students who have had calculus but have not taken the AP test may petition the Mathematics Department for a waiver of the calculus requirements for a major in mathematics.

2. *Double major.* The requirements for the double major are the same as above with the exception that up to nine of the twenty-four semester hours numbered 300 or above can be replaced by approved mathematics-related courses.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Program. Admission to graduate study in mathematics will be granted to a limited number of students who have indicated ability for advanced and original work. Normally one or two years are required after the bachelor's degree to obtain an M.A. degree and three or four years to obtain a Ph.D. An M.A. is not a prerequisite for the Ph.D.

A number of graduate scholarships and fellowships are available and will be awarded on the basis of merit. As part of the graduate education in mathematics, each graduate student is normally expected to engage in teaching or other instructional duties. Generally less than six hours a week is devoted to such duties.

The Qualifying Examinations. The qualifying examinations in mathematics consist of two parts: the general examination and the advanced examination.

1. *The general examination* consists of three parts, covering algebra, analysis, and topology, respectively. The examination will be given twice a year, in mid-September and in mid-January. A student should take this examination after the third semester of graduate study or sooner. A student who fails one or more parts of the general examination may, with the approval of the departmental graduate committee, be allowed to retake the appropriate part(s) at the next scheduled examination time. A student generally will not be allowed to take any part of the general examination more than two times.

2. *Advanced oral examination.* After completing the general examination the student should prepare for an advanced oral examination by selecting some special field (e.g., homotopy theory, several complex variables, group theory, etc.), and submitting the topic to the departmental graduate committee for approval. The time of the advanced examination will be scheduled by the graduate committee, and will normally be within six to nine months after the general examination. A student who fails the advanced examination may, with the approval of the graduate committee, be allowed to retake it (on the same, or possibly a different topic), but will generally not be allowed to take the advanced examination more than two times.

The Master's Degree. Requirements for candidacy for the Master of Arts degree:

1. Satisfactory completion (grade of 2 or better) of a course of study approved by the department and fulfillment of the general rules of the university (described on page 91). Transfer of credits from another university will be allowed only when approved by both the department and the University Graduate Council.

2. Satisfactory performance on an examination in at least one approved foreign language (French, German, or Russian)

Other requirements for the master's degree may be satisfied in either of the following ways:

1. Completion of all the requirements for qualification as a candidate for the Ph.D. degree as given below, or
2. Presentation and oral defense of an original thesis acceptable to the department

The Ph.D. degree. Requirements for candidacy for the Ph.D. degree:

1. Satisfactory completion (grade of 2 or better) of a course of study approved by the department. Transfer of credits from another university will be allowed only when approved by both the department and the University Graduate Council.
2. Satisfactory performance on both the general and advanced qualifying examinations described above
3. Satisfactory performance on examinations in two approved foreign languages (French, German, or Russian)

Remaining requirements for the Ph.D.:

1. The writing of an original thesis acceptable to the department
2. Satisfactory performance on a final oral examination on the thesis
3. Any other conditions required by the general rules of the university (described on pages 91 to 92).

Mathematics Courses

101a,b; 102a,b. Differential and Integral Calculus for Functions of One Variable (4-0-4 each semester).

Includes careful discussion of continuity; sequences, series, and power series. Mathematics 102 is open to entering freshmen with advanced placement and departmental approval.

Mr. Pfeiffer, Mr. Veech, Mr. Wells, Mr. Taylor, Mr. Beatrous, Mr. Fegan, Mr. Pool

103a, 106b. Introduction to Calculus and its Applications (3-0-3 each semester).

Emphasis on problem solving and applications. Intended for non-science-engineering students. Not open to mathematics majors.

Mr. Curtis, Mr. Weinstein

104b. Finite Mathematics (3-0-3).

Topics from elementary propositional calculus, partitions and counting, linear programming. Not open to mathematics majors.

Mr. Palmer

105. Elementary Probability and Combinatorics (3-0-3).†

Probability theory on discrete sample spaces. Not open to Mathematics majors.

107, 108. The Role of Mathematics in Civilization (3-0-3 each semester).†

121a, 122b. Analysis (4-0-4 each semester).

Covers the material of 101, 102 with emphasis on theoretical aspects. Registration by departmental permission.

Mr. Jones

211a. Ordinary Differential Equations (4-0-4). *Mr. Dadok, Mr. Harvey, Mr. Fegan*

212b. Differential and Integral Calculus for Functions of Several Variables (4-0-4). *Mr. Stanton, Mr. Calderon, Mr. Beatrous*

221a, 222b. Advanced Analysis (3-0-3 each semester).

Covers the material of Mathematics 211, 212, including an introduction to ordinary differential equations. Emphasis is on theoretical aspects. Curves, surfaces, and more general manifolds. Stokes' theorem in detail.

Mr. Polking

312b. Principles of Analysis (3-0-3).

A careful treatment of: the topology of \mathbb{R}^n , convergence of sequences and series of functions, the implicit function theorem, existence theorems for ODE's, and related topics.

Mr. Weinstein

355a. Linear Algebra (3-0-3).

Linear transformations and matrices. Solution of linear equations. The eigenvalue problem and quadratic forms. No prerequisites. Students cannot take this course and Mathematics 464.

Mr. Beatrous

356b. Abstract Algebra (3-0-3).

Groups: normal subgroups, factor groups, Abelian groups. Rings: ideals, Euclidean rings, unique factorization. Fields: algebraic extensions, finite fields. Note: Students cannot take this course and Mathematics 463.

Mr. Berthier

365a. Elementary Number Theory (3-0-3).

Properties of number depending mainly on the notion of divisibility. Continued fractions.

Mr. Fegan

366b. Projective Geometry (3-0-3).

Mr. Berthier

381a. Analysis and Applications (3-0-3).

Laplace transform: inverse transform, applications to constant coefficient differential equations. Boundary value problems: Fourier series, Bessel functions, Legendre polynomials.

Mr. Polking

382b. Complex Analysis and Applications (3-0-3).

Partial differential equations of mathematical physics: fluid flow, heat flow, telegraph equations. Complex analysis: Cauchy integral theorem. Taylor series, residues, evaluation of integrals by means of residues, conformal mapping, application to 2-dimensional fluid flow.

Mr. Calderon

401a, 402b. Differential Geometry (3-0-3 each semester).

Differential manifolds, Stokes' Theorem and deRham's Theorem, fundamental theorem of local Riemannian geometry, Lie groups, vector bundles, affine connections.

Mr. Taylor

411, 412. Ordinary Differential Equations: Mathematical Physics (3-0-3 each semester).†
421, 422. Ordinary Differential Equations: Celestial Mechanics (3-0-3 each semester).†
423a, 424b. Partial Differential Equations (3-0-3 each semester).

Cauchy-Kowalewski Theorem, first order hyperbolic systems, harmonic functions and potential theory, Dirichlet and Neumann problems, integral equations, parabolic and elliptic equations.

Mr. Dadok

425a. Real Analysis (3-0-3).

Lebesgue theory of measure and integration.

Mr. Jones

426b. Topics in Real Analysis (3-0-3).

Continuation of Mathematics 425.

Mr. Bochner

427a, 428b. Complex Analysis (3-0-3 each semester).

Cauchy-Riemann equations, power series, Cauchy's integral formula, residue calculus, conformal mappings, special topics such as the Riemann mapping theorem, Runge's Theorem, elliptic function theory.

Mr. Harvey, Mr. Wells

434. Theory of Special Functions (3-0-3).†
438a. Computational Methods in Partial Differential Equations (3-0-3).

Methods of solution: finite-element methods, collocation methods, finite difference methods, and associated algebraic problems. Also offered as Mathematical Sciences 551.

Mr. Wang

443a. General Topology (3-0-3).

Basic point set topology. Includes set theory, well ordering, Metrization.

Mr. Curtis

444b. Geometrical Topology (3-0-3).

Introduction to algebraic methods in topology and differential topology. Elementary homotopy theory. Covering spaces.

Mr. Curtis

463a, 464b. Algebra (3-0-3 each semester).

Groups, rings, fields, vector spaces. Matrices, determinants, eigenvalues, canonical forms, multilinear algebra. Structure theorem for finitely generated abelian groups. *Mr. Hempel*

466. Cohomology of Groups (3-0-3).†**490. Supervised Reading in Mathematics** (Credit variable).**521a. Special Topics in Complex Analysis** (3-0-3).

Several complex variables.

Mr. Harcey

523a. Functional Analysis (3-0-3).

Locally convex spaces, theory of distributions. Branch spaces, Hilbert spaces. *Mr. Berthier*

525a, 526b. Advanced Topics in Analysis (3-0-3 each semester).

Lie groups and Lie algebras.

Mr. Stanton

537a. Algebraic Topology (3-0-3).

Singular homology and cohomology.

Mr. Taylor

538b. Algebraic Topology (3-0-3).

Homotopy theory, Serre spectral sequence and applications.

Mr. Hempel

541a, 542b. Advanced Topics in Topology (3-0-3 each semester).

Topological dynamics and ergodic theory.

Mr. Veech

557, 558. Topics in Algebra (3-0-3 each semester).†**561, 562. Advanced Topics in Algebra** (3-0-3 each semester).†**601a, 602b. Thesis** (Credit variable).**700c. Summer Research.****800b. Degree Candidate Only.**

Military Science

Chairman to be named

Assistant Professors Duffy and T.M. Adams

The Department of Military Science is chaired by a U.S. Army officer, assisted by officers and noncommissioned officers of the U.S. Army. Training in military leadership is emphasized, with instruction being given in subjects common to all branches of the Army.

The four-year Army ROTC course consists of the basic course taken the freshman and sophomore years and the advanced course taken the junior and senior years. The Army ROTC also offers a two-year program to those students with two years of study remaining who did not participate in the normal basic course. In the two-year program, the student attends a six-week summer camp, which gives credit for the basic Army ROTC course, and enters the advanced course the next fall. The advanced course includes a six-week summer camp, normally between the junior and senior years, in practical military instruction.

One-, two-, and three-year scholarships are available on a competitive basis to students who participate in the Army ROTC program. Each scholarship student receives \$100 per month with all tuition, fees, books, and equipment paid by the Army for the period of the scholarship. Nonscholarship students receive \$100 per month during the advanced course.

Graduates of this program are commissioned in the various branches of the Army based upon the preference of the individual, academic major, demonstrated leadership and technical qualifications, and the needs of the service.

Military science students are permitted to enroll in a university course in lieu of the scheduled military science course according to the following semester schedule:

MS I — second semester (spring)

MS II — first semester (fall)

MS III — first semester (fall)

Approval of the university course desired must be obtained from both the university and military science faculty advisers. Military science leadership laboratory requirements remain in effect although the cadet is enrolled in a university course. See the Schedule of Courses Offered available from the Registrar's Office for registration data.

Military Science Courses

101a. The Defense Establishment in National Security I (1-2-1).

Organization of the Department of Defense, structure of ROTC, individual weapons design and characteristics, and marksmanship instruction. *Staff*

102b. The Defense Establishment in National Security II (1-2-1).

Study of national defense policy and world-wide implications requiring interdependence of the Army, Navy, and Air Force. *Staff*

201a. American Military History (3-2-3).

Analysis of American military history with emphasis on factors leading to organizational and social patterns of the modern-day Army. *Staff*

202b. Introduction to Tactics and Operations (3-2-3).

Study of principles involved in combined arms teams, map and aerial-photo readings, and the command of troops. *Mr. Adams*

301a. Leadership and Management, Fundamentals, and Dynamics of the Military Team I (3-2-3).

Study of leadership qualities, delegation of authority, and the psychological, physiological, and sociological factors affecting behavior while in the Army. *Mr. Adams*

302b. Leadership and Management, Fundamentals, and Dynamics of the Military Team II (3-2-3).

Study of leadership principles and techniques, military instructional methodology, and the history and roles of the various Army branches. *Mr. Duffy*

401a. Leadership and Management, Fundamentals, and Dynamics of the Military Team III (3-2-3).

Examination of international affairs and U.S. alliances, command and staff procedures, and the military justice system. *Mr. Duffy*

402b. Leadership and Management, Fundamentals, and Dynamics of the Military Team IV (3-2-3).

Modern-day warfare techniques are examined in terms of traditional warfare principles and technological advancements. *Mr. Duffy*

The Shepherd School of Music

Professor S. Jones, *Dean*

Professors P. Cooper, Holloway, Shapiro, and Tipton

Adjunct Professor Lert

Associate Professors Crouse, Fliegel, Kurtzman, Milburn, Patterson
Schnoebelen, and Trepel

Assistant Professors R.S. Brown, Citron, Ellison, Koehler, and Rosenberg

Lecturers Arbiter, Bacon, Bible, Ettelson, Deck, Guderian, Norris,
Pickar, Rose, and Waters

Instructors Hanson and Gottschalk

Degrees Offered: B. Mus./M. Mus. (simultaneously); M. Mus.

The Shepherd School of Music, committed to the professional training of musicians within a broad liberal arts curriculum, offers an integrated program of performance, creation, and academic study of music from a combined historical/theoretical/practical point of view.

Close rapport exists between the school and Houston's professional musical organizations. The apprenticeship programs of the fourth and fifth years are designed to meet both educational and professional goals.

Degrees Offered. A Master of Music degree is offered in the following areas: composition, conducting, music history, performance (orchestral instrument, piano, voice), and theory. The master's degree is awarded after successful completion of the requirements, electives, apprenticeships, and recitals of a five-year program. Because of the accelerated programs in music history and theory and the high selectivity of performance majors and applied majors, the five-year program is comparable to other programs requiring a four-year bachelor's degree and a two-year professional degree. Six years may be required to complete the conducting major.

Admission to these programs is based upon evaluation of a student's achievements in one or more of the degree areas. An audition, a theory evaluation, and a personal interview are required of each applicant. Admission is determined jointly by the Shepherd School faculty and by the Admissions Committee of Rice University, which bases its evaluation upon successful academic achievements and standard college admission indices.

Transfer students from other colleges, conservatories, and universities may apply for admission. These applicants are evaluated in terms of prior preparation, which may reduce the required period of study at Rice.

Curriculum Design. Students must complete satisfactorily 102 semester hours (thirty-four courses) in prescribed music courses, appropriate performance and/or thesis requirements, and apprenticeship.

They must also complete at least 48 semester hours outside the departmental requirements for a total program of at least 150 semester hours. Distribution requirements for music majors are discussed on the next page. All M. Mus./B. Mus. programs include (1) the core curriculum and (2) a specialized curriculum.

1. The first five semesters consist of core curriculum courses and their application to a principal instrument. Each semester at least three semester hours are taken in each of the following areas of study: applied studies (ear-training, sight-singing, rhythm, intonation, phrasing, style, performance practice, ensemble techniques); historical studies; individual musicianship (principal instrument); theoretical studies; and academic distribution courses. The typical course of study for the core curriculum is:

First and second semesters:

Individual musicianship (major instrument); Music 211, 212; 221, 222; 231, 232; and academic electives (English)

Third and fourth semesters:

Individual musicianship; Music 311, 312; 321, 322; 331, 332; and academic electives

Fifth semester:

Individual musicianship; Music 411, 421, 431; and academic elective

2. The final two years are devoted to specialized curriculum, in which the student concentrates on creativity, performance, or research supported by laboratory and performing ensembles, theory and history seminars, and professional apprenticeships. Apprenticeships encourage a diversity of professional activities as appropriate for the individual. These include participation with major or civic orchestras, choirs, or opera theaters; off-campus solo and small ensemble performances; conducting apprenticeships with professional orchestras, operas, or ballet companies; composing for films, television, public schools, and for ensembles in residence; research in major national and international libraries; music criticism apprenticeships for campus and off-campus newspapers. Specialized studies are engaged by the individual student with the approval of the faculty.

Twelve university academic distribution courses in humanities, social sciences, and natural sciences are required for the combination master's/bachelor's music degree. Music courses may not be used to satisfy the humanities requirement. Selection is made jointly by the student and faculty adviser and may be taken consecutively or may be paired to allow for off-campus apprenticeships and research projects. Knowledge of at least one foreign language is strongly recommended.

Upon satisfactory completion of the requirements for the Master of Music degree with an area major, the five-year student is also awarded the Bachelor of Music degree.

Courses for Nonmajors. Nonmajors will find the following courses designed for the general student: Music 117, 118; 307, 308; 317, 318; 413; 327, 328; 151, 152, 153; 154, 155, 156; 157, 158. In addition, other music courses may be taken by the nonmajor with the permission of the instructor and approval of the dean of the Shepherd School.

Musical Opportunities. Musical and educational opportunities are afforded the student both on campus and in the greater Houston area. A visiting lecturer series, a professional concert series, and numerous visiting distinguished musicians contribute to the Shepherd School environment. The Houston Symphony Orchestra, Symphony Chorale, Houston Grand Opera, Texas Opera Theater, Houston Ballet, as well as the activities of other institutions of higher learning in the area, provide exceptional opportunities for musical experiences.

Grades. The curriculum of the Shepherd School is a combination undergraduate honors and graduate curriculum. Any student who does not meet a correspondingly high level of achievement will be subject to warning and music probation and possibly to dismissal as a music major.

Special Examinations:

- a. At the end of each semester an examination will be given in individual musicianship over the material studied during the semester.
- b. Keyboard proficiency is required of all degree candidates and may be satisfied by examination or by the election of sequential courses.
- c. Sight-reading proficiency examinations on the major instrument are re-

quired at the end of the fourth semester. Students who do not pass this examination are required to take remedial work in sight-reading until the proficiency level is attained.

- d. Each student must take a qualifying examination during the fifth or sixth semester to determine admissibility to the student's preferred major area in the specialized curriculum. For performance majors this examination will consist of the junior recital and two three-hour examinations (one in music history and one in music theory) based on the compositions to be performed on the junior recital. The Graduate Record Examination will be administered to all music students at the conclusion of the fifth semester.

Performance. Students are expected to perform frequently during their residence at Rice. Performance majors must present at least three full recitals, in the fifth or sixth semester, in the seventh or eighth semester, and in the ninth or tenth semester. Frequent performance is expected of all students during the core curriculum. Composition majors are expected to present full recitals in the fourth and fifth years, and conducting majors, in the fifth and sixth years. Students are expected to attend both faculty and student recitals.

Thesis and Comprehensive Graduate Examinations. The master's-degree for composition, conducting, music history, and theory majors assumes a high level of scholarship. A thesis is required of music history and theory majors. An original work of extended scope is required of composition majors. Conducting majors may present either an extended composition or a thesis.

Comprehensive graduate examinations, both written and oral, are required of all majors in composition, conducting, music history, and theory. Comprehensive graduate examinations are not required of performance majors. Final recitals are considered the equivalent of comprehensive graduate examinations for performance majors.

Large Ensembles. All students are required to participate in one of the school's large ensembles each semester during the five-year program. Freshmen may be exempt from this requirement at the request of their artist teacher and with the approval of the dean.

Warning, Music School Probation, Discontinuation. A student performing unsatisfactorily in one or more courses at the midterm period may be placed on warning. If at the end of the semester significant improvement has not been shown, the student may be placed on music probation. A student may be placed directly on probation without having been placed on warning. Probation is a more serious status than warning, and it signifies that the student's work has been sufficiently unsatisfactory to preclude graduation unless significant improvement is achieved promptly. A student on music probation may be absent from class only for extraordinary reasons and may not represent the school in any public function not directly a part of a degree program.

If at the conclusion of the probationary period the student has not shown marked improvement, the student may be discontinued from the school as a music major. Any student discontinued as a music major but not on academic suspension may elect a major elsewhere in the university, subject to the requirements of the major department or school.

The Shepherd School of Music opened its doors to its first freshman class in 1975. This catalog describes courses offered in 1978-1979 and gives an overview of courses to be offered in subsequent years. For a copy of the complete curriculum and course offerings of the Shepherd School, address the Dean, The Shepherd School of Music, Rice University, Houston, Texas 77001.

Composition

Music Courses

201a. Composition I (3-0-3).

Creative composition employing midcentury vocabularies supported by extensive performance, listening, and analysis, of related scores. Permission of instructor required.

Mr. Cooper, Mr. Milburn, Mr. Gottschalk

202b. Composition II (3-0-3).

Creative composition employing current musical vocabularies supported by appropriate performance, listening, and analysis.

Mr. Cooper, Mr. Milburn, Mr. Gottschalk

301a. Composition III (3-0-3).

Composition for solo instruments and small ensembles.

Mr. Milburn

302b. Composition IV (3-0-3).

Composition for four-six instruments and/or voices.

Mr. Milburn

307a, 308b. Composition for Nonmajors (3-0-3 each semester).

Staff

401a, 402b. Composition V, VI (3-0-3 each semester).

Staff

501a, 502b. Advanced Composition I, II (3-0-3 each semester).

Composition for large ensembles.

Mr. Cooper, Mr. Jones, Mr. Milburn

503a. Electronic Music Composition (1-6-3).

Mr. Gottschalk

504a. Music for Media (1-6-3).

Mr. Milburn

601a, 602b. Advanced Composition III, IV (3-0-3 each semester).

Mr. Cooper, Mr. Jones, Mr. Milburn

603a, 604b. Graduate Composition Seminar (Credit variable).

Mr. Cooper, Mr. Milburn

Theory

Music Courses

117a. Fundamentals of Music I (3-0-3).

For non-music majors with minimal musical preparation. Rudiments of pitch and duration. Study of scales, chord structure tonality, and forms.

Staff

118b. Fundamentals of Music II (3-0-3).

Application of Music 117 materials. Creative work utilizing twentieth-century art and popular vocabulary.

Staff

211a. Theoretical Studies I (3-0-3).

Music aesthetics, physical properties of sound, melody, rhythm, counterpoint, instrumentation, and form. Study of and creative work in music of the late Medieval period and the Renaissance. For music majors. Prerequisite: theory evaluation survey.

Mr. Cooper

212b. Theoretical Studies II (3-0-3).

Discussion, analysis, and creative application of theoretical concepts and vocabulary from 1700 to 1950. For music majors. Prerequisite: theory evaluation survey.

Mr. Cooper

311a. Theoretical Studies III (3-0-3).

Baroque and Early Classical music. Species counterpoint and two-three-four voice tonal counterpoint. Analysis of representative compositions of diverse genre and media. For music majors.

Mr. Milburn

312b. Theoretical Studies IV (3-0-3).

Late Classical and Romantic music. Continued study of tonal counterpoint. Instrumentation. Analysis of selected major works. For music majors.

Mr. Gottschalk

317a. Theory for Nonmajors I (3-0-3).

For non-music majors with appreciable instrumental and/or theory background. Discussion, analysis, and application of melody, rhythm, harmony, counterpoint, instrumentation, and form. Application to literature to 1700.

Ms. Citron

318b. Theory for Nonmajors II (3-0-3).

Stylistic harmony, melody, and form from 1700 to the present.

*Ms. Citron***411a. Theoretical Studies V (3-0-3).**

Music of the twentieth century. Counterpoint and orchestration, employing twentieth-century vocabulary and techniques. Analysis of selected major works.

*Mr. Gottschalk***412b. Theoretical Studies VI (3-0-3).**

Advanced analytical techniques. Practical applications of principal and analytical systems from the Middle Ages to the present.

*Mr. Milburn***414b. Acoustics of Music (3-0-3).***Mr. Gottschalk***511a, 512b. Graduate Theory Review I,II (3-0-2 each semester).***Mr. Cooper***513a. Model Counterpoint I (2-0-2).**

Imitative composition in two to eight voices. Analysis of selected works from the fifteenth and sixteenth centuries.

*Mr. Milburn***515a, 516b. Advanced Orchestration I, II (2-0-1 each semester).***Mr. Cooper, Mr. Gottschalk***611a, 612b. Pedagogy of Theory I, II (3-0-3 each semester).**

Principal learning theories and philosophies of learning and teaching. Examination and critique of college-level materials. Supervised teaching experience and apprenticeship.

*Mr. Cooper***613b. Canon and Fugue (2-0-2).**

Specialized study of imitative counterpoint. Examples from the fifteenth to twentieth centuries. Emphasis on the Baroque fugue.

*Mr. Milburn***715, 716. History of Theory I, II (3-0-3 each semester).†**

History and Literature

Music Courses

221a, 222b. Historical Studies I, II (3-0-3 each semester).

Historical study of musical style. The Middle Ages to 1700, first semester; 1700 to the present, second semester.

*Ms. Hanson***321a, 322b. Historical Studies III, IV (3-0-3 each semester).**

Advanced historical studies in music of the seventeenth, eighteenth, and nineteenth centuries. Baroque and Early Classical, first semester; Classical and Romantic, second semester. Correlated with Music 311, 312, and 331, 332.

*Ms. Schoebelen, Ms. Hanson***327a, 328b. Music Literature for Nonmajors I, II (3-0-3 each semester).**

Historical survey of music from the Middle Ages to the present.

*Mr. Kurtzman***421a. Historical Studies V (3-0-3).**

Twentieth century and contemporary. Advanced historical studies in music of the twentieth century. Correlated with Music 411 and 431.

*Mr. Kurtzman***422. Renaissance Music (3-0-3).†****423b. Chamber Music Literature (3-0-3).**

Survey of chamber music literature from the early Baroque to the present.

*Ms. Schoebelen***424a, 425b. Organ Literature I, II (3-0-3 each semester).***Mr. Holloway***426. Piano Literature (3-0-3).†****427. Song Literature (3-0-3).†****428a. Symphonic Literature (3-0-3).**

Historical development of the symphony and its literature from ca. 1740 to the present.

*Ms. Hanson***429b. Music of the Middle Ages (3-0-3).***Mr. Kurtzman***521a, 522b. Graduate History Review I, II (3-0-2 each semester).**

- 523a. Bibliography and Research Methods, I (3-0-3).**
Techniques in research methodology, studies in bibliography. *Staff*
- 524. Bibliography and Research Methods II (3-0-3).†**
- 525a. Performance Practice Seminar (3-0-3).**
Advanced studies in performance practice; study of treatises, editing, analyses of performance. *Ms. Schnoebelen*
- 528b. History of Musical Instruments (3-0-3).**
An historical survey of the various families of musical instruments and their development to the present. *Staff*
- 529. History of Opera (3-0-3).†**
- 621. Pedagogy of Music History (3-0-3).†**
- 624b. Beethoven (3-0-3).**
Advanced study of Beethoven's music, sketchbooks, contemporaries, and historical setting. *Ms. Schnoebelen*
- 721. Selected Studies in Music History (3-0-3).†**
- 723. Aesthetics in Music (3-0-3).†**
- 724. Collegium Practicum (1-3-1).†**
- 725, 726. History of Notation I, II (3-0-3 each semester).†**

Applied Studies, Ensembles, Conducting

Music Courses

- 231a. Applied Studies I (2-3-3).**
Solfege, rhythmic studies, intonation, listening. *Mr. Tipton, Ms. Citron*
- 232b. Applied Studies II (0-10-3).**
Continuation of Music 231 plus string, wind, percussion, and vocal ensembles. *Mr. Tipton, Ms. Citron*
- 331a, 332b. Applied Studies III, IV (0-14-3 each semester).**
Studies in solfege, rhythmic studies, intonation; phrasing, style, performance practice. Chamber ensembles, large ensemble (orchestra or chorus). Baroque (first semester) and Classical/Romantic (second semester). *Mr. Tipton, Ms. Citron*
- 335a,b. Chorus (0-3-1).** *Mr. Koehler*
- 337a,b. Undergraduate Orchestra (0-9-1).** *Mr. Jones*
- 338a,b. Undergraduate Chamber Music (3-3-1).** *Staff*
- 431a. Applied Studies V (6-0-1).**
Sight reading, phrasing, style, performance practice. Contemporary chamber ensembles, large ensemble (orchestra or chorus). *Mr. Tipton, Ms. Citron*
- 433a. Score Reading (2-2-2).** *Mr. Jones*
- 434b. Elements of Conducting (2-9-2).** *Mr. Jones*
- 531a,b. Orchestral Repertoire (1-3-1).**
May be repeated.
- 537a, 538b. Advanced Conducting I, II (3-9-3 each semester).** *Mr. Jones*
- 539a. Psychology of Conducting (1-0-1).** *Mr. Jones*
- 635a,b. Advanced Orchestra (7-5-2).** *Mr. Jones*
- 636a,b. Advanced Chamber Music (2-5-2).** *Staff*
- 637a, 638b. Advanced Conducting III, IV (3-9-3 each semester).** *Mr. Jones*
- 639b. Orchestra Administration (1-0-1).** *Mr. Jones*

Nonmajor Individual Instruction

Music Courses

151a, 152b; 153a, 154b; 155a, 156b; 157a, 158b. Individual Musicianship for Nonmajors (1-5-1 each semester).

College-level study in any instrument or voice. Instructor assigned by the dean. Fee required.

Woodwind Instruction

Music Courses

251a, 252b - 651a, 652b. Flute 1,2 - 9,10 (1-25-3 each semester).

Five-year sequence.

Mr. Tipton

253a, 254b - 653a, 654b. Oboe 1,2 - 9,10 (1-25-3 each semester). *Mr. Rosenberg*

255a, 256b - 655a, 656b. Clarinet 1,2 - 9,10 (1-25-3 each semester). *Mr. Pickar*

257a, 258b - 657a, 658b. Bassoon 1,2 - 9,10 (1-25-3 each semester). *Mr. Arbiter*

159a,b; 259a,b; 359a,b. Secondary Woodwind Instruction I, II, III (Credit variable).

459a. Theory of Woodwind Performance Technique (1-3-1). *Mr. Rosenberg*

559a,b. Woodwind Pedagogy (1-3-2).

Staff

Brass Instruction

Music Courses

261a, 262b - 661a, 662b. Horn 1,2 - 9,10 (1-25-3 each semester).

Five-year sequence.

263a, 264b - 663a, 664b. Trumpet 1,2 - 9,10 (1-25-3 each semester).

Mr. Guderian

265a, 266b - 665a, 666b. Trombone 1,2 - 9,10 (1-25-3 each semester).

Mr. Waters

267a, 268b - 667a, 668b. Tuba 1,2 - 9,10 (1-25-3 each semester). *Mr. Deck*

169a,b; 269a,b; 369a,b. Secondary Brass Instruction I, II, III (Credit variable). *Staff*

469a,b. Theory of Brass Performance Techniques (1-3-1). *Mr. Bacon*

569a,b. Brass Pedagogy (1-3-2).

Staff

Percussion Instruction

Music Courses

271a, 272b - 671a, 672b. Percussion 1,2 - 9,10 (1-25-3 each semester).

Five-year sequence.

Mr. Brown

479a,b. Theory of Percussion Performance Techniques (1-3-1). *Mr. Brown*

579a,b. Percussion Pedagogy (1-3-2).

Mr. Brown

Voice Instruction

Music Courses

- 273a, 274b - 673a, 674b. **Voice 1,2 - 9,10** (1-20-3 each semester).
Five-year sequence. *Ms. Bible*
- 179a,b; 279a,b; 379a,b. **Secondary Voice Instruction I, II, III** (Credit variable). *Staff*
- 549a,b. **Voice Pedagogy** (1-3-2). *Staff*
- 575a, 576b; 675a, 676b. **Voice Repertoire I, II, III, IV** (1-3-1 each semester).
- 577a, 578b; 677a, 678b. **Diction I, II, III, IV** (1-3-1 each semester). *Staff*

Keyboard and Harp Instruction

Music Courses

- 281a, 282b - 681a, 682b. **Piano 1,2 - 9,10** (1-25-3 each semester).
Five-year sequence. *Ms. Norris*
- 283a, 284b - 683a, 684b. **Organ 1,2 - 9,10** (1-25-3 each semester). *Mr. Holloway*
- 285a, 286b - 685a, 686b. **Harpichord 1,2 - 9,10** (1-25-3 each semester).
Mr. Holloway
- 287a, 288b - 687a, 688b. **Harp 1,2 - 9,10** (1-25-3 each semester). *Ms. Rose*
- 189a,b. **Secondary Piano I** (1-5-1 each semester).
May be taken two times. Required of all majors if piano proficiency not passed. *Ms. Ettelson*
- 289a,b. **Secondary Piano II** (1-5-1 each semester).
May be taken three times. Required of all majors if piano proficiency not passed. *Ms. Ettelson*
- 389a,b. **Secondary Piano III** (Credit variable). *Staff*
- 445a, 446b; 545a, 546b. **Keyboard Proficiency I, II, III, IV** (Credit variable).
Mr. Holloway
- 489a,b. **Secondary Piano IV** (Credit variable). *Staff*
- 589a,b. **Keyboard Pedagogy** (1-3-2). *Staff*
- 645a,b. **Organ Construction** (Credit variable). *Staff*

String Instruction

Music Courses

- 291a, 292b - 691a, 692b. **Violin 1,2 - 9,10** (1-25-3 each semester).
Five-year sequence. *Ms. Shapiro, Mr. Fliegel, Mr. Patterson*
- 293a, 294b - 693a, 694b. **Viola 1,2 - 9,10** (1-25-3 each semester). *Mr. Crouse*
- 295a, 296b - 695a, 696b. **Violoncello 1,2 - 9,10** (1-25-3 each semester).
Ms. Trepel
- 297a, 298b - 697a, 698b. **Double Bass 1,2 - 9,10** (1-25-3 each semester).
Mr. Ellison
- 199a,b. **Secondary String Instruction I** (Credit variable).
Violin, viola, cello, or bass. *Staff*
- 299a,b. **Secondary String Instruction II** (Credit variable).
Continuation of Music 199. Prerequisite: Three semesters of Music 199 or five semesters of major string instruction. *Staff*

399a,b. Secondary String Instruction III (Credit variable).

Continuation of Music 299. Prerequisite: Three semesters of Music 299 or five semesters of major string instruction. *Staff*

499. Theory of String Performance Techniques (1-3-1).†

Primarily for conductors and composers.

599a,b. String Pedagogy (1-3-2).

Staff

Courses Applicable to All Specializations

Music Courses

449a,b. Undergraduate Independent Study (Credit variable). *Staff***547. Pre-Thesis in Composition, Theory, or History and Literature, or Conducting (Credit variable).** *Staff***647a,b. Master's Thesis in Composition, Theory, History and Literature, or Conducting (1-0-3 each semester).****649a,b. Graduate Independent Study in Theory or History and Literature (Credit variable).** *Staff***741a,b. Recital in Conducting, Major Instrument, or Voice (Credit variable).** *Staff***749a,b. Apprenticeship in Composition, Theory, Music History, Conducting, or Major Instrument (Credit variable).** *Staff*

Naval Science

Professor A. E. Nelson, *Chairman*

Associate Professor B. B. Williams

Assistant Professors C. L. Brown and A. A. Desantis

The Department of Naval Science is administered by a senior U.S. naval officer, assisted by officers and men of the U.S. Navy and Marine Corps. The purpose of the Naval Reserve Officers' Training Corps is to train highly select young men and women for naval service as commissioned officers of the Navy and Marine Corps.

Students taking five-year courses are considered eligible for enrollment at the beginning of their first or second year. In view of the heavy academic loads for fifth-year engineering students and scheduling difficulties, all students are encouraged to enroll in the regular manner during freshman matriculation. Students may voluntarily disenroll any time during the first two years of the program, without incurring further service obligation.

There are two categories of NROTC students: (1) scholarship; (2) non-scholarship.

Scholarship Students. A scholarship NROTC student is appointed a midshipman, U.S. Naval Reserve, on a nationwide competitive basis and receives retainer pay at the rate of \$100 per month for a maximum of four academic years, with all tuition, fees, books, and equipment paid for by the government. He is required to complete prescribed naval science courses, participate in drills and three summer cruises, and, upon graduation with a baccalaureate or advanced degree, to accept a regular commission as ensign in the U.S. Navy or second lieutenant in the U.S. Marine Corps.

Nonscholarship Students. Nonscholarship students are civilian college students who enter into a mutual contract with the Secretary of the Navy in which they take naval science courses and participate in drills and one summer training cruise. In return, the Navy pays the student \$100 per month during the junior and senior years, and offers a reserve commission in the Navy or Marine Corps upon graduation. Nonscholarship students may, on a local, competitive basis, be recommended for scholarship status by the professor of naval science.

Two-Year Program Students. Interested students may, in their sophomore year (junior year for five-year students at Rice), apply for the two-year NROTC Program. A nationwide competition will initially determine their scholarship or nonscholarship status (see above). Following selection, applicants attend a six-week Naval Science Institute (NSI) at Newport, Rhode Island, during July and August, which is designed to "make up" the first two years of the regular NROTC program. Successful completion of NSI qualifies the student for enrollment in the advanced NROTC on an equal footing with the four-year students. About 15% of the nonscholarship students finishing NSI may be offered a full NROTC scholarship at that time. Additional scholarships may be awarded to the others from time to time upon the recommendation of the professor of naval science at Rice.

U.S. Marine Corps. NROTC students, either scholarship or nonscholarship, may apply for the Marine Corps program. Such selectees are referred to as Marine Corps option students and attend separate classes under a Marine officer instructor during their junior and senior years.

Naval Science Courses

101a. Naval Orientation (2-2-2).

An introduction to naval traditions and customs, seamanship, naval organization and missions, and the fundamental concepts of seapower. *Staff*

102b. Naval Ships Systems I — Naval Engineering (3-2-3).

A study of ship design, stability, compartmentation, propulsion, auxiliary power, refrigeration, electrical systems, and damage and casualty control measures. *Mr. Brown*

201a. Naval Ships Systems II — Naval Weapons (3-2-3).

An introduction to naval weapons systems with emphasis on linear analysis of ballistics and control system dynamics. *Mr. Brown*

202b. Sea Power and Maritime Affairs (3-2-3).

Readings, discussions, and research on selected topics related to the history, importance, and impact of sea power on modern civilization. *Mr. Nelson*

301a. Navigation (3-2-4).

A comprehensive study of coastal piloting, celestial and electronic ship navigation; involves nautical astronomy, navigational aids, satellite and inertial systems. *Staff*

302b. Naval Operations (3-2-4).

An analysis of ship movements, formations, and fleet operations; includes Rules of the Road, maneuvering board, tactical publications and communications. *Staff*

401a,b; 402a,b. Principles of Leadership and Management (3-2-3 each semester).

An introduction to the principles and concepts of management organization, leadership, military law and discipline, information systems, and decision making. *Mr. Williams, Mr. Desantis*

NROTC 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 Courses***303Ma. Evolution of Warfare (3-2-3).**

Historical survey of the evolution of the conduct of warfare. Strategy, tactics, weapons, organization, and military leaders/thinkers are studied. *Mr. Desantis*

403Ma. Amphibious Warfare (3-2-3).

Study of the history of amphibious warfare. Case studies examine doctrine, tactics, and the factors necessary for successful operations. *Mr. Desantis*

In addition to the courses listed above, NROTC students may be required to complete certain other courses that are offered by the university.

Philosophy

Professor Brody, Chairman

Professor Kolenda; Associate Professor Giannoni

Assistant Professors Kulstad, Loevinsohn, Modrak, and Rawlinson

Instructor Bencivenga

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Major. The philosophy major requires thirty semester hours (ten courses); at least eighteen semester hours (six courses) must be at the 300-level or above. Majors must take Philosophy 201, 202, 306, one course in logic (either 106 or 305), and two further courses in the history of philosophy (301, 302, 308, 501, or 502). If the student wishes, metaphysics (Philosophy 304) or epistemology (Philosophy 303) may be substituted for one of these additional history courses.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Requirements for the Master of Arts Degree:

1. Completion with high standing of at least twenty-four semester hours in advanced courses approved by the department
2. Satisfactory performance on a reading examination in one foreign language
3. Completion of a written thesis on a subject approved by the department
4. Satisfactory performance on a final oral examination not limited to the student's special field of study

Requirements for the Degree of Doctor of Philosophy:

1. Satisfactory performance during the early part of the second semester on a preliminary examination based on specific reading chosen from among major philosophical works
2. Completion with high standing of courses approved by the department and of work in the area of logic
3. Satisfactory performance on a reading examination in one foreign language; students whose research interests require a substantial knowledge of another discipline can petition to substitute for the language exam an examination in that other discipline
4. Satisfactory performance on examinations in history of philosophy, metaphysics and epistemology, value theory, and philosophy of science and language

5. Completion of a written thesis on a subject approved by the department; at least one year of thesis research must be spent in residence
6. Satisfactory performance in limited teaching duties assigned by the department
7. Satisfactory performance on a final oral examination, not limited to the student's special field of study

Philosophy Courses

101a. Philosophical Perspectives on Contemporary Moral and Legal Issues (3-0-3).

An examination of the moral and legal issues surrounding such topics as abortion, euthenasia, war, capital punishment, and equality of opportunity. *Mr. Brody*

102b. Four Perspectives on the Meaning of Life: Existentialism, Marxism, Mysticism, Humanism (3-0-3).

An examination of contrasting orientations toward human life which emerged from the contemporary intellectual, social, and political situation. *Mr. Kolenda*

103a. Philosophy and Psychology: The Critical Interaction (3-0-3).

An examination of the interrelationship between philosophical and psychological thought. *Ms. Rawlinson*

104b. Philosophical Perspectives on Science (3-0-3).

Philosophical issues that arise in and about science; specific theories in both natural and social science, analyzed to understand the nature and impact of scientific knowledge. *Mr. Giannoni*

106b. Logic (3-0-3).

A system of natural deduction will be used to establish the validity of arguments whose validity turns on their truth functional or quantificational form. *Mr. Bencivenaga*

201a. History of Philosophy I (3-0-3).

A survey of major philosophers of the ancient and medieval world, from Thales to Ockham. *Ms. Modrak*

202b. History of Philosophy II (3-0-3).

A survey of modern philosophy beginning with Descartes and including logical positivism, philosophical analysis, and existentialism. *Mr. Kulstad*

203a,b. Problems of Philosophy: Knowledge and Reality (3-0-3).

Survey of traditional and contemporary authors on presuppositions of knowledge; relation of language to reality; nature of knowledge and truth; conflict between determinism and freedom. *Staff*

301a. Ancient and Medieval Philosophy (3-0-3).

A survey of major philosophical writings from the fourth century through the fourteenth. *Ms. Modrak*

302b. Modern Philosophy (3-0-3).

The topic for this year is Continental Rationalism: Descartes, Spinoza, and Leibniz, Prerequisite: one course in philosophy. *Mr. Kulstad*

303a. Epistemology (3-0-3).

Topics: knowledge, truth, perception, memory, etc. Prerequisite: one course in philosophy. *Mr. Kulstad*

304. Metaphysics (3-0-3).†

An examination of some classical and contemporary metaphysical systems. Particular attention to the very possibility of metaphysical analysis. Prerequisite: one course in philosophy. *Mr. Brody*

305a. Mathematical Logic (3-0-3).

Natural deduction, axiomatic, and semantical treatment of first order logic. Also, Godel's Incompleteness Theorem for arithmetic. *Mr. Giannoni*

306b. Ethics (3-0-3).

A philosophical analysis of traditional and contemporary theories of ethics. *Mr. Loevinsohn*

307a. Social and Political Philosophy (3-0-3).

What makes a society just? On what grounds may the liberty of individuals be legitimately limited? What social ends may a state legitimately pursue? *Mr. Loevinsohn*

308a. Continental Philosophy From Kant to Heidegger (3-0-3).*Ms. Rawlinson***309b. Aesthetics (3-0-3).**

Contemporary critiques of traditional theories of art. Examples from film, paintings, and a variety of recent movements in the arts. *Ms. Rawlinson*

311a. Philosophy of Religion (3-0-3).†

An examination of God's existence, the problem of evil, the relation between faith and reason, and the varieties of religious experience.

312b. Philosophy of Mind (3-0-3).

An inquiry into the nature of mind with emphasis on the mind/body problem. Prerequisite: one course in philosophy. *Ms. Modrak*

313a. Philosophy of Science (3-0-3).

A study of the relationship between scientific theories, experiment, observation, and reality. Prerequisite: one course in philosophy. *Mr. Giannoni*

314. Biomedical Ethics (3-0-3).†

An examination of such questions as abortion and euthanasia, the allocation of scarce medical resources, and experimentation upon human beings.

316b. Philosophy of Law (3-0-3).

Examination of social control of private property, compensation in the law of torts, the right to privacy and bodily integrity, and justice through compensatory discrimination, etc. *Mr. Brody*

318a. Philosophy in Literature (3-0-3).

Study of philosophical themes in selected works in English, French, German, and Russian literature. *Mr. Kolenda*

320. Space and Time (3-0-3).†

The impact of recent theories on our views of the nature and structure of space and time.

322b. American Philosophy (3-0-3).*Mr. Kolenda***401a, 402b. Independent Reading I, II (3-0-3 each semester).**

By permission of the department.

*Staff***403. Philosophy of Language (3-0-3).†**

A philosophical investigation of relations among language, thought, and reality. Theories of reference will be emphasized. Prerequisite: two courses in linguistics or philosophy. Also offered as Linguistics 466.

404. Action Theory (3-0-3).†

The philosophical problems embedded in our conception of human action — topics include the problem of individuation of actions and the relation between actions and reasons.

405b. Senior Seminar (3-0-3).*Mr. Loevinsohn***407a. Philosophy of Logic and Mathematics (3-0-3).***Mr. Bencivenga***501. Seminar in Modern Philosophy (3-0-3).†**

May be repeated for credit.

502b. Seminar in Ancient Philosophy (3-0-3).

May be repeated for credit.

*Ms. Modrak***503a. Seminar in Epistemology (3-0-3).***Mr. Kulstad***505b. Seminar in Metaphysics (3-0-3).***Mr. Brody***506b. Seminar in Philosophy of Physics (3-0-3).***Mr. Giannoni***507a. Seminar in Ethics (3-0-3).***Mr. Loevinsohn***508. Seminar in Social and Political Philosophy (3-0-3).†**

509. Seminar in Philosophy of Science (3-0-3).†
 510a. Seminar in Philosophy of Language (3-0-3). *Mr. Bencivenga*
 512. Seminar in Philosophy of Mind (3-0-3).†
 513a. Pragmatism (3-0-3). *Mr. Kolenda*
 514. Husserl (3-0-3).†
 515. Wittgenstein and Austin (3-0-3).†
 516. Frege to Logical Positivism (3-0-3).†
 518b. Recent Continental Thought (3-0-3). *Ms. Rawlinson*
 601a, 602b. Advanced Independent Reading I, II (3-0-3 each semester). *Staff*
 701a, 702b. Research and Thesis (3-0-3 each semester). *Staff*
 800b. Degree Candidate Only. *Staff*

Physics

Professor N. F. Lane, *Chairman*

Professors S. D. Baker, Class, Clayton, Donoho, Duck, Estle, Michel,
 Phillips, Risser, Rorschach, Stebbings, Trammell,

Valkovic, Walters, and Wolf

Visiting Professor Lovesey

Adjunct Professor Hazlewood

Associate Professors Dunning, Hannon, Huang, and Mutchler

Adjunct Associate Professor Rundel

Assistant Professors J. B. Roberts and Dodds

Visiting Assistant Professor Miettinen

Adjunct Assistant Professor Chang

Degrees Offered: B.A., M.A., Ph.D.

Undergraduate Program. During the first two years, all physics majors, including those electing one of the five physics options listed below, are required to take the following courses:

Mathematics 101, 102 (or equivalent honors courses) and 211, 212

Physics 101, 102, 132; and 201, 202, 231

Chemistry 101, 102, 107

Each student will be assigned a faculty adviser at the end of the sophomore year who will be responsible for course registration for the junior and senior years. Unless students elect one of the special options given below, seven physics lecture courses and four physics laboratory courses at or above the 300 level are required during the junior and senior years. These are:

Physics 301, 302 and 311, 312

Physics 331, 332 (Advanced Laboratory)

Physics 411, 412, and 425

Physics 431, 432 or 433, 434 (Senior Research)

Students will select courses in mathematics or mathematical sciences in consultation with their advisers so that they will complete three semesters beyond the two-year introductory sequence.

In addition to the departmental requirements for the major, all students, including those who select one of the options below, must satisfy the distribution

requirements (see page 50) and complete at least 60 semester hours outside the departmental requirements. Regular physics majors must complete a total program of at least 138 semester hours.

Physics majors with a special interest in astrophysics, biophysics, geophysics, or nuclear energy may wish to elect one of the special options described below.

Option in Space Physics and Astronomy. During the first two years, the requirements coincide with those for a standard physics major (described above). In addition, Space Physics and Astronomy 251, 252, 261, and 262 should ordinarily be elected in the sophomore year. The following upper level courses are required:

Physics 301, 302 and 311, 312

Physics 331, 332 (Advanced Laboratory)

Physics 425

Space Physics and Astronomy 471, or 472

Space Physics and Astronomy 431, 432 (Senior Research)

Upper level mathematics or mathematical sciences (two semesters)

Students selecting this option must complete a total program of at least 140 semester hours. A faculty adviser who is jointly appointed by the Physics and the Space Physics and Astronomy Departments will be assigned to each student.

Option in Biophysics. During the first two years, the student should satisfy the physics, chemistry, and mathematics requirements listed above for a standard physics major. The following additional courses are also required for graduation:

Chemistry 211, 212, 213, 214 (should be taken second year)

Biology 101, 102, 103, 104

Biochemistry 361

Physics 301, 302 and 311, 312

Students selecting the biophysics option must complete a total program of at least 134 semester hours.

Option in Geophysics. During the first two years, the student should satisfy the physics, chemistry, and mathematics requirements listed for a standard physics major. The following additional courses are also required for graduation:

Geology 101, 102; 111, 112; and 461, 462

Electrical Engineering 220

Physics 301, 302, and 311

Mathematical Sciences 340 (or equivalent)

Physics 431, 432 or Physics 433, 434 (Senior Research)

Upper level mathematics or mathematical sciences (three semester hours)

Students selecting the geophysics option must complete a total program of at least 139 semester hours.

Option in Nuclear Energy. During the first two years, the student should satisfy the physics, chemistry, and mathematics requirements listed above for a standard physics major. The following additional courses are also required for graduation:

Engineering 200

Physics 301, 302; 311, 312; 331, 332; and 411

Materials Science 395

Mechanical Engineering 481

Chemical Engineering 631, 632

Physics 431, 432 or 433, 434 (Senior Research)

Students selecting the nuclear energy option must complete a total pro-

gram of at least 139 semester hours.

Chemical Physics Major. An interdepartmental major in chemical physics is offered in conjunction with the Department of Chemistry. Students wishing to elect this major must be approved by both departments, and should consult the department chairmen for further details.

Graduate Program. The Department of Physics offers studies and research programs leading to the degrees of Master of Arts and Doctor of Philosophy. The Physics Department offers research facilities and thesis supervision in the fields of astrophysics, atomic and molecular physics and quantum electronics, biophysics, nuclear physics, solid state and low temperature physics, and theoretical physics.

To be eligible for the Master of Arts degree, a graduate student must complete thirty semester hours of approved graduate level studies, including a research thesis performed under the direction of a physics faculty member. A minimum of one year of graduate study is required for the M.A.

To be eligible for the Doctor of Philosophy degree, a graduate student must first demonstrate to the department the ability to engage in advanced research. This is normally done by successfully completing the work for the Master of Arts in physics, or by equivalent research publication. The student must also complete in residence sixty semester hours of approved graduate level study, including fifteen semester hours in required courses and a research thesis completed under the direction of a physics faculty member. A minimum of two years of graduate study is required for the Ph.D. Further details of research programs in physics and departmental degree requirements are contained in a pamphlet "Graduate Study in Physics and Space Physics and Astronomy" available from the Physics Department on request.

Physics Courses

101a. Mechanics (3-0-3).

The first semester of the sequence in physics for science and engineering students.

Mr. Baker, Mr. Rorschach

102b. Electricity and Magnetism (3-0-3).

The second semester of the sequence in physics for science and engineering students.

Mr. Baker, Mr. Rorschach

111a. Mechanics (3-0-3).

A self-paced version of Physics 101. Limited enrollment.

Mr. Risser

112b. Electricity and Magnetism (3-0-3).

A self-paced version of Physics 102. Limited enrollment.

Mr. Risser

121a. Technical Physics I (3-0-3).

A noncalculus survey of mechanics, sound and optics, primarily intended for architecture and premedical students, with emphasis on problem-solving.

Mr. Estle

122b. Technical Physics II (3-0-3).

Continuation of Physics 121. Electricity and magnetism, physical optics, heat and thermodynamics.

Mr. Estle

123a, 124b. Introductory Physics Laboratory (0-3-1 each semester).

Recommended for all students enrolled in Physics 121, 122 and 141, 142.

Mr. Risser

132b. Elementary Physics Laboratory (0-3-1).

Recommended for students enrolled in Physics 102 or 112.

Mr. Class, Mr. Walters

141a, 142b. Concepts in Physics I, II (3-0-3 each semester).

Emphasis on the nature of physical phenomena, the conceptual development of physics, and related cultural influences. The laboratory Physics 123, 124 is recommended.

Mr. Clayton

201a. Electromagnetic Waves and Heat (3-0-3).

The third semester of the four-semester sequence in physics for science and engineering students.

Mr. Dunning, Mr. Mutchler

202b. Modern Physics (3-0-3).

The final semester of the four-semester sequence in physics for science and engineering students. *Mr. Dunning, Mr. Mutchler*

211a. Electromagnetic Waves and Heat (3-0-3).

A self-paced version of Physics 201. Limited enrollment. *Mr. Haymes, Mr. Trammell*

212b. Modern Physics (3-0-3).

A self-paced version of Physics 202. Limited enrollment. *Mr. Haymes, Mr. Trammell*

231a. Elementary Physics Laboratory (0-3-1).

Recommended for students enrolled in Physics 201 or 211. *Mr. Class, Mr. Walters*

301a, 302b. Introduction to Mathematical Physics I, II (4-0-4 each semester).

Classical mechanics, electrodynamics, and appropriate mathematical methods. Emphasis on problem-solving. *Mr. Anderson, Mr. Baker, Mr. Huang, Mr. Miettinen, Mr. Roberts*

311a, 312b. Introduction to Quantum Physics I, II (3-0-3 each semester).

Wave mechanics is developed and applied to the harmonic oscillator, free particle, and atomic structure. *Mr. Stebbings*

331a, 332b. Junior Physics Laboratory (1-3-2 each semester).

Mr. Mutchler, Mr. Rorschach

411a, 412b. Principles of Modern Physics I, II (3-0-3 each semester).

Continuation of quantum mechanics and modern physics begun in Physics 311, 312. Topics covered include molecular, solid state, nuclear, and elementary particle physics. *Mr. Class*

425a. Statistical and Thermal Physics I (3-0-3).

Mr. Dodds

426b. Frontiers in Physics (3-0-3).

Content varies from year to year. Examines topic or topics of current research interest in physics or related fields. *Mr. Trammell*

431a, 432b. Senior Physics Research (0-6-2 each semester). *Mr. Phillips, Staff***433a, 434b. Honors Research (0-12-3 each semester).**

The student pursues a research project in a similar way to Physics 431, 432 but in considerably greater depth. Departmental approval required. *Mr. Phillips, Staff*

451, 452. Special Topics in Physics: Methods of Experimental Physics (3-0-3 each semester).†**461a, 462b. Independent Study in Physics (Credit variable).**

A reading course in special topics.

Staff

482b. Introduction to Biophysics (3-0-3).

Senior/graduate-level course in the application of physics to biological problems involving structure, statistical mechanics, transport processes and electrophysiology. *Mr. Chang, Staff*

495a, 496b. Physics Teaching (Credit variable).

A combination of in-service teaching and a weekly seminar. Departmental approval required. *Mr. Class*

515a. Advanced Classical Mechanics (3-0-3).

Lagrangian and Hamiltonian dynamics, normal vibrations, rigid body motion, and the transformation theory of dynamics. Also offered as Space Physics and Astronomy 515. *Mr. Lane*

521a, 522b. Principles of Quantum Mechanics (3-0-3 each semester).

Also offered as Space Physics and Astronomy 521, 522.

Mr. Huang

526b. Statistical and Thermal Physics II (3-0-3).

A continuation of Physics 425 intended primarily for first-year graduate students and qualified undergraduates. *Mr. Dodds*

531a, 532b. Electromagnetic Theory (3-0-3 each semester).

Mr. Duck

541a, 542b. Nuclear Structure and Particle Physics I, II (3-0-3 each semester).

Mr. Phillips, Mr. Roberts, Mr. Miettinen

543. Neutron and Reactor Physics (3-0-3).†

544. Applied Nuclear Physics (3-0-3).†**563a. Introduction to the Solid State (3-0-3).**

Fundamental concepts about crystalline solids and basic preparation for further courses in the sequence Physics 564-567. Also offered as Electrical Engineering and Materials Science 563.
Mr. Brotzen

564b. Electron Transport and Superconductivity (3-0-3). *Mr. Dodds***565. Dielectric and Optical Properties of Solids (3-0-3).†**

A survey of the optical and dielectric properties of solids. Interband transitions, excitons, lattice vibrations, and nonlinear optical properties.

566. Imperfections and Mechanical Properties of Crystalline Solids (3-0-3).†

The effect of lattice imperfections, such as point defects, dislocations, phonons, electrons, etc., upon the physical and mechanical properties of crystals. Also offered as Electrical Engineering and Materials Science 566.

567b. Magnetism and Magnetic Resonance (3-0-3). *Mr. Estle***571a. Atomic and Molecular Spectra and Structure (3-0-3). *Mr. Walters*****572b. Theory of Electronic and Atomic Collisions (3-0-3). *Mr. Lane*****573. Quantum Optics (3-0-3).†**

Laser physics and the use of lasers in physical research.

574. Theory of Atomic and Molecular Structure (3-0-3).†**575. Experimental Atomic Physics (3-0-3).†****591a, 592b. Graduate Research (Credit variable). *Staff*****595a, 596b. Physics Teaching. *Staff*****621a. Advanced Quantum Mechanics I (3-0-3). *Mr. Duck*****622. Advanced Quantum Mechanics II (3-0-3).†****641, 642. Advanced Experimental Nuclear Physics (3-0-3 each semester).†****643, 644. Theoretical Nuclear Physics (3-0-3 each semester).†****645, 646. Special Topics in Nuclear Physics (3-0-3 each semester).†****660. Gravitation and Relativity (3-0-3).†****661a. Special Topics in Solid State Physics (3-0-3 each semester). *Mr. Lovesey*****700c. Summer Graduate Research.****800b. Degree Candidate Only.**

Political Science

Professor von der Mehden, *Chairman*

Professors Ambler, J. Cooper, Cuthbertson, Dix, and Doran

Assistant Professors Gow and Sanders

Instructor Harris

Lecturer Hudspeth

Visiting Lecturer D. Brady

Degrees Offered: B.A., M.A., Ph.D.

Majors in Political Science. Students majoring in political science are required to complete thirty semester hours (ten courses) in the field. All majors must also complete six semester hours (two courses) of advanced work, selected with the advice of the department in any of the following fields: anthropology,

behavioral science, economics, history, philosophy, psychology, or sociology.

Double majors in one of the above fields may automatically substitute six semester hours (two courses) in upper level courses in their second field for six of the required thirty semester hours in political science courses. Double majors whose second major is legal studies or managerial studies may automatically substitute three hours (one course). Double majors whose second field is not listed above normally will be required to take thirty semester hours (ten courses) in political science. They may petition for substitution of courses in other fields, but such substitutions will be permitted only when the course to be substituted has a close and significant relationship to political science.

Within the major each student is encouraged to take a program of courses that provides both a broad understanding of the field and a specialized knowledge of some portion of it. Specific distribution requirements are minimal. However, students are required to take at least one course in any four of the six areas listed below:

- | | |
|----------------------------|--------------------------------------|
| (1) American politics | (4) International relations |
| (2) Comparative government | (5) Normative political theory |
| (3) Law | (6) Empirical theory and methodology |

Political Science 209, 210, 210H, 211, and 212 constitute the introductory courses in normative theory, American politics, international relations, and comparative government, respectively. Prospective majors are encouraged to take one or more of these courses, preferably in their freshman or sophomore years. However, none are required of majors, except that Political Science 209 and 210 (or 210H) together remain the courses that meet the Texas state licensing requirements in political science for teachers. It should also be noted that no more than three of the above introductory courses may be counted toward the major.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Honors Program. Political science majors who qualify may enter an honors program. The program will consist of (1) a one-semester reading course in the junior year (taken either term) which will serve as the basis for drawing up a prospectus for the senior essay, plus (2) the writing of the essay, normally in the senior year. The nine semester hours completed will count toward the thirty semester hours required for the major and will be counted for purposes of distribution in the appropriate area within the major. Alternatively, instead of writing the essay, a student may take six semester hours in graduate level courses.

Admission to the honors program will, as a rule, occur in the spring of the sophomore year at the time majors are selected. Others may be admitted during the junior year. Double majors are eligible for the program. Admission requires the approval of the departmental director of undergraduate studies, Mr. Cuthbertson.

Program in Managerial Studies. The Department of Political Science participates in the interdepartmental program in managerial studies. More information on the program may be obtained from the program description given on pages 55 and 109. The departmental adviser for this program is Mr. Cuthbertson.

Graduate Program. The Department of Political Science offers a graduate program leading to the Ph.D. The student is expected to complete forty-

eight semester hours in advanced courses or seminars prior to candidacy and to present a dissertation displaying original research. Normally the student will take the core course and one other seminar or course in American government, comparative government, and international relations, plus a two-semester course in scope and methods. The student will also be expected to have some background in statistical analysis and in traditional political theory prior to candidacy. The student is expected to take comprehensive written examinations in two of the three major fields (American government, comparative government, and international relations) after the completion of (1) course work in the department, (2) two courses in a minor field outside political science, and (3) the language requirement. The language requirement may be fulfilled through (a) satisfactory language skills in two foreign languages, (b) one language and advanced course in statistics, or (c) high level of skill in one language sufficient to use it in advanced research. The language program and minor of the individual student should be decided in consultation with the faculty adviser. A limited master's program is also offered by the department.

Political Science Courses

209b. Introduction to Constitutionalism and Modern Political Thought (3-0-3).

Constitutionalism and authoritarianism from Machiavelli to Marx; introduction to contemporary ideologies. Together with Political Science 210 or 210H meets state professional requirements for teachers. *Mr. Cuthbertson, Staff*

210a. Introduction to American Government and Politics (3-0-3).

Major topics in American politics; public opinion, group politics, political parties, elections, congressional-presidential-bureaucratic politics, and judicial politics. Together with Political Science 209 meets state professional requirements for teachers. *Mr. Brady, Staff*

210. Introduction to American Government and Politics — Honors (3-0-3).†

An honors course covering the same material given in Political Science 210a. Permission of the instructor required. Together with 209, this course meets state professional requirements for teachers. *Miss Sanders*

211b. Introduction to International Relations (3-0-3).

Analysis of basic factors in world politics from the balance of power to multipolarity. Discusses new meaning of peace. *Mr. Doran*

212a. Introduction to Comparative Government (3-0-3).

A comparison of political patterns in selected "developed" and "developing" political systems including democratic and communist examples. *Mr. Dix*

305a, 306b. Directed Reading I, II (0-0-3 each semester).

Independent reading under the supervision of a member of the department. Open to junior majors in the honors program and to others in special cases with the consent of the department. *Staff*

309a, 310b. Law and Society (3-0-3 each semester).

An examination of the nature of law and of justice; employment of the casebook method to study specific aspects of the law. *Mr. Hudspeth*

314a. Politics of Energy and the Environment (3-0-3).

Political aspects of environmental protection, the population explosion, energy, and resource scarcity at local, national, and international levels. *Mr. Doran*

315a. President and Congress in American Politics (3-0-3).

Examination of the two major policy making institutions in the United States: the Congress and the President. *Mr. Cooper*

321a. American Constitutional Law (3-0-3).

This course deals with the interpretation of the Constitution by the Supreme Court.

Mr. Cuthbertson

325a. Criminal Justice (3-0-3).

The cause of crime and response to crime, including the organization and activities of the police, lawyers, courts, and prisons.

Mr. Gow

326. Politics of the Judicial System (3-0-3).†

How does politics influence the judiciary and how does the judiciary influence politics? The federal courts, both trial and appellate, will be the focus.

Mr. Gow

331a. American Political Parties and Electoral Behavior (3-0-3).

The nature and functions of contemporary American political parties, including characteristics of party systems, party organization, elite recruitment, political socialization, and voting behavior.

Staff

333b. Southern Politics (3-0-3).

An historical and contemporary overview of Southern Politics.

Miss Sanders

335. Systems Analysis and American Politics (3-0-3).†

Various systems approaches to politics, including general systems theory, Parsonian systems theory, and organization theory.

Mr. Cooper

337a. Bureaucracy and Public Policy (3-0-3).

The role public bureaucracy plays in national policy making process. Sources of agency power will be examined and then linked to different policy outcomes.

Staff

339b. Public Policy (3-0-3).

This course examines American public policy at the national level and concerns both the contents of public policy and the politics involved.

Miss Sanders

340a. Ancient and Medieval Political Theory (3-0-3).

The sources of ancient and medieval political thought. Special emphasis on historical analysis of political philosophy and methodology and the influence of Plato and Aristotle.

Mr. Cuthbertson

344a. Contemporary Political Ideology (3-0-3).

Elements of major ideologies including nationalism, democracy, socialism, and revolution and their spokesmen in Afro-Asia and the West.

Mr. von der Mehden

351. The Politics of Southeast Asia (3-0-3).†

Political processes, institutions, and attitudes in selected Southeast Asian states. Emphasis on the post war period but traditional forces influencing contemporary political behavior also considered.

Mr. von der Mehden

353. Politics of China and Japan (3-0-3).†

Political processes, institutions, and attitudes of China and Japan; emphasis on post-war developments in relation to traditional patterns, political ideology, and international politics.

Mr. von der Mehden

354b. Latin American Politics (3-0-3).

A study of the political process in contemporary Latin America, with particular attention to selected major countries.

Mr. Dix

360. Western European Democracies (3-0-3).†

A survey of government and politics in Western European democracies; with primary emphasis on Great Britain, France, and Germany.

Mr. Ambler

361. Comparative Communist Systems (3-0-3).†

A survey of government and politics in selected communist systems, including the U.S.S.R. and Communist China.

Mr. Ambler

371a. Comparative Foreign Policy (3-0-3).

A survey and comparative analysis of the foreign policies and policy-making systems of selected countries, including China, Japan, and Soviet Union.

Mr. Harris

372a. The Conduct and Control of American Foreign Policy (3-0-3).

Examines the internal and external aspects of foreign policy leadership, presidential initiative, congressional control, press, public opinion, crisis management.

Mr. Harris

374. Oil, Cartels, and Changing World Order (3-0-3).†

A study of the spectacular success of OPEC, its durability, political impact, relationship to other alliances, and the emergence of other cartels and commercial blocs.

Mr. Doran

375b. International Organizations (3-0-3).

Survey of political processes in regional and global intergovernmental organizations and policy problems created by conditions of global interdependence. *Mr. Harris*

377. Imperialism (3-0-3).†

The origins and meaning of imperialism in the twentieth century. *Mr. Doran*

378. Politics of American National Security (3-0-3).†

Major issues in national security policy, including strategic doctrines, policy making processes on defense issues, arms control, and nuclear proliferation. *Mr. Harris*

379. Problems in International Relations (3-0-3).†

This course will examine a major issue in international relations and the contributions of the social sciences to an understanding and/or solution to that question. *Staff*

386. Political Socialization (3-0-3).†

The ways in which political knowledge, attitudes, and values are acquired and modified. Emphasis on political socialization as a particular kind of social learning. *Staff*

405a, 406b. Senior Thesis (0-0-3 each semester).

Open to senior honors majors with the permission of the department. Students must complete both Political Science 405 and 406 to obtain credit. *Staff*

410. Seminar in Adjudication of Current Social Issues (3-0-3).†

The current state of law and court delay, family planning, abortion, euthanasia, drugs, consumerism, privacy, environment, the poor, etc. Prerequisite: consent of the instructor. *Mr. Hudspeth*

454. Revolutions and Revolutionary Movements (3-0-3).†

Causes and outcomes of revolutions, both past and contemporary, and their relationships to the societies in which they occur. *Mr. Dix*

457a. The Conditions of Democracy (3-0-3).

Seminar on social, economic, psychological, historical, cultural, and political roots of democracy and of its principal modern antitheses: communism and facism. *Mr. Dix*

460b. Seminar in Comparative Government (3-0-3).

In 1978-79 this seminar will deal with political parties and voting behavior in Western democracies. *Mr. Ambler*

470. Research Seminar in International Relations (3-0-3).†

Conflict modeling and quantitative analysis of alliance formation, foreign aid, regime structures, ideologies, and arms races as they affect the probability of war. *Mr. Doran*

472b. Seminar in American Foreign Policy (3-0-3).

The content of American foreign policy, its sources, and the process of policy formulation. *Mr. Harris*

475. Seminar in Transnational Organizations and Processes (3-0-3).†

Selected topics in the analysis of transnational politics and processes, such as the role of multinational corporations, the functioning of international organizations, transnational movements, and global policy problems. *Mr. Harris*

486. Topics in American Politics (3-0-3).†

Seminar on politics of sectionalism. *Miss Sanders*

490b. Research Seminar in Modern Political Theory and Interdisciplinary Fields (3-0-3).

The 1978-1979 topic is Texas Politics. *Mr. Cuthbertson*

495a. Introduction to Statistics (3-0-3).

Investigation of the basic concepts and techniques in probability theory and statistical inference. Begins with a review of selected mathematical topics. *Mr. Gow*

503b. Special Topics in Research Methods and Data Analysis (3-0-3).

Applications of least squares and general linear model. *Mr. Gow*

510b. Scope and Methods (3-0-3).

Introduction to research in political science, problems of the discipline, and basic political concepts. History of political science as a discipline. *Mr. Cooper*

511b. Measurement and Research Design (3-0-3).

Research design. Measurement theory. Data collection and modes of analysis. Use of the computer in political research. Theory building. *Staff*

520. Approaches to Comparative Government (3-0-3).†

Core graduate course analyzing basic approaches to the study of comparative government. Open to qualified undergraduates with permission of instructor. *Mr. von der Mehden*

527b. Organization Theory I (3-0-3).

An intensive and extensive study of the theory of large-scale organizations in both the private and public sectors. Prerequisite: Administration 511. Also offered as Administration 514. *Mr. Cooper*

528a. Organization Theory II (3-0-3).

A continuation of Political Science 527. Also offered as Administration 515. *Mr. Cooper*

530a. Approaches to American Government (3-0-3).

Core graduate course analyzing basic approaches to study of American politics. *Miss Sanders*

538. Management of Bureaucracy (3-0-3).†

The management of public sector organizations: communications, management styles, organizational design, budgeting, motivation, planning, organizational change, staffing, and recruitment. Emphasis on public sector problems. Also offered as Administration 517. *Mr. Meier*

540a. Approaches to International Relations (3-0-3).

Core graduate course analyzing basic approaches to the study of international relations. Open to qualified undergraduates with permission of instructor. *Mr. Doran*

542b. International Problems of Energy Supply (3-0-3).

Explores the energy question as a global imbalance between energy demand and supply; the policies of major consumer nations and OPEC's imbalance. Also offered as Administration 574. *Mr. Doran*

570. Seminar in Comparative Government (3-0-3).†

Readings and original research on selected topics. *Mr. Dix*

571a. International Relations and Business I (3-0-3).

Emphasizes through comparative political analysis the societal conditions in the advanced industrial and developing countries and their impact on business. Also offered as Administration 571. *Mr. von der Mehden*

580b. Seminar in American Politics (3-0-3).

Congress and the presidency; the relevance and contribution of organization theory to the study of these institutions. *Staff*

590. Scope and Method of Current Research in International Relations (3-0-3).†

Critical survey of empirical research of diverse topics in international relations: research design, data acquisition, and hypothesis testing.

591a, 592b. Directed Reading in Methodology and Research Design (0-0-3 each semester).*Staff***593a, 594b. Directed Reading in American Politics (0-0-3 each semester).***Staff***595a, 596b. Directed Reading in International Relations (0-0-3 each semester).***Staff***597a, 598b. Directed Reading in Comparative Politics (0-0-3 each semester).***Staff***600a,b. Topics in Political Science.**

Research and thesis for resident students. *Staff*

700c. Summer Study and Research.*Staff***800b. Degree Candidate Only.***Staff*

Psychology

Professor Howell, *Chairman*
Professors Brelsford, Schum, and Wann
Associate Professor Dipboye
Assistant Professors Burnett, Dorfman, D.M. Lane, Rathjen,
and Schuberth
Adjunct Professor R.L. Bell

Degrees Offered: B.A., M.A., Ph.D.

Major in Psychology. Twenty-seven semester hours (nine courses) are required for a major (single or multiple) in psychology. Psychology 201 is required for all majors and 339, 340 are strongly recommended. Specific course sequences are developed individually for each student in accordance with his or her pattern of interests and goals. Most courses are also open to nonmajors subject to the approval of the instructors.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Studies in Psychology. Graduate programs are offered at both the M.A. and Ph.D. levels. The emphasis, however, is upon doctoral training, and only applicants of the Ph.D. caliber will be admitted.

A research thesis with public oral defense is required for both master's and Ph.D. degrees. In addition, sixty semester hours must be accumulated for the Ph.D. and thirty for the master's. Included in this total are required courses in the areas of learning, physiological, social, and methodology plus whatever offerings are available in the student's specialty area. The two specialty areas currently offered are cognitive-experimental, industrial-organizational/social.

Competence in a foreign language is not required. The student must, however, pass an admission-to-candidacy procedure designed to establish his or her expertise in the chosen specialty area.

Psychology Courses

201a,b. Introduction to Psychology (3-0-3).

Major concepts, methods, and theories of modern psychology as they relate to everyday life.
Mr. Dorfman, Mr. Schuberth

303a. Industrial and Organizational Psychology (3-0-3).

An overview of the principles, techniques, and theories of psychology applied in the industrial setting.
Mr. Dipboye

305a. Introductory Social Psychology (3-0-3).

Theories and research in social psychology with emphasis given to the implications for societal problems and interpersonal dynamics. Prerequisite: Psychology 201.
Mr. Dipboye, Ms. Rathjen

307a. Learning (3-0-3).

Introductory survey of issues, theories, research, and applications in learning and memory. Prerequisite: Psychology 201.
Ms. Burnett

308b. Human Learning and Cognition (3-0-3).

Emphasis upon current status of research and theory in such topics as verbal learning, memory and forgetting, and mnemonics. Prerequisite: Psychology 201, 307.
Ms. Burnett

312b. Developmental Psychology (3-0-3).

Focus on behavioral changes with age and general laws of development in both human and nonhuman species. Prerequisite: Psychology 201 or consent of instructor.

Mr. Lane, Mr. Schubert

329a. Differential Psychology (3-0-3).

Techniques for measuring individual differences and critical review of theories of individual differences in intelligence and personality. Prerequisite: Psychology 201.

Mr. Wann

330b. Personality Theory (3-0-3).

Concepts and techniques of personality study. A continuation of Psychology 329, which is a prerequisite.

Mr. Wann

332b. Psychology of Abnormal Behavior (3-0-3).

Various aspects of human behavior including personality functions and abnormal behavior. May be repeated with instructor's permission. Prerequisite: Psychology 201.

Ms. Rathjen

333. Social Motivation (3-0-3).†

Both social processes and personality factors (self-esteem, sex differences) will be examined as they relate to motivation.

339a. Methods in Experimental Psychology (3-0-3).

This course will present both quantitative and non-quantitative methods applicable to research in experimental psychology. Prerequisite: Psychology 201 and permission of instructor.

Mr. Brelsford

340b. Experimental Research in Psychology (3-0-3).

A continuation of Psychology 339 with a stronger emphasis on individual student experiments and the writing of research reports. Prerequisite: Psychology 339 or Mathematical Sciences 280 and permission of instructor.

Mr. Brelsford

341. Animal Behavior (3-0-3).†

The ontogeny, evolution, adaptive significance, and physiology of animal behavior with concepts drawn from psychology and ethology. Prerequisite: Psychology 307 and permission of instructor.

Ms. Burnett

351. The Psychology of Perception (3-0-3).†

Critical evaluation of data, theories, and methods in the area of human perception. Prerequisite: Psychology 201.

362a. Physiological Psychology — A Keller Method Course (3-0-3).

An overview of the neurophysiological correlates of behavior.

Mr. Howell

404b. Advanced Learning and Memory (3-0-3).

An examination of method, theory, and research in the study of cognitive processes. May be repeated for credit. Prerequisite: Psychology 307 and permission of instructor.

Ms. Burnett

409a, 410b. Developmental Social Psychology (3-0-3 each semester).

Major topics include adolescence, comparative social psychology, and theories and problems of social psychology. Prerequisite: Permission of instructor and senior standing.

Mr. Wann

413a. Advanced Social Psychology (3-0-3).

Selected topics in the experimental and theoretical content of modern social psychology. Topic this year: Applications of social psychology and behavior modification. Prerequisite: Psychology 201, 305, and permission of instructor.

Ms. Rathjen

421a. Senior Seminar in Psychology (3-0-3).

A seminar on special topics of interest to particular staff members. Topic announced each semester. May be repeated.

Mr. Dorfman

431a,b. Advanced Topics in Social Psychology (3-0-3).

Prerequisite: Permission of instructor. May be repeated for credit with instructor's approval.

Ms. Rathjen

433a,b. Advanced Research Topics in Cognitive Psychology (3-0-3).

Prerequisite: Permission of instructor. May be repeated for credit with instructor's approval.

Staff

434. Psychopathology (3-0-3).†

Theoretical and applied issues in selected forms of deviant behavior with emphasis on treatment. Prerequisite: Psychology 332 and permission of instructor.

- 435a, 436b. Advanced Research Topics in Industrial Organization (3-0-3 each semester).**
Prerequisite: Permission of instructor. May be repeated for credit with instructor's approval. *Staff*
- 437a, 438b. Advanced Research Topics in Advanced General Psychology (3-0-3 each semester).**
Prerequisite: Permission of instructor. May be repeated for credit with instructor's approval. *Staff*
- 440b. Sensory Psychology (3-0-3).**
A study of phenomena, methods, and theory in contemporary research on visual and auditory processes. Prerequisite: Open only to undergraduate majors and graduate students in psychology. *Mr. Schum*
- 444b. Evidentiary Processes in Jurisprudence (3-0-3).**
This course will involve a study of the inferential behavior of the factfinder (judge/juror) in legal proceedings. Prerequisite: Permission of instructor.
- 452. Human Performance Theory (3-0-3).†**
Survey of research on those aspects of human behavior relevant to design of man-machine systems.
- 491a, 492b. Independent Study and Research (3-0-3 each semester).**
May be repeated for credit. *Staff*
- 509a, 510b. Advanced Psychological Statistics (3-0-3 each semester).**
Descriptive and inferential statistics for beginning graduate students in psychology. Prerequisite: Permission of instructor. *Mr. Lane*
- 511. Research Strategies in Social Psychology (3-0-3).†**
- 512b. Theories of Social Psychology (3-0-3).**
Comprehensive survey with focus on psychology of the individual in relation to social groups. Students will develop thorough working knowledge of theoretical literature and explore selected areas in depth. Prerequisite: Permission of instructor. *Ms. Rathjen*
- 513, 514. Topics in Quantitative Methods and Research Design (3-0-3 each semester).†** *Mr. Lane, Mr. Schum*
- 515a. Topics in Cognitive Psychology (3-0-3).**
Prerequisite: Permission of instructor. *Staff*
- 516b. Topics in Cognitive Psychology (3-0-3).**
The 1979 topic will be: Cognitive development. *Mr. Schubert*
- 517. Professional Issues in Psychology (3-0-3).†** *Mr. Howell*
- 520a,b. Topics in Engineering Psychology (3-0-3).** *Staff*
- 521a. Advanced Learning and Memory (3-0-3).** *Mr. Brelsford, Ms. Burnett*
- 522b. Topics in Learning and Memory (3-0-3).** *Mr. Brelsford*
- 530a. Topics in Industrial-Organizational Psychology (3-0-3).** *Mr. Dorfman*
- 551a, 552b. Graduate Research in Psychology (3-0-3 each semester).**
Supervised literature, laboratory, and field research projects. *Staff*
- 553a, 554b. Graduate Teaching in Psychology (3-0-3 each semester).** *Staff*
- 700c. Summer Graduate Research in Psychology (3-0-3).**
- 800b. Degree Candidate Only.**

Religious Studies

Professor Neilsen, *Chairman*; Professors Sellers and Newport
Associate Professor Kelber
Visiting Associate Professor Haugh
Adjunct Assistant Professors Dunn and Sanborn
Lecturers Benjamin, T.F. Freeman, Shaper, and Sherman

Degrees offered: B.A., M.A., Ph.D.

Undergraduate Majors. All undergraduates majoring in religious studies are expected to enroll in one of the introductory courses offered at the freshman or sophomore level. A total of twenty-four semester hours (eight courses) in advanced courses are required for completion of the major. At least six semester hours (two courses) are to be elected in each of the following areas represented in the department:

1. Historic and Biblical studies
2. Interpretation, theology, comparative religions
3. Religion in the modern world

Qualified upperclassmen will be given an opportunity to engage in independent work. Related courses offered by other departments may be taken for credit in religious studies with the approval of the major adviser.

In addition to the departmental requirements for the major students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Study. The Department of Religious Studies offers graduate work in a variety of fields: ethics, Judeo-Christian origins, philosophy of religion, and theology. In keeping with the traditions of Rice University, study and research are not confessionally oriented. The awarding of advanced degrees is not based solely on the accumulation of credits or compliance with formal requirements. Course plans are determined according to the preparation, needs, and interests of the candidate. A capacity for independent work is considered essential to study in the department.

Requirements for the Degree of Master of Arts:

1. Completion with high standing of a program approved by the department; normally, this will include twenty-four semester hours in advanced courses plus thesis work
2. Satisfactory performance on a reading examination in French or German
3. Satisfactory performance on preliminary written and oral examinations in the field of religious studies; normally, these will include Biblical studies, philosophy of religion, and ethics, with detailed attention to the area of thesis specialization
4. Completion of an acceptable thesis
5. Satisfactory performance on a final oral examination

Requirements for the Degree of Doctor of Philosophy:

1. Completion with high standing of a program approved by the department; normally, this will include fifty-four semester hours, counting that given for the degree of Master of Arts. Six of these semester hours may be waived upon petition to the graduate faculty after the first year. Normal minimum resi-

- dence is at least two years, even for candidates already holding advanced degrees.
2. Satisfactory performance on a reading examination in both French and German
 3. Satisfactory performance on preliminary written and oral examinations in religious studies. Candidates for the Ph.D. degree are expected to prepare themselves for four qualifying examinations (Biblical studies, philosophy of religion, ethics, etc.), at least two of which must be in their major area of concentration.
 4. Completion of a dissertation approved by the department
 5. Satisfactory performance on a final oral examination on the dissertation and related fields

Religion Courses

111a. Religion and Culture (3-0-3).

The Religion Game-I. Examination of major traditions East and West. Religion in human experience: personal, historical, cultural and theological dimensions. *Mr. Nielsen, Staff*

112b. Religion and Culture (3-0-3).

The Religion Game-II. Religious alternatives. The secular vs. the sacred. Competing world views, East and West. *Mr. Nielsen, Staff*

117a. American Religion (3-0-3).

A survey of religion in the U.S. and Canada from the colonial to the contemporary period. Attention to continuing problems and issues, internal and external, to organized religion. *Staff*

202b. Atheism (3-0-3).

Readings in Marx, Feuerbach, Nietzsche, Sartre, Ernst Bloch, as well as classical theistic arguments. *Staff*

203a. The Radical Revolutionaries of Thought (3-0-3).

Study of the founders of the great religions as well as contemporary thinkers. *Mr. Haugh*

204b. Diety, Mysticism, and the Occult (3-0-3).

Critical, phenomenological study of psychology of religion and the occult. Comparative use of the categories of the Western and Eastern traditions. *Mr. Newport*

205a. Futurology and Religion (3-0-3).

Critical study of representative secular and religious futurologies, utopias, and eschatologies. Attention given to religious perspectives on planetary, global, biological, and sociological engineering. *Mr. Newport*

221, 222. First-Year Hebrew (3-0-3 each semester).†

301a. Mysticism and Existentialism (3-0-3).

Examination of these two approaches to life in the Christian and non-Christian literature, ancient and modern. *Miss Dunne*

303. Job and Hebrew Prophets (3-0-3).†

304. Modern Jewish Thought (3-0-3).†

305a. Introduction to Judaism (3-0-3).

Study of Biblical monotheism, Talmud, Jewish philosophy, mysticism, and contemporary reinterpretation. *Mr. Sherman*

306b. The Modern Jew: Despair Vs. Happiness (3-0-3).

Examination of the meaning of the Holocaust for Jews and Christians through literature, art, poetry, and other memoirs. Prerequisite: Religious Studies 111, 112 or other approved courses. *Mr. Sherman*

307a. Jesus in History (3-0-3).

The life of Jesus viewed against the background of the political, social, cultural, economic, and religious history of his time. *Mr. Kelber*

308. Synoptic Gospels (3-0-3).†

310b. Pauline Theology (3-0-3).

Introduction into the theological controversies between Paul and anti-Pauline Christians.
Mr. Kelber

311a. History of Religion: The Far Eastern Tradition (3-0-3).

Readings in the holy books of India, China and Japan. Study of Hinduism, Buddhism, Confucianism, Taoism, and Shinto.
Mrs. Shaper

312b. History of Religion: The Western Tradition (3-0-3).

Study of Judaism, Christianity, and Islam in their historical development. Attention to the basic themes of Western theism.
Miss Dunne

315a. Hebrew Religion: Law and History (3-0-3).

Religious values of the Pentateuch and historical books. Traditions and composition. Israel's religious symbols, cosmology, anthropology, and legislation against its Near Eastern background.
Mr. Benjamin

316b. Hebrew Religion: Psalms and Prophets (3-0-3).

Origin and nature of Hebrew poetry and prophecy. Human dimensions. Character of Israel's beginnings and faith. Religious themes and individual writers.
Mr. Benjamin

331a. Psychology of Religion (3-0-3).

Study of the primary developments that have taken place in the field, with particular emphasis on changing issues and methods.
Mr. Sanborn

334b. Problems in Psychology of Religion (3-0-3).

Significant contemporary problems are examined from a clinical standpoint — e.g., idea of God, evil, anxiety, guilt, and therapeutic process.
Mr. Sanborn

345a. Ethics and the Life Cycle I (3-0-3).

Birth, death, and life's "stages": an overview. Readings from Erikson, Kierkegaard, Skinner, mythology and theology. Not open to freshmen.
Mr. Sellers

346b. Ethics and the Life Cycle II (3-0-3).

Concrete problems of the life cycle, including sex ethics, medical ethics, aging, death, and dying. Not open to freshmen.
Mr. Sellers

347a. Varieties of Contemporary Religion (3-0-3).

Varying religious life styles, traditional and non-traditional, in the Indian, Black, Mexican-American, Islamic, and Jewish communities. Worship, sacred literature, ethics, community involvement, evangelical efforts. Field trips, guests, discussion.
Mr. Freeman

348b. Community Ethical Dilemmas (3-0-3).

Current community problems and their ethical and religious implications: drugs, race, inequities, poverty, law enforcement, religious intolerance. Guest speakers, visitations.
Mr. Freeman

362b. Myth, Evil and Immortality (3-0-3).

Special attention to the thought of Mircea Eliade and Paul Ricoeur.

*Staff***374a. Religious Experience (3-0-3).**

Mystical experience and popular religious movements as diverse aspects of traditional Christianity.
Staff

375a. Man in the Cosmos (3-0-3).

Fundamental questions on the nature of man and his place in the universe.
Miss Dunne

376b. Origin and Destiny of the Universe (3-0-3).

Major cosmological theories and their affect on both religious and secular thinking.

*Miss Dunne***401a, 402b. Independent Study (3-0-3 each semester).***Staff***415. Contemporary Moral Problems (3-0-3).†****443b. Moral Conflict in America (3-0-3).**

Men and movements illustrative of the moral-religious dimensions in the American experience. Prerequisite: two semesters of history, philosophy, or religion.
Mr. Sellers

444. American Manners and Morals (3-0-3).†

453a, 454b. History of Christianity I, II (3-0-3 each semester).

Study of representative thinkers of the Reformation and Enlightenment periods, together with contemporary history. *Staff*

462b. Recent Protestant Theology and Ethics (3-0-3).

Emphasis on Karl Barth, Paul Tillich, Reinhold Niebuhr. Prerequisite: two semesters of history, philosophy, or religion *Staff*

501a, 502b. Research and Thesis (Credit variable).*Staff***506. Seminar in the Synoptic Gospels (3-0-3).†****507a. Pauline Theology (3-0-3).***Mr. Kelber***508. The Gospel of John (3-0-3).†****511a, 512b. Seminar in Hebrew Religion I, II (3-0-3 each semester).***Mr. Benjamin***521a. Readings in Non-Christian Religious Philosophy (3-0-3).**

Critical examination of major traditions of Indian and Chinese philosophy: historical development and modern expressions of Hindu and Buddhist thought. *Staff*

522a. Seminar in Philosophical Theology (3-0-3).*Mr. Newport***523a, 524b. Independent Study (Credit variable)***Staff***525. Seminar in the Problem of Religious Knowledge (3-0-3).†****526b. Seminar in Contemporary Theology (3-0-3).***Mr. Newport***528. Ecumenical Theology Seminar (3-0-3).†****529. Religious Knowledge in Historical Perspective (3-0-3).†****530. Seminar in Historical Theology (3-0-3).†****533a. Methodology in Historical Theology (3-0-3).***Mr. Nielsen***541a. Seminar in Ethics (3-0-3).***Mr. Sellers***543. Seminar in Social Ethics (3-0-3).†****544b. Seminar in Theology and Ethics (3-0-3).***Mr. Sellers***552b. Seminar in History of Religion (3-0-3).***Mr. Nielsen***700c. Summer Graduate Research (3-0-3).***Staff***800b. Degree Candidate Only.**

Sociology

Associate Professor Klineberg, *Chairman*
 Professor C. Gordon
 Associate Professors Davidson and W.C. Martin
 Assistant Professor Long

Degree Offered: B.A.

The Undergraduate Major in Sociology is designed to enable students to gain greater understanding of the nature of human societies, as an important part of a liberal education, as a foundation for a variety of occupations, and as preparation for graduate study. The program provides students with considerable latitude in pursuing substantive interests, while ensuring a basic familiarity with theoretical approaches and issues of methodology. Majors in sociology are not required to take a foreign language; those planning graduate study, however, should be aware that many graduate departments of sociology require demonstrated competence in at least one foreign language. A minimum of twenty-four semester hours (eight courses) in sociology must be passed, of which at least eighteen semester hours (six courses) must be at the advanced level. In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete at least 60 semester hours outside the departmental requirements for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Requirements for the major in sociology are: (1) Sociology 203; (2) at least one of the two courses emphasizing theoretical approaches: Sociology 316, 353; (3) Sociology 421 and 423; and (4) at least fifteen semester hours (five courses) in the substantive areas of sociological specialization. A statistics course such as Mathematical Sciences 221, 280, 301, 380, 480, or 481 may be used as one of these.

All sociology courses listed are regularly offered by the present faculty, although not necessarily every year. Additional courses may be offered with the addition of new faculty or variations in present course assignments; similarly, some courses may be discontinued from the regular offerings. It is the responsibility of the student to consult the listing of university distribution requirements before registering and to be certain to satisfy all the requirements for his or her degree. The registration of every sociology major must be signed by a departmental adviser.

The Honors Program in Sociology. The honors program is designed (1) to provide undergraduates whose primary concentration is in the field of sociology with the opportunity to deepen their understanding of the sociological perspective through a two-semester program of directed independent research and writing, and (2) to provide an opportunity for the recognition of undergraduates who have demonstrated unusual competence in sociology and capacity for sustained independent research.

To be eligible for the program, a student must have maintained a 2 average in at least four sociology courses beyond the introductory level. During the first semester of the junior year, students who meet this requirement are invited to submit, no later than two weeks prior to registration for the spring semester, a description of their proposed research project to the Undergraduate Honors Committee (Professor Chandler Davidson, chairman). This committee, in consultation with the candidate, will evaluate the proposal in

terms of both its feasibility and its sociological significance. Upon acceptance into the program, the student will be assigned a faculty adviser who will supervise the student's independent research and the selection of further courses relevant to the project. It is expected that all honors candidates will have completed Sociology 421 and 423 before beginning their second semester of honors research.

Honor students will register for two successive semesters of directed honors research (Sociology 492, 493). The first semester will normally be devoted to a review of the relevant literature and the preparation of a detailed outline of the planned research. The research itself will normally be carried out during the second semester and written up as a completed honors thesis by the end of that period.

The thesis will be read and evaluated by two other faculty members in addition to the student's primary adviser, followed by an oral examination open to the public. These three faculty members will share responsibility for determining departmental honors, based on the student's performance in the program as a whole.

Sociology Courses

203a. Introduction to Sociology (3-0-3).

Introduction to the principal concepts, theories, and methods of the field of sociology.

Mr. Martin

204b. Contemporary American Society (3-0-3).

Distinctive organizational and structural characteristics of modern American society considered in relation to cultural norms and values. Review and critique of leading social analysts.

Ms. Long

230. Race and Ethnic Relations (3-0-3).†

The study of race and ethnicity in American life. Review of sociological research complemented by readings in ethnic literature, such as biography and the novel.

300b. Social Stratification (3-0-3).

Social inequality in human societies. American stratification is compared with other systems. Theories of inequality are examined. Experiments in abolishing stratification are discussed.

Mr. Davidson

305a. Sociology of Sex Roles (3-0-3).

Relationship between gender and social role. Development of the contemporary sexual division of labor and processes of socialization with reference to family, education, media, and occupations.

Ms. Long

311. Collective Behavior (3-0-3).†

Consideration of relatively noninstitutionalized conduct: crowds, mobs, publics, social movements; conditions and consequences of social unrest, excitement, panic, and protest.

316b. Basic Trends in Sociological Theory (3-0-3).

Conflict/integration theory, symbolic interactionism, structural-functionalism and exchange theory as influenced by Marx, Weber, and Durkheim, as well as Parsons, Mills, and Merton.

Mr. Gordon

319a. The Sociology of Occupations (3-0-3).

The influence of occupation upon life style, values, social and economic status, and views of the world. Field work by the student is encouraged.

Mr. Davidson

321. Criminology (3-0-3).†

Types of criminal behavior, theories of crime and juvenile delinquency, with attention to the role of police, courts, correction agencies, and other social structures.

326b. Sociology of Situational Interaction (3-0-3).

Interpretation and normative regulation of face-to-face interaction. Presentation of self and allocation of involvement in different social situations. Field observations will be included.

Mr. Gordon

327a, 328b. Problems in Media and Sociology (3-0-3 each semester).

A focused independent study relating media and substantive sociology. Also listed as Anthropology 327, 328 and Arts 327, 328.

329. The New Shape of Work (3-0-3).†

An examination of critical changes in work discipline and occupational structure during the nineteenth century, and of efforts to assess the meaning of those changes. Also offered as History 329.

331. Politics and Society in Texas (3-0-3).†

The political sociology of the state. Special emphasis on research.

336. Mass Communications (3-0-3).†

Analysis of the structure, social context, and effects of large-scale impersonal communication to dispersed and heterogeneous audiences, through both print and electronic media.

353a. Personality, Social Structure, and Culture, I (3-0-3).

Interrelations between personality and social systems, as seen by psychoanalysis, behaviorism, Piaget, and the symbolic interactionists; the changing conceptions of man in the behavioral sciences. *Mr. Klineberg*

354b. Personality, Social Structure, and Culture, II (3-0-3).

Attitudes, conformity and deviance, psychological dimensions of social change. Relation of psychology, sociology, and anthropology to individual behavior and the persistence of social systems. Prerequisite: Sociology 353 or permission of the instructor. *Mr. Klineberg*

356b. Sociology of Health and Illness (3-0-3).

The social and cultural factors that influence the development of physical and mental disorders and the delivery of health care within American society. *Mr. Kaplan*

370. Sociology of Education (3-0-3).†

Social inequality in education from two sociological perspectives: the cultural deprivationist perspective and the interactionist perspectives of Goffman and Cicourel.

381a. Small Groups (3-0-3).

Analysis of individual-group conflict, group development, communication between members, and small groups as the carriers of culture, based in part on experience in a self-study group. *Ms. Huddle*

391a. Sociology of Leisure (3-0-3).

Leisure activity (relaxation, diversion, personal development, creativity and serious transcendence) in relation to work, family, education, income, socio-economic status, and life-cycle stage. *Mr. Gordon*

403a, 403b. Independent Study (0-0-3 each semester).**412b. Social Change (3-0-3).**

Processes of social change from the perspectives of leading theorists and recent research; individual and collective responses to the transformations in modern societies. *Mr. Klineberg*

421a. Introduction to Research Methods (3-0-3).

Examination of the major objectives, strategies, and tactics of social science research, combined with practical experience in conducting an empirical project. Laboratory (Sociology 423) required. *Mr. Gordon, Ms. Long*

423a. Introduction to Research Methods Laboratory (0-3-1).

A three-hour laboratory devoted to a class project, including literature review, hypotheses formulation, research design, data collection, and analysis. *Mr. Gordon, Ms. Long*

425a. Political Sociology (3-0-3).

An examination of the distribution of power in American society. Particular attention is given to the relation of class and ethnicity to politics. *Mr. Davidson*

426b. The Sociology of Marx (3-0-3).

Sociological aspects of Marx's theory: class, alienation, ideology, and historical materialism. Marx's predictions in light of twentieth-century developments. Sociological critiques and revisions of Marxism. *Mr. Davidson*

429a. Sociology of Religion (3-0-3).

Religious beliefs, symbols, actions, organizations, roles, and various interrelationships between religion and society, new religious movements, secularization, and functional alternatives to religion. Field Work. *Mr. Martin*

431. Sociology of the Life-Cycle, I (3-0-3).†

Seminar analyzing socialization, interaction patterns, self-conception development, and aspirations during infancy, childhood, and adolescence. Effects of sex role, family structure, social class, and ethnicity.

432. Sociology of the Life-Cycle, II (3-0-3).†

Seminar analyzing identity transformations, adult socialization, occupation, family, role losses, and death from young adulthood through old age. Effects of sex role, social class, ethnicity.

434. Family Structures and Processes (3-0-3).†

Analysis of role structure, sexuality, and interaction patterns in the "standard" U.S. nuclear family and its alternatives in diverse social settings.

436b. Sociology and Literature (3-0-3).

The interconnections between literature and society, considered from a range of theoretical perspectives. The uses of literary materials as "evidence" in sociological analysis. *Ms. Long*

440. Complex Organizations (3-0-3).†

Organizational structure and social processes within large-scale organizations; the impact of change and conflict, informal and formal norms, alienation, and professionalization.

446. Urban Sociology (3-0-3).†

Urban growth and physical structure, the quality of human relations and of cultural and individual survival in an urbanized society, and strategies of response.

471. Popular Culture (3-0-3).†

Examination and analysis of social origins, significance, and implications of various types of media, arts, and popular entertainments. Enrollment limited. Permission of instructor required.

480. Sociology of the Future (3-0-3).†

Processes that underlie the transformation of American society; educational and occupational changes, social movements, and personal values, as they interact to shape the future.

492b, 493a. Directed Honors Research (3-0-3 each semester).

Sociological research under faculty supervision. First semester: review of relevant literature and preparation of outline for planned research. Research carried out and honors thesis completed during the second semester. Open only to students in sociology honors program.

Staff

Space Physics and Astronomy

**Professor Michel, *Chairman*; Professors H.R. Anderson, Chamberlain,
Clayton, Cloutier, Dessler, J.W. Freeman, W.E. Gordon, Haymes,
Heymann, N.S. Lane, Stebbings, Walters, and Wolf
Adjunct Professor Low
Associate Professors Dunning, Few, and Talbot
Adjunct Associate Professor Rundel
Assistant Professors Dufour, Hill, and Reiff**

Degrees Offered: B.A. in Physics with space physics and astronomy option, M.S., Ph.D.

Undergraduate Program. There is no undergraduate major in the department; however, the Physics Department offers a space physics and astronomy option leading to a B.A. with a major in physics for students with an interest in studies directed toward space physics and astronomy. The course requirements for this option can be satisfied in any order consistent with prerequisites. The following is a typical program (laboratory courses in parentheses):

<i>Freshman:</i>	Physics 101, 102 or 111, 112 (132) Mathematics 101, 102 Chemistry 101, 102, (107)
<i>Sophomore:</i>	Space Physics and Astronomy 251, 252, (261, 262) Physics 201, 202 or 211, 212 (231) Mathematics 211, 212
<i>Junior:</i>	Physics 301, 302 (331, 332) Physics 311, 312 Mathematics or Mathematical Sciences elective (300 or above)
<i>Senior:</i>	Space Physics and Astronomy 471 or 472 (431, 432) Physics 425 Math elective

Additional courses in space physics, electrical engineering, mathematics, computer science, geology, and other subjects may be of use to undergraduate majors. The department has prepared a list of such courses, and should be consulted prior to registration. In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 140 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Graduate Program. Research opportunities exist for graduate studies leading to degrees of Master of Science and Doctor of Philosophy in the Department of Space Physics and Astronomy. To gain such a degree a student must be knowledgeable in many areas of space physics and astronomy and expert in at least one.

Because of the interdisciplinary nature of the department's activities, holders of bachelor's degrees in astronomy, chemistry, electrical engineering, geophysics, physics, or any of several other scientific and engineering disciplines may apply for admission to graduate work in the department. Research programs in the Department of Space Physics and Astronomy include astrophysics, atmospheric electricity, atomic physics, fields and particles, meteoritics, planetary structure, and planetary atmospheres.

The requirements for M.S. and Ph.D. degrees are outlined below. A booklet giving more detailed and specific information is available from the departmental office.

Degree of Master of Science. Candidates for the master's degree must complete successfully at least thirty semester hours of approved graduate level studies and must demonstrate an understanding of physics and astronomy in an oral examination by their faculty committee. They must prepare a written thesis on an original research topic and defend the thesis orally.

Degree of Doctor of Philosophy. The basic requirement for a Ph.D. is demonstration of the capacity for independent, original research. Additional formal requirements are indicated below.

A student is normally admitted to candidacy for the Ph.D. degree by satisfying the requirements for the M.S. degree in space physics and astronomy as outlined above.

Candidates who hold a master's degree could possibly complete requirements for the doctorate in two years; however, a minimum of three years' graduate study is normally required. Students must complete at least sixty semester hours of approved graduate level studies, prepare a thesis on an

original research topic, and defend the thesis orally. The thesis must be of quality acceptable for publication in a reputable scientific journal. Further details of research programs in space physics and astronomy and departmental degree requirements are contained in a pamphlet available on request from the Department of Space Physics and Astronomy.

Space Physics and Astronomy Courses

241a,b; 242b. Astronomy: Exploring the Universe (3-0-3 each semester).
A self-paced introductory course intended for students in academic programs. *Ms. Reiff*

251a, 252b. Introduction to Space Physics and Astronomy (3-0-3 each semester).

Introductory course recommended for science-engineering majors. Concurrent registration in Space Physics and Astronomy 261, 262 required. *Mr. Dufour*

261a, 262b. Observational Astronomy Laboratory (0-3-1 each semester).
Astronomical coordinates, telescopes, astrophotography, photometry, and spectroscopy.

Corequisite: Space Physics and Astronomy 251, 252. *Mr. Dufour*

301a. Space Colonies (3-0-3).

Physics of the space environment, design and construction of large space structures, economic justification (power generation, specialized manufacturing), and evolution of social and political framework. *Mr. Dessler*

431a, 432b. Senior Research (0-6-2 each semester).

For majors in the space physics and astronomy option. *Staff*

433a, 434b. Honors Research I and II (0-9-3 each semester).

Student pursues a research project, similar to Space Physics and Astronomy 431, 432, but in considerably greater depth. Departmental approval required. *Staff*

443a. Introduction to Atmospheric Science (3-0-3).†

Fundamentals of meteorology and climatology: radiation and energy balance, measurements, thermodynamics, clouds, weather systems, motions on small and global scales. Also offered as Environmental Science and Engineering 443 and Mechanical Engineering 477. *Mr. Few*

444b. Atmospheric Dynamics (3-0-3).†

Hydrodynamic equations of motion on a rotating planet solved for static, stable, perturbed, and unstable flows for meso-scale and macro-scale weather systems on the Earth and other planets. Also offered as Environmental Science and Engineering 444 and Mechanical Engineering 478. *Mr. Few*

471a. Modern Astronomy and Astrophysics (3-0-3).

Observational and theoretical aspects of the generation of corpuscular, electromagnetic, and gravitational radiation in astronomical objects. Prerequisite: Space Physics and Astronomy 251, 252, 262; Physics 301, 302, 311, and 312 or equivalent. *Mr. Dufour*

472b. Solar System Physics (3-0-3).

Solar-terrestrial relationships, planetary atmospheres, ionospheres, and magnetospheres. Prerequisite: Space Physics and Astronomy 251, 252, 262; Physics 301, 302, 311, and 312 or equivalent. *Mr. Anderson*

488b. Topics in Space Utilization and Industrialization (3-0-3).

The utilization of space for industrial and advanced scientific purposes. Science/Engineering majors only; other majors should enroll in space Physics and Astronomy 301. *Mr. Freeman*

495a, 496b. Science Teaching (3-0-3 each semester).

Supervised teaching experience in the science classroom or laboratory. For undergraduates. *Staff*

503a, 504b. Introduction to Plasma Astrophysics (3-0-3 each semester).

Magnetohydrodynamics, particle drifts, electrical conductivities, waves, and instabilities. Emphasis on applications. *Mr. Cloutier*

506. Advanced Plasma Physics (3-0-3).†

The course will treat plasma waves and instabilities from the point of view of kinetic theory and the Vlasov equation. Prerequisite or corequisite: Space Physics and Astronomy 504.

Mr. Wolf

507a, 508b. Research Topics in Space Physics, Astronomy, and Atmospheric Physics (2-0-2 each semester).

A presentation of current research programs in the department.

Mr. Chamberlain

511a. Planetary Atmospheres: Radiative Equilibrium (3-0-3).

Physics and chemistry of the lower atmospheres of planets.

Mr. Chamberlain

512b. Planetary Atmospheres: Aeronomy (3-0-3).

Physics and chemistry of planetary atmospheres.

Mr. Chamberlain

515a. Advanced Classical Mechanics (3-0-3).

Lagrangian and Hamiltonian dynamics, normal vibrations, rigid body motion, the transformation theory of dynamics, and the covariant formulation. Also offered as Physics 515.

Mr. Lane

521a, 522b. Quantum Mechanics (3-0-3 each semester).

Also offered as Physics 521, 522.

Mr. Huang

531a, 532b. Electromagnetic Theory (3-0-3 each semester).

Also offered as Physics 531, 532.

Mr. Duck

535. The Solar System (3-0-3).†

Basic physical features of the solar system and the current theories that attempt to explain its origin and evolution.

Mr. Freeman

537. Cosmochemistry II (3-0-3).†

Chemistry of interstellar media.

Mr. Heymann

538b. Cosmochemistry I (3-0-3).

Chemical evolution of the solar system.

Mr. Heymann

544b. Mathematical Methods in Space Physics (3-0-3).

Selected mathematical techniques and methods useful in physics and space physics. Prerequisite: Physics 301 and 302 or equivalent. Mathematical Sciences 440 recommended. Also offered as Mathematical Sciences 544.

Mr. Hill

545a, 546b. Cosmology (3-0-3 each semester).

Structure and evolution of the universe.

Mr. Wolf

551. Stellar Evolution and Nuclear Astrophysics (3-0-3).†

Physical principles governing structure and evolution of stars.

Mr. Talbot

552. Stellar and Galactic Evolution (3-0-3).†

Application of Space Physics and Astronomy 551 to stellar and galactic evolution.

Mr. Talbot

555, 556. Radiation Theory and High Energy Astrophysics (3-0-3 each semester).†**591a, 592b. Graduate Research (Credit variable).**

Staff

595a, 596b. Teaching Space Physics and Astronomy (Credit variable).

For graduate students.

Staff

603a, 604b. Special Topics in Space Physics and Astronomy (3-0-3 each semester).

Current topics including modern developments in space physics and astronomy. Emphasis may vary from year to year.

Mr. Freeman, Mr. Dufour

611a, 612b. Special Topics in Ionospheric Physics (3-0-3 each semester).

Current research in ionospheric physics, with emphasis on experimental studies.

Mr. Gordon

615. Experimental Methods of Space Physics and Astronomy (3-0-3).†

660. Gravitation and Relativity (3-0-3).†

Theories of gravitation with emphasis on the General Theory of Relativity and cosmological applications. Prerequisite: Physics 415 or equivalent. Also offered as Physics 660. *Mr. Clayton*

700c. Summer Graduate Research (0-0-6).

Staff

800b. Degree Candidate Only.

Staff

Spanish, Portuguese, and Classics

Associate Professor Urrutibéheity, *Chairman*

Professors Castañeda and Levin

Associate Professors Boorman, Leal de Martinez, and Wallace

Assistant Professor Callahan

Instructors Cameron and Kauffmann

Lecturers Daichman, Eaker, and Kiperman

Degrees Offered: B.A. and M.A. in Spanish; B.A. in Classics

Study is offered in classics, Greek, Latin, Portuguese, and Spanish. A fully equipped language laboratory is in operation. Laboratory work is required of students in the beginning classes of all modern languages.

Qualified upperclass students may engage in independent work at the discretion of the department.

Spanish

Requirements for an Undergraduate Major in Spanish. A student majoring in Spanish may pursue the following options: (1) language, (2) literature, or (3) Latin American studies. For an option in language or literature, thirty semester hours (ten courses) offered in fulfillment of major requirements must be Spanish courses numbered 300 or higher. For an option in Latin American studies, a minimum of eighteen semester hours (six courses) in Spanish numbered 300 or higher must be taken, plus six semester hours (two courses) of Portuguese, and at least twelve semester hours (four courses) related to the Latin American field in other departments. Qualified upperclass students are offered an opportunity to earn up to six semester hours in independent work. For specific requirements as to courses and the sequence to be followed, see the departmental advisers. All majors must have their programs approved by the department.

In addition to the departmental requirements for the major, students must also satisfy the distribution requirements and complete no fewer than 60 semester hours outside the departmental requirements, for a total program of at least 120 semester hours. See Degree Requirements and Majors, pages 50 and 51.

Requirements for the Degree of Master of Arts in Spanish:

1. Completion with high standing of a program approved by the department; normally this will include twenty-four semester hours in advanced courses plus six semester hours of thesis work
2. Satisfactory performance on a reading examination in one foreign language other than Spanish approved by the department

3. Satisfactory performance on a written comprehensive examination in Spanish, which will test the student's mastery of the chosen area of specialization and general competence in the remaining areas of Hispanic literature and linguistics
4. One semester of college Latin or equivalent
5. Completion of an acceptable thesis
6. Satisfactory performance on a final oral examination on the thesis

Summer Graduate and Undergraduate Program. Each summer since 1973 the Department of Spanish has offered programs designed to prepare students to study the Spanish language and do research on Spanish and Latin American study projects. These programs have been held in Argentina, Spain and Mexico. Beginning this year the Summer Program of Hispanic Studies will be held in three cities in Spain: Seville, Madrid, and San Sebastián.

Spanish Courses

101a, 102b. First-Year Spanish (3-2-4 each semester).

Introduction to the study of the Spanish language with emphasis on the development of audio-lingual skills. Language laboratory work required. *Staff*

103a. Accelerated Beginning Spanish (6-2-6).

Double course comparable to Spanish 101 and 102, designed to achieve in one semester maximum proficiency in spoken language. Five classes a week, language lab twice a week.

Mr. Urrutibéheity, Staff

201a, 202b. Second-Year Spanish (3-0-3 each semester).

Contemporary short stories will provide current linguistic models and serve as the point of departure for class conversation and discussion. *Staff*

204b. Accelerated Intermediate Spanish (6-2-6).

A continuation of Spanish 103 comparable to Spanish 201, 202. Contemporary short stories will provide current linguistic models and serve as the point of departure for class conversation and discussion.

Mr. Urrutibéheity, Staff

303a. Spanish Literature in Translation (3-0-3).

Selected works of outstanding Spanish writers. Readings and class discussion in English. Open to all students. Does not count toward a major in Spanish. *Mr. Castañeda*

304b. Spanish American Literature in Translation (3-0-3).

Selected works of outstanding contemporary Latin American writers. Readings and class discussion in English. Open to all students. Does not count toward a major in Spanish.

Mrs. Boorman

311a, 312b. Advanced Spanish (3-0-3 each semester).

Third-year course designed primarily to improve spoken language. Emphasis on new vocabulary and idioms, morphology, syntax, and mechanisms of interference. *Staff*

315a. Spanish Phonetics (3-0-3).

Spanish phonetics including major dialectical variants. Specific emphasis on analysis of the most frequent types of English interference. Active practice in pronunciation and intonation.

Mrs. Boorman

316. Advanced Spanish Syntax and Composition (3-0-3).†

A detailed study of Spanish syntax with special attention to the interference caused by structural differences between English and Spanish. *Mr. Urrutibéheity*

319a, 320b. Survey of Spanish Literature (3-0-3 each semester).

The history of Spanish literature through representative readings from the medieval period to the present. Emphasis on stylistic analysis. Formerly offered as Spanish 301, 302.

Mrs. Leal de Martínez, Mr. Cameron

321a, 322b. Survey of Spanish American Literature (3-0-3 each semester).

The main trends and outstanding writers of Spanish America. Offered alternate years.

Mrs. Callahan, Mrs. Boorman

323a. Hispanic Culture and Civilization (3-0-3).

Topics relating to the development of social, political, and economic institutions of Spain will form the basis for extensive conversation, discussion and composition. *Mr. Kauffmann*

324b. The Culture and Civilization of Latin America (3-0-3).

The development of social, political, and economic institutions of Latin America forms the basis for extensive conversation, discussion, and composition. *Mrs. Leal de Martínez*

341, 342. Spanish Literature From 1800 to the Present (3-0-3 each semester).†

Mrs. Leal de Martínez

361a, 362b. Golden Age of Drama (3-0-3 each semester).

Development of the "comedia," illustrated by selected works of Lope de Vega, Tirso de Molina, Ruiz de Alarcón, Calderón de la Barca, and other seventeenth-century playwrights. Offered alternate years. *Mr. Castañeda*

381, 382. Prose and Lyric Poetry of the Golden Age (3-0-3 each semester).†

Analysis of poetry and prose emphasizing mysticism, the development of lyric poetry from Garcilaso to Góngora, the picaresque novel, and Cervantes. Offered in alternate years. *Mr. Castañeda*

402. Introduction to Semiotics (3-0-3).†

Study of literary texts (rhetoric, poetics, and narrative theory); semiotics as a framework for social science studies. Readings and lectures in English; some readings in Spanish for majors. No prerequisites. *Mr. Kauffmann*

405, 406. Spanish American Literature (3-0-3 each semester).†

Mrs. Boorman

411, 412. Medieval and Renaissance Spanish Literature (3-0-3 each semester).†

Mrs. Leal de Martínez

415a, 416b. The Art and Mechanics of Translation (2-2-3 each semester).

Intensive practice in Spanish-English, English-Spanish translation. Introduction to the techniques of consecutive and simultaneous interpretation. Lab work required. Prerequisite: 311, 312 or equivalent. *Staff*

421a, 422b. Independent Work: Special Topics (0-0-3 each semester).

Hispanic literature, Hispanic linguistics, and Hispanic culture and civilization. Reserved for qualified upperclassmen who are particularly interested in a topic not covered in other courses. Permission of the department required. *Staff*

501a, 502b. Research and Thesis (0-0-3 each semester).

Staff

507a. Teaching College Spanish (1-0-1).

Teaching methods and techniques, preparation of tests, and evaluation. One hour per week of discussion. Students observe language class one week, teach three weeks. Required for graduate students. *Mr. Urrutibéheity*

511a. Methods of Research in Hispanic Literature (3-0-3).

Theoretical and practical course for beginning graduate students. Emphasis on techniques of stylistic and linguistic analysis, and on the bibliographical resources of the field. *Staff*

512. Methods of Research in Hispanic Literature (3-0-3).†

Continuation of Spanish 511.

Staff

515a. Studies in Hispanic Linguistics (3-0-3).

Topics: history of the Spanish language, Old Spanish, applied Spanish linguistics, and Spanish American dialectology. *Mr. Urrutibéheity*

516. Studies in Hispanic Linguistics (3-0-3).†

Mr. Urrutibéheity

517. Studies in Medieval Spanish Literature (3-0-3).†

Mrs. Leal de Martínez

518b. Studies in Medieval Spanish Literature (3-0-3).

Topic: *La Celestina*

Mrs. Leal de Martínez

523, 524. Studies in Golden Age Theatre (3-0-3 each semester).†

Mr. Castañeda

525, 526. Studies in Spanish Golden Age Prose and Lyric Poetry (3-0-3 each semester).†

Mr. Castañeda

- 535a. Studies in the Spanish Literature of the Nineteenth Century (3-0-3).**
Topic: Poetry, drama and ideology of the early nineteenth century. *Mr. Cameron*
- 536. Studies in the Spanish Literature of the Nineteenth Century (3-0-3).†**
Staff
- 541. Studies in the Spanish Literature of the Twentieth Century (3-0-3).†**
Staff
- 542b. Studies in the Spanish Literature of the Twentieth Century (3-0-3).**
Topic: Spanish Modernism. *Mr. Kauffmann*
- 555a. Studies in Spanish American Literature from the Colonial Period to the Present Day (3-0-3).**
Topic: Contemporary Latin American drama. *Mrs. Boorman*
- 556. Studies in Spanish American Literature from the Colonial Period to the Present Day (3-0-3).†**
Mrs. Boorman
- 566. Studies in the Culture and Civilization of Spain and Latin America (3-0-3).†**
Staff
- 575. Introduction to Romance Linguistics (3-0-3).†**
The development of the Romance languages from Vulgar Latin and the creation of Romance standards. *Mr. Urrutibécheity*
- 576. Introduction to Romance Linguistics (3-0-3).†**
Mr. Urrutibécheity
- 591a, 592b. Independent Study: Special Topics in Hispanic Literature, Hispanic Linguistics, and Hispanic Culture and Civilization (0-0-3 each semester).**
Staff
- 700c. Summer Graduate Research.**
Staff
- 800b. Degree Candidate Only.**

Portuguese Courses

- 101a, 102b. First Year Portuguese (3-2-4 each semester).**
Introduction to the study of the Portuguese language with emphasis on development of audio-lingual skills. Language laboratory work required. *Mrs. Boorman, Mrs. Leal de Martínez*
- 201, 202. Second-Year Portuguese (3-0-3 each semester).†**
- 311, 312. Advanced Portuguese (3-0-3 each semester).†**
- 400b. Independent Study: Special Topics in Luso-Brazilian Literature and Linguistics (0-0-3).**
Reserved for qualified students particularly interested in a topic not covered in other courses. Permission of the department required. *Staff*

Classics

Requirements for an Undergraduate Major in Classical Studies. A major in classical studies is presently offered with the cooperation of the departments of History and Fine Arts. The overall major requirement is distributed between classical languages and literature, at least thirty semester hours (ten courses) of which eighteen semester hours (six courses) must be at the 300 level or above, and relevant courses in fine arts, history, humanities, and philosophy. Preparation to insure an adequate reading and speaking knowledge of at least one modern foreign language is very strongly urged. All prospective programs for individuals majoring in classical studies are to be drawn up in consultation with the members of the classics staff.

*Classics Courses***211a. Classical Civilization: Greece (3-0-3).**

A introductory survey of the various aspects of ancient Greek culture, including political and social history, art and architecture, religion, philosophy, and literature. No prerequisites.

Mrs. Eaker

212b. Classical Civilization: Rome (3-0-3).

An introductory survey of the various aspects of Roman civilization, including the rise of Christianity; political and social history, art and architecture, religion, philosophy, and literature. No prerequisites.

Mrs. Wallace

214b. Greek and Latin Elements in English (3-0-3).

The relationship of English to the classical languages; a systematic guide to understanding of vocabulary and an example of historical and cultural development. No prerequisites.

Mrs. Eaker

335a, 336b. Classical Mythology (3-0-3 each semester).

Survey of Greek myths with their extension to Rome and to modern European literature. All works will be read in English translation. No prerequisites.

Mr. Levin

412. Roman Historians (3-0-3).†

Study of Roman historiography, with emphasis upon Sallust, Livy, and Tacitus, including comparison with Greek historians and with the ancient biographical tradition. Prerequisite: Classics 211 or 212, or History 201 or 202, or permission of instructor. Offered in alternate years. Also offered as Latin 412.

*Greek Courses***101a, 102b. First Year Greek (3-0-3 each semester).**

Designed to develop as rapidly as possible an ability to read simple Greek prose. Study of grammar, forms, and vocabulary combined with practice in reading.

Mrs. Eaker

201a, 202b. Intermediate Greek: Classical (3-0-3 each semester).

Designed to broaden previously acquired skills through close study of readings which may include a dialogue of Plato, a tragedy, or selections from Homer. Prerequisite: Greek 101, 102 or equivalent.

Staff

211. Intermediate Greek: New Testament (3-0-3).†

Experience and facility in reading New Testament Greek. The Gospel of Mark and selected letters of Paul will be read. Prerequisite: Greek 101, 102, or equivalent.

Mrs. Eaker

491a, 492b. Special Topics in Greek Literature (0-0-3 each semester).

Independent work for qualified upperclassmen in genres or authors not presented in other upper-level courses; may be repeated for credit. If Greek 301, 302 is not given, students who wish to study Greek beyond the 200 level should register for this course.

Staff

*Latin Courses***101a. First Year Latin (3-0-3).**

The fundamentals of Latin grammar with emphasis on acquisition of reading skill. Open to students with no previous study of Latin or who need a refresher course.

Mrs. Eaker

102b. First Year Latin (3-0-3).

A first reading course in Latin. Selections of prose and poetry from the Classical and Medieval periods will be read.

Mrs. Wallace

201a. Intermediate Latin (3-0-3).

Rapid review of forms and syntax followed by reading of representative prose selections. For students who enter with two or three years of high school Latin or who have successfully completed Latin 101, 102.

Staff

301a. Catullus and Horace (3-0-3).

Selected lyric poems of both authors will be studied. Prerequisite: same as for Latin 301.

Mrs. Wallace

302b. Plautus and Terence (3-0-3).

Study of selected comedies. Consideration will be given to the position of both authors in ancient comic tradition. Prerequisite: Latin 201, 202, or three or four years of high school Latin.

Mr. Levin

411. Literature of the Late Republic (3-0-3).†

Mr. Levin

412. Roman Historians (3-0-3).†

Mrs. Wallace

421a. Vergil (3-0-3).

Study of the poet's works (*Bucolics, Georgics, Aeneid*), with special emphasis on the *Aeneid*. Offered in alternate years.

Mr. Levin

422b. Ovid (3-0-3).

Study of selections of the major works, both epic and elegiac, with special emphasis on the *Metamorphoses*. Offered in alternate years.

Mr. Levin

491a, 492b. Special Topics in Roman Literature (0-0-3 each semester).

Independent work for qualified upperclassmen in genres or authors not presented in other upper-level courses: may be repeated for credit. Prerequisite: Latin 301, 302 or equivalent. *Staff*

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