“The goals of the University of Arizona are to provide the opportunity for the acquisition of comprehensive education and usable skills, to serve as a resource for the expansion of knowledge through research, and to extend the opportunity to improve the quality of life by making available the services and resources of the University, its faculty and staff, to the students of the University and citizens of the State.”
The University of Arizona Record
Tucson, Arizona
All colleges and departments establish certain academic requirements which must be met before a degree is granted. These requirements concern such things as curricula and courses, majors and minors, and campus residence. Advisers, directors, department heads, and deans are available to help the student understand and arrange to meet these requirements, but the student is responsible for fulfilling them. At the end of the student's course of study, if requirements for graduation have not been satisfied, the degree will not be granted. For this reason it is important for each student to be acquainted and remain currently informed about all regulations, and to be responsible for completing requirements. Courses, programs, and requirements described in the catalog may be suspended, deleted, restricted, supplemented, or changed in any other manner at any time at the sole discretion of the University and the Arizona Board of Regents. The catalog does not establish a contractual relationship but it summarizes the total requirements which the student must presently meet before qualifying for a faculty recommendation to the Arizona Board of Regents to award a degree.

The determination of acceptability of credit for course work completed at another institution of higher learning, whether the other institution is accredited or not, is made solely at the discretion of this institution as guided by its academic policy bodies. Students are advised to check with Office of Admissions to determine the acceptability of credit from other institutions and its applicability toward a program of study at the University of Arizona.

The University of Arizona does not discriminate on the basis of sex, age, race, religion, color, national origin, Vietnam Era Veteran's status, or disability in its admissions, employment and educational programs or activities, and is required by Title IX of theEducation Amendment of 1972, Title VII of the Civil Rights Act of 1964, Sections 503 and 504 of the Rehabilitation Act of 1973, the Age Discrimination in Employment Act of 1967, and the Vietnam Era Veteran's Readjustment Assistance Act of 1972 not to discriminate in such manner. Inquiries concerning the application of said regulations to the University of Arizona may be referred to Dr. Celestino Fernandez, Affirmative Action Officer, Administration 501, phone (602) 621-3081.

In compliance with the Family Education Rights and Privacy Act of 1974, the University of Arizona guarantees that the parents of dependent children will have a right to information about their offspring without having to gain the student's consent.

Announcements in this catalog concerning regulations, fees, curricula, or other matters are subject to change without notice. Inquiries regarding admission the University should be addressed to:

Director of Admissions
The University of Arizona
Tucson, Arizona 85721
(602) 621-3237
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Contents

ACADEMIC CALENDAR .............................................................. 6
HOW TO USE THIS CATALOG .................................................. 8
Abbreviation Guide ............................................................... 9

I. GENERAL UNIVERSITY INFORMATION
   Memberships and Accreditations ........................................... 13
   History and Academic Organization ..................................... 14
   Admission to the University ............................................... 24
   Registration ......................................................................... 32
   Academic Guidelines .......................................................... 35
   Graduation Requirements .................................................... 48
   Expenses and Fees .............................................................. 51
   Scholarships and Financial Aid ............................................. 58
   Provisions for Superior Students ......................................... 60
   Student Services .................................................................. 62
   Housing Facilities, Student Conduct and Campus Life ............. 68
   The University of Arizona Alumni Association ....................... 77
   The University of Arizona Foundation ................................... 79

II. COLLEGES AND GENERAL DIVISIONS OF THE UNIVERSITY
   Undergraduate Degrees ....................................................... 83
   Colleges
      College of Agriculture ...................................................... 84
      College of Architecture ................................................... 90
      College of Arts and Sciences ............................................ 95
      College of Business and Public Administration ................... 114
      College of Education ...................................................... 126
      College of Engineering .................................................... 133
      College of Law ................................................................ 151
      College of Medicine ....................................................... 153
      College of Mines ............................................................ 154
      College of Nursing ......................................................... 162
      College of Pharmacy ....................................................... 165
   The Graduate College ......................................................... 170
   General Divisions of the University ...................................... 177
      Department of Exercise and Sport Sciences ......................... 177
      Athletic Programs .......................................................... 177
      Office of Interdisciplinary Programs .................................... 178
      School of Health-Related Professions .................................. 178
      School of Military Science, Naval Science, and Military Aerospace Studies ........................................ 178
      Division of Continuing Education ...................................... 182
      Office of International Programs ...................................... 182
      Office of the Summer Session .......................................... 183

III. DEPARTMENTS AND COURSES OF INSTRUCTION .................. 187

IV. THE BOARD OF REGENTS, ADMINISTRATION,
    AND FACULTY ................................................................. 487

V. INDEX ............................................................................. 553
# ACADEMIC CALENDAR

<table>
<thead>
<tr>
<th>Event</th>
<th>1985-86</th>
<th>1986-87</th>
</tr>
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<tbody>
<tr>
<td>Last day for receipt of applications for admission and all supporting transcripts</td>
<td>July 22, M</td>
<td>July 21, M</td>
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<tr>
<td>Degrees awarded as of this date for students completing requirements at close of summer session</td>
<td>Aug. 15, Th</td>
<td>Aug. 14, Th</td>
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<tr>
<td>Residence halls open</td>
<td>Aug. 18, Su</td>
<td>Aug. 17, Su</td>
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<tr>
<td>New-student orientation program</td>
<td>Aug. 19-20, M-Tu</td>
<td>Aug. 18-19, M-Tu</td>
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<tr>
<td>Registration</td>
<td>Aug. 21-23, W-F</td>
<td>Aug. 20-22, W-F</td>
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<tr>
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<td>Aug. 26, M</td>
<td>Aug. 25, M</td>
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<tr>
<td>Labor Day—no classes</td>
<td>Sept. 2, M</td>
<td>Sept. 1, M</td>
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<tr>
<td>Last day of registration for credit</td>
<td>Sept. 3, Tu</td>
<td>Sept. 2, Tu</td>
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<tr>
<td>Last day for dropping courses resulting in a deletion of course enrollment from record</td>
<td>Sept. 20, F</td>
<td>Sept. 19, F</td>
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<td>Midsemester scholarship records due in Office of the Registrar</td>
<td>Oct. 11, F</td>
<td>Oct. 10, F</td>
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<tr>
<td>Honors Convocations—no classes 9:00-11:00 a.m.</td>
<td>Oct. 22, Tu</td>
<td>Oct. 22, W</td>
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<td>Last day for dropping courses</td>
<td>Nov. 1, F</td>
<td>Oct. 31, F</td>
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<td>Veterans’ Day—no classes</td>
<td>Nov. 11, M</td>
<td>Nov. 11, Tu</td>
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<td>Thanksgiving recess</td>
<td>Nov. 28-Dec. 1, Th-Su</td>
<td>Nov. 27-30, Thu-Su</td>
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<td>Dec. 2, M</td>
<td>Dec. 1, M</td>
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<tr>
<td>Class and laboratory sessions end</td>
<td>Dec. 11, W</td>
<td>Dec. 10, W</td>
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<tr>
<td>Semester examinations begin</td>
<td>Dec. 12, Th</td>
<td>Dec. 12, F</td>
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<tr>
<td>Semester examinations end</td>
<td>Dec. 19, Th</td>
<td>Dec. 19, F</td>
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<tr>
<td>Winter Commencement</td>
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### ACADEMIC CALENDAR

#### Second Semester

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<td>Dec. 13, F</td>
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<td>Registration</td>
<td>Jan. 13-15, M-W</td>
<td>Jan. 12-14, M-W</td>
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<td>Classes begin</td>
<td>Jan. 16, Th</td>
<td>Jan. 15, Th</td>
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<td>Last day of registration for credit</td>
<td>Jan. 23, Th</td>
<td>Jan. 22, Th</td>
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<tr>
<td>Last day for dropping courses resulting in deletion of course enrollment from record</td>
<td>Feb. 12, W</td>
<td>Feb. 11, W</td>
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<tr>
<td>La Fiesta de los Vaqueros—no classes</td>
<td>Feb. 27, Th</td>
<td>Feb. 26, Th</td>
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<td>Applications for bachelor's degree candidacy must be filed for degrees to be awarded at close of the following fall semester</td>
<td>Mar. 3, M</td>
<td>Mar. 2, M</td>
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<td>Midsemester scholarship records due in Office of the Registrar</td>
<td>Mar. 5, W</td>
<td>Mar. 4, W</td>
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<td>Founder's day</td>
<td>Mar. 12, W</td>
<td>Mar. 12, Th</td>
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<td>Spring recess</td>
<td>Mar. 15-23, Sa-Su</td>
<td>Mar. 14-22, Sa-Su</td>
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<tr>
<td>Last day for dropping classes</td>
<td>Apr. 2, W</td>
<td>Apr. 1, W</td>
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<tr>
<td>Applications for bachelor's degree candidacy must be filed for degrees to be awarded at close of the following spring semester</td>
<td>May 1, Th</td>
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<td>Class and laboratory sessions end</td>
<td>May 7, W</td>
<td>May 6, W</td>
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<td>May 9, F</td>
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#### Preession

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<td>May 19-June 7</td>
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#### Summer Session

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<td>June 6, F</td>
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<td>First term</td>
<td>June 9-July 10</td>
<td>June 8-July 9</td>
</tr>
<tr>
<td>Registration for second term</td>
<td>July 11, F</td>
<td>July 10, F</td>
</tr>
<tr>
<td>Second term</td>
<td>July 14-Aug. 13</td>
<td>July 13-Aug. 12</td>
</tr>
</tbody>
</table>
How to Use This Catalog

This general catalog is divided into four basic sections. A brief guide to each section follows.

GENERAL UNIVERSITY INFORMATION — This section contains all of the basic, non-curricular information pertinent to undergraduate education.

COLLEGES AND GENERAL DIVISIONS OF THE UNIVERSITY — The major academic divisions of the University are described in these chapters:

The description for each college is divided into four parts:

I. Brief description of the college.
II. List of the degrees offered by the college.
III. Specific college degree requirements. The specific major departmental requirements are listed in the Departments and Courses of Instruction section of this catalog, except for the departments in the Colleges of Architecture, Business and Public Administration, Engineering, Mines, and Pharmacy which provide that information in the college sections.
IV. General college information giving such items as special research facilities and student organizations.

DEPARTMENTS AND COURSES OF INSTRUCTION — Two types of information will be found in this section:

I. A description of the purpose of the department or committee, and a listing of the departmental curriculum requirements for the majors and, in some cases, the minors.
II. A complete listing of the courses offered by the department or committee. (For a complete explanation of the information contained in the course listings, please see "Curricular Change," "Explanatory Notes," "Key to Symbols," and "University-Wide House-Numbered Courses" at the beginning of the department section.)

THE BOARD OF REGENTS, ADMINISTRATION, AND FACULTY — This section lists the complete Board of Regents, Administration, and Faculty of the University as of the academic year 1984-85.
# ABBREVIATION GUIDE

The abbreviations listed below are used throughout this catalog to refer to the disciplines indicated:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Discipline</th>
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</thead>
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<tr>
<td>a.ec</td>
<td>agricultural economics</td>
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<tr>
<td>a.ed.</td>
<td>agricultural education</td>
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<tr>
<td>a.en.</td>
<td>agricultural engineering</td>
</tr>
<tr>
<td>a.m.e.</td>
<td>aerospace and mechanical engineering</td>
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<td>a.ph.</td>
<td>animal physiology</td>
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<tr>
<td>acct.</td>
<td>accounting</td>
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<tr>
<td>agri.</td>
<td>agriculture</td>
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<tr>
<td>A.In.s.</td>
<td>American Indian studies</td>
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<td>animal sciences</td>
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<td>anat.</td>
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<td>arid lands resource sciences</td>
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<tr>
<td>atmo.</td>
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<td>business and career education</td>
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<tr>
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<td>c.e.</td>
<td>civil engineering</td>
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<td>c.d.f.r.</td>
<td>child development and family relations</td>
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<td>chemical engineering</td>
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<td>counseling and guidance</td>
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<tr>
<td>c.s.</td>
<td>consumer studies</td>
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<td>c.sc.</td>
<td>computer science</td>
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<td>c.t.</td>
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<td>dance</td>
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<td>e.m.</td>
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<td>economics</td>
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<td>honors</td>
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<td>history and philosophy of science</td>
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ply. s. ................. planetary sciences
R. lg. ..................... Romance languages
ra. m. ..................... range management
radi. ........................ radiology
rdng. ........................ reading
reli. ........................ religious studies
rhab. ........................ rehabilitation
r.n.r. ......................... renewable natural resources
r.t.v. ........................ radio-television
Russ. ...................... Russian and Slavic languages
s.ed. ......................... secondary education
s.i.e. ........................ systems and industrial engineering
soc. ........................ sociology
sp.c. ........................ speech communication
sp.h. ........................ speech and hearing sciences
Span. ........................ Spanish
spec. ........................ special education
stat. ........................ statistics
surg. ........................ surgery
s.w. ........................ soil and water science
tox. ........................ toxicology
v.sc. ........................ veterinary science
w.f.sc. ...................... wildlife and fisheries science
w.r.a. ...................... water resources administration
w.s. ........................ women's studies
ws.m. ........................ watershed management
General
General University Information

**Memberships And Accreditations**

**ACCREDITATIONS** — Accreditation Board for Engineering and Technology; American Assembly of Collegiate Schools of Business; American Association for Accreditation of Laboratory Animal Care; American Association of Museums; American Chemical Society; American Council on Education for Journalism; American Council on Pharmaceutical Education; American Dietetic Association; American Library Association; American Planning Association; American Psychological Association (graduate program in clinical psychology and graduate program for school psychologists); American Society of Landscape Architects; American Speech-Language-Hearing Association; Association of American Law Schools and American Bar Association; Committee on Rehabilitation Education; Council on Rehabilitation Education (rehabilitation counselor education); Liaison Committee on Medical Education of the American Medical Association and the Association of American Medical Colleges; National Architectural Accrediting Board; National Association of Schools of Dance; National Association of Schools of Music; National Association of Schools of Public Affairs and Administration; National Council for Accreditation of Teacher Education; National League for Nursing; North Central Association of Colleges and Schools; Society of American Foresters.

**MEMBERSHIPS** — American Association for Higher Education; American Association for Laboratory Animal Science; American Association of Colleges for Teacher Education; American Association of Colleges of Nursing; American Association of Colleges of Pharmacy; American Association of Collegiate Registrars and Admissions Officers; American Association of University Women; American College Theatre Festival; American Council on Learned Societies; American Council on Education; American Home Economics Association; American Psychological Association; American Society for Engineering Education; American Society for Public Administration; American Statistical Association; Argonne Universities Association; Associated Western Universities; Association for Gerontology in Higher Education; Association for Public Policy and Management; Association for University Business and Economic Research; Association of Academic Health Centers; Association of American Colleges; Association of American Medical Colleges; Association of American State Geologists; Association of American University Presses; Association of Collegiate Schools of Architecture; Association of Collegiate Schools of Planning; Association of Research Libraries; Association of Systematics Collections; Association of Universities for Research in Astronomy; Association of University Summer Sessions; Border State Universities Consortium for Latin America; Broadcasters Educational Association; College Art Association of America; College Entrance Examination Board; Consortium of Western Universities and Colleges; Council for Advance- ment and Support of Education; Council of Graduate Schools in the United States; Council of United States Universities for Soil and Water Development in Arid and Subhumid Areas; EDUCOM, Interuniversity Communications Council; Eisenhower Consortium; Graduate Management Admissions Council; Institute of International Education; International Museum of Photography; Latin American Scholarship Program of American Universities; Mid-America College Art Association; Midwestern Association of Graduate Schools; National Association of Colleges and Teachers of Agriculture; National Association of College and University Attorneys; National Association of Schools of Art and Design; National Association of State Universities and Land Grant Colleges; National Consortium for Black Professional Development; National Public Radio; National University Extension Association; North American Association of Summer Sessions; Pacific Mountain Network; Public Broadcasting Service; Rocky Mountain Science Council; Society of Architectural Historians; Speech Communication Association; Travel Research Association; Universities Council on Water Resources; Universities Research Association; University Corporation for Atmospheric Research; University Film Association; University Resident Theatre Association; University Space Research Association; Western Association of Graduate Schools; Western College Association; Western Interstate Commission for Higher Education (WICHE); Western Interstate Council on Nursing.
History and Academic Organization

THE UNIVERSITY — A HISTORICAL SKETCH

In 1885 — nearly three decades before Arizona became a state — the thirteenth territorial legislature approved $25,000 for building the University of Arizona in Tucson. The first classes convened in 1891, when 32 students and six teachers met in the original building now known as Old Main.

The university has developed in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act. This legislation created the land-grant colleges and enabled the institution to obtain federal funds for its original schools of agriculture and mines.

In its early days, there were more students in the preparatory department than in the university proper, and the number of university graduates was never more than ten a year. Then came a decade of rapid expansion. The territory became a state; high schools multiplied, and the preparatory department was closed. In 1915, the university was reorganized as three colleges — the College of Letters, Arts, and Sciences (later Liberal Arts); the College of Mines and Engineering; and the College of Agriculture. The Arizona Bureau of Mines was established the same year.

In 1922 the College of Education was organized, and in 1925 offerings in law, originally established in 1915, were organized under the College of Law. The School of Business and Public Administration, established within the College of Letters, Arts, and Sciences in 1934, was reorganized as a separate college in 1944. In 1934 the Department of Home Economics was enlarged to a school within the College of Agriculture. In 1934 the College of Fine Arts, including the School of Music, and the Graduate College were established. In 1940 the Board of Regents reorganized the College of Mines and Engineering into two separate colleges. In 1967 the School of Earth Sciences was organized within the College of Mines, and became the College of Earth Sciences in 1971. In 1947 the School of Pharmacy was organized within the College of Liberal Arts, and was given separate status as the College of Pharmacy in 1949. The Board of Regents in 1956 authorized the establishment of the School of Nursing as a division of the College of Fine Arts, and in 1964 the school became the College of Nursing. The Department of Architecture in the College of Fine Arts, authorized in 1958, became the College of Architecture in 1964. The Board of Regents authorized the College of Medicine in 1961. In 1974 the School of Renewable Natural Resources was approved as a new unit of the College of Agriculture. The School of Health-Related Professions was authorized by the Board of Regents in 1977. In 1982 the College of Liberal Arts and the College of Fine Arts were reorganized into the College of Arts and Sciences which includes the Faculty of Fine Arts, the Faculty of Humanities, the Faculty of Science, and the Faculty of Social and Behavioral Sciences. In 1984, the departments that constituted the former College of Earth Sciences were reorganized to become part of the College of Arts and Sciences and the College of Engineering and the School of Home Economics was renamed the School of Family and Consumer Resources.

The forty-acre campus of the 1890s has grown to 319 acres and 131 buildings. Its purpose remains, in the language of the organic law, "to provide the inhabitants of this state with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and, insofar as possible, to provide a technical education adapted to the development of the resources peculiar to Arizona. The university is maintained by funds appropriated by the state of Arizona and the United States government, and by fees and collections including private grants from many resources.
ACADEMIC DIVISIONS OF THE UNIVERSITY

More detailed information may be found under listings for the specific college or department.

COLLEGE OF AGRICULTURE. School of Family and Consumer Resources (with divisions of Child Development and Family Relations; Clothing, Textiles and Interior Design; Home Economics Education/Consumer Studies); School of Renewable Natural Resources (with programs in Landscape Architecture, Natural Resource Recreation, Range Management, Watershed Management, Wildlife and Fisheries Science). Departments of: Agricultural Economics; Agricultural Education; Animal Sciences; Entomology; Nutrition and Food Science; Plant Pathology; Plant Sciences; Soils, Water and Engineering; Veterinary Science. University Departments of: Biochemistry, Microbiology and Immunology; Molecular and Cellular Biology.

COLLEGE OF ARCHITECTURE

COLLEGE OF ARTS AND SCIENCES. School of Music. Departments of: Anthropology; Art; Astronomy; Atmospheric Sciences; Chemistry; Classics; Computer Science; Drama; Ecology and Evolutionary Biology; English; French and Italian; Geosciences; German; History; Journalism; Linguistics; Mathematics; Oriental Studies; Philosophy; Physics; Planetary Sciences; Political Science; Psychology; Radio-Television; Russian and Slavic Languages; Sociology; Spanish and Portuguese; Speech and Hearing Sciences; Speech Communication; Statistics; University Departments of: Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology. Committee on Dance.

COLLEGE OF BUSINESS AND PUBLIC ADMINISTRATION. Departments of: Accounting; Economics; Finance and Real Estate; Management and Policy; Management Information Systems; Marketing.

COLLEGE OF EDUCATION. Graduate Library School; Center for the Study of Higher Education. Departments of: Business and Career Education; Counseling and Guidance; Educational Foundations and Administration; Educational Psychology; Elementary Education; Reading; Rehabilitation; Secondary Education; Special Education.

COLLEGE OF ENGINEERING. Departments of: Aerospace and Mechanical Engineering; Civil Engineering and Engineering Mechanics; Electrical and Computer Engineering; Hydrology and Water Resources; Nuclear and Energy Engineering; Systems and Industrial Engineering.

COLLEGE OF LAW

COLLEGE OF MEDICINE. Departments of: Anatomy; Anesthesiology; Family and Community Medicine; Internal Medicine; Neurology; Obstetrics-Gynecology; Ophthalmology; Pathology; Pediatrics; Pharmacology; Physiology; Psychiatry; Radiology; Surgery. University Departments of: Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology.

COLLEGE OF MINES. Departments of: Chemical Engineering; Materials Science and Engineering; Mining and Geological Engineering.

COLLEGE OF NURSING.

COLLEGE OF PHARMACY. Departments of: Pharmaceutical Sciences; Pharmacology and Toxicology; Pharmacy Practice.

GRADUATE COLLEGE. Committees on: Animal Physiology; Arid Lands Resource Sciences; Environment and Behavior; Genetics; History and Philosophy of Science; Materials Engineering; Medieval Studies; Nutritional Sciences; Optical Sciences; Pharmacology and Toxicology; Planning; Plant Protection; Romance Languages.

GENERAL DEPARTMENTS. Exercise and Sport Sciences; School of Health-Related Professions; School of Military Science, Naval Science, and Military Aerospace Studies.

UNIVERSITY DEPARTMENTS. Biochemistry; Microbiology and Immunology; Molecular and Cellular Biology.

GENERAL COMMITTEES. American Indian Studies; Applied Mathematics; Biomedical Engineering; Black Studies; Business Administration; Gerontology; Humanities; Latin American Studies; Mexican American Studies; Religious Studies; Remote Sensing; Women's Studies.

CONTINUING EDUCATION

THE UNIVERSITY LIBRARIES
DIVISIONS OF RESEARCH AND SPECIAL PUBLIC SERVICE

The following divisions are a part of or are affiliated with the University. Additional information regarding their organization and services may be obtained upon inquiry to the director concerned.

The AGRICULTURAL EXPERIMENT STATION (1890), one of the divisions of the College of Agriculture, is responsible for the basic and applied research programs in the schools, departments, and other units within the College of Agriculture. It is administered by the Director of the Experiment Station. Modern facilities for laboratory and field research and extension, as well as graduate and undergraduate teaching, are available on the University campus and at agricultural centers throughout the State of Arizona. Research is also conducted on farms, orchards, ranches, rangelands, and forests in cooperation with farmers, ranchers, and officials of various state and federal agencies.

The ANIMAL DISEASE DIAGNOSTIC SERVICE was initiated by the Department of Veterinary Science in 1934 and has provided continuous service to the animal owners of Arizona since its establishment. Administered under the Agricultural Experiment Station, diagnostic services are provided upon referral from private veterinary practitioners for any resident of the state.

ARIZONA CENTER FOR EDUCATIONAL EVALUATION AND MEASUREMENT (1980) initiates and conducts multidisciplinary research on such topics as nondiscriminatory psychological assessment; assessment of developmental competencies, sequencing of instruction, cognitive skills in children; and evaluation of school effectiveness. The center maintains state-of-the-art research technology, prepares graduate students in research methodology; and provides technical assistance to public and private agencies regarding testing, student services, curriculum development and systems for program evaluation.

ARIZONA CENTER FOR EDUCATIONAL RESEARCH AND DEVELOPMENT (1971) initiates and conducts research and development programs in such areas as early childhood education, teaching and learning, language and literacy, cultural diversity and learning, and education of exceptional children. The center provides faculty and graduate students with the following support services: grant proposal development; weekly notices of funding sources; computer allocations for research and instruction; funding for small projects; and budget review and negotiation assistance.

The ARIZONA COOPERATIVE FISHERY UNIT (1964) is engaged in graduate education, research, and extension. It is supported by the University of Arizona, the Arizona Game and Fish Department, and the U.S. Bureau of Sport Fisheries and Wildlife. The research program is directed chiefly toward learning how to meet the rapidly increasing demand for inland sport-fishing opportunities in the Southwest. The unit is housed in the School of Renewable Natural Resources.

The ARIZONA COOPERATIVE NATIONAL PARK RESOURCES STUDY UNIT (1973), located in the School of Renewable Natural Resources, is engaged in research to support the natural science program of the National Park Service. In cooperation with the University of Arizona, the unit provides graduate research opportunities and instructional support in a broad array of natural resource problem areas.

The ARIZONA COOPERATIVE WILDLIFE RESEARCH UNIT (1951) is sponsored and supported jointly by the University of Arizona, the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute. Unusual opportunities for research on game-management problems exist because of the large diversity of habitats and of game species native to the state. The unit is housed in the School of Renewable Natural Resources.
The ARIZONA POISON AND DRUG INFORMATION CENTER (1980) is operated by the College of Pharmacy and is located in the Arizona Health Sciences Center library. The center provides comprehensive poison information and advice on treatment of poisoning to anyone in the state. It also offers drug information and therapeutic consultations to health professionals. The center has a toll-free telephone number (listed on the inside cover of Arizona telephone directories) and can be reached 24 hours a day, seven days a week. Full-time clinical pharmacists staff the center and serve as poison and drug information specialists. Serving as consultants are a medical toxicologist and specialists in plant and animal poisons, drugs, and environmental and industrial poisons. The Arizona Poison and Drug Information Center provides for clinical training of pharmacy students in the areas of drug and poison information. The Arizona Poison and Drug Information Center is a component of the Arizona Poison Control System which was established by the Arizona State Legislature in 1980 and is based in the College of Pharmacy. The Arizona Poison Control System is certified as a regional poison control program by the American Association of Poison Control Centers.

The ARIZONA REMOTE SENSING CENTER (1972) is the focus of remote sensing research in the College of Agriculture. The staff of the Center is involved in interdisciplinary remote sensing and computer mapping projects related to agriculture and natural resource management. The Center contains equipment for manual analysis of satellite and aircraft imagery and a computer system for digital processing and display of images and maps. These facilities are available to faculty, students and cooperators from outside the University.

The ARIZONA RESEARCH LABORATORIES (1979) is an interdisciplinary research unit established to provide a mechanism for administering and fostering research which bridges disciplines embraced by departments from more than one collegiate unit. A major thrust of the organization is to form research groups to initiate new programs of high priority to the development of the educational and research mission of the University. The organization of the Laboratories also provides a mechanism for serving as an organized research component for those teaching and research units that do not have such a capability.

The ARIZONA STATE MUSEUM, founded as a territorial museum in 1893, is an educational, research, and service division of the University. Museum exhibits emphasize prehistoric and recent Indian cultures of Arizona and the Southwest. Special temporary exhibits on a variety of subjects are presented throughout the year. The Museum is open daily to the public. Closed major holidays.

The ARIZONA TRANSPORTATION AND TRAFFIC INSTITUTE (1959) is engaged in broad research aimed at developing advanced methods of analysis and obtaining answers to the transportation problems in Arizona. Topics considered include the planning, design, and operation of transportation facilities, including pavement design and highway materials, as well as maintenance of these systems. The institute acts as a technical information center, and its activities are closely tied to those of the Department of Civil Engineering and Engineering Mechanics.

The BOYCE THOMPSON SOUTHWESTERN ARBORETUM (1927) is operated cooperatively by the University of Arizona (College of Agriculture), Arizona State Parks Board, and the Boyce Thompson Southwestern Arboretum Board. This public botanic garden has facilities for teaching and research. Situated on the edge of the low desert near Superior, Arizona, the Arboretum is a two-hour drive from the campus. Thirty acres of native and introduced plants from arid and semi-arid regions, together with about 1,000 additional acres of undisturbed fauna and flora, are under Arboretum control. Additionally, large tracts of relatively undisturbed habitats in a variety of biomes lie in the surrounding Tonto National Forest. Laboratory facilities and housing are available. The Arboretum is open daily except for Christmas Day.
18 GENERAL UNIVERSITY INFORMATION

The BUREAU OF APPLIED RESEARCH IN ANTHROPOLOGY (1952), a division of the Department of Anthropology, is a regional and international center for basic and applied research relating to culture change, urban and rural living, technological innovation, social and cultural impact assessment, agricultural and institutional development, and educational innovation.

The BUREAU OF GEOLOGY AND MINERAL TECHNOLOGY (1915) is a state agency affiliated with the College of Mines and is directly charged with developing, maintaining, and disseminating to the people of Arizona information relating to mining, metallurgy, and earth sciences generally. The Bureau's primary functions are those of a state geological survey and mines bureau and, therefore, include scientific investigation and public service activities comparable to those conducted by similar organizations in other states.

The close union of the Bureau with the teaching programs of the College of Mines and the College of Arts and Sciences has been exceptionally productive in the development and dissemination of knowledge about the mineral resources and environmental characteristics of Arizona. The Bureau is a member of the Association of American State Geologists, the national affiliation of geological surveys of individual states.

The CENTER FOR CREATIVE PHOTOGRAPHY (1975), a division of the University Library, is a growing research library and archive containing material on all aspects of photography. The collection includes rare photographic books, periodicals, photographs, and manuscript collections, as well as the archives of major American photographers and a large collection representing over 1500 photographers. In addition, the Center sponsors a lecture series and frequent exhibitions and publishes a journal entitled The Archive. Photographs not on exhibition may be viewed by appointment.

The CENTER FOR THE STUDY OF HIGHER EDUCATION (1978) in the College of Education conducts research studies and provides related service activities to meet state and institutional needs, as well as those of national, international and regional governmental units and other organizations. It develops and disseminates information about higher education policy and operation and facilitates the research of faculty members and students. Special research and service projects are provided through University funds and outside support. The Center also provides graduate-level instruction leading to master's and doctoral degrees.

The COOPERATIVE EXTENSION SERVICE (1914) brings information to interested people of Arizona. One of the three divisions of the College of Agriculture, it emphasizes agricultural production and natural resources, family and consumer sciences, youth development (4-H), and rural development. The Service is financed from federal, state, and county appropriations. It operates through the county extension agent, state and area specialist system with faculty trained in their specialty, and in the practical application of scientific information on farms, ranches and in rural and urban homes. Assistance is provided to target audiences in problem solving, information dissemination and educational programs.

The DIVISION OF ECONOMIC AND BUSINESS RESEARCH (1949) is a research and service organization within the College of Business and Public Administration. Its broad objective is to conduct basic and applied research in business, economics, public policy, and planning. Continuing research programs are conducted in economic models, resources and environment, consumer impact, and public sector economics. In addition, an information service is operated which serves government, business and the general public by responding to requests for information and publication of Arizona business statistics. The Division publication program includes the Arizona Review, Arizona's Economy, monographs, special studies, and a chart book.

The DIVISION OF MEDIA AND INSTRUCTIONAL SERVICES (1939) provides a wide range of instructional media, production, research, and public broadcasting services to the University, community, and state. The division operates three maximum-power public broadcasting stations: KUAT-TV (Channel 6 and Translator Channel 71), KUAT-AM (1550kHz), and KUAT-FM (90.5 MHz and Translator Frequency 89.5 MHz). Professional production facilities are maintained in the Modern Languages Building, the Audiovisual Building, the Harvill Building, and the Arizona Health Sciences Center. Production capability includes color studio and mobile.
television, and 16mm motion picture equipment. The stations are affiliated with the Public Broadcasting Service (PBS) and National Public Radio (NPR).

The Microcampus produces and distributes University courses to business and industry in the Tucson area through a two-channel interactive Educational Television System (IETS) and throughout the nation by videotape.

The Instructional and Research and Development area is committed to improving the quality of instruction at the University. Members of the staff consult with members of the faculty in course design and revision. The staff holds workshops for interested University personnel and provides an ongoing evaluation of teaching effectiveness.

The Graphics Center provides outstanding graphic and photography services to the University.

The Film Library and Equipment Services provide media and audiovisual materials to both the University and other educational institutions.

Many members of the division staff serve as faculty members.

The ENGINEERING EXPERIMENT STATION (1941) administers the funds of all sponsored grants and contracts of the faculty of the College of Engineering. Students are often supported by wages or work-study arrangements under individual projects. Using state-appropriated funds, the Station promotes, initiates, and conducts engineering research of potential benefit to the state of Arizona.

The ENVIRONMENTAL RESEARCH LABORATORY (1967) conducts research in controlled-environment agriculture (CEA) for intensive food production, in seawater crop irrigation, and in solar heating and cooling. ERL has designed CES vegetable systems which produce crops in the desert sands of the United States, Mexico and Middle East, and it has developed CEA for the intensive culture of marine shrimp. ERL is developing halophytic crops for livestock feeds and other uses — plants which are irrigated solely with seawater or other highly saline water. ERL consults on such special projects as the portrayal of agriculture of the future at the EPCOT Center at Walt Disney World in Florida. ERL has also developed a series of demonstration solar homes at Tucson International Airport, where the laboratory is located.

The GRACE H. FLANDRAU PLANETARIUM (1975), a part of the College of Arts and Sciences, was built as a result of a gift to the University by Grace H. Flandrau. It houses a 50-foot projection dome, a Minolta Series IV planetarium projector, and a hemispheric 35mm motion picture projector. It is used as a teaching facility for University classes in astronomy, and 25,000 Tucson public school children attend its special educational programs each year. The Planetarium presents dramatic public programs on astronomy and planetary science that take audiences on cosmic journeys through time and space. The science exhibit halls and 16-inch telescope are open free to the public. Open daily; theatre dark Mondays.

The HUMAN DEVELOPMENT LABORATORY (1979) is an interdisciplinary research and training center within the Division of Child Development and Family Relations in the School of Family and Consumer Resources. The laboratory is charged with promoting and conducting applied research to enhance the welfare of families and individuals. The laboratory supports and conducts funded and nonfunded research on issues relating to all stages of human life. Priority is given to research that is interdisciplinary, preventive, and issue-oriented. The facility is equipped for audio and video taping and sponsors colloquia and a semiannual newsletter.

The INSTITUTE OF ATMOSPHERIC PHYSICS (1954) conducts research on the fundamental mechanisms that govern weather processes. Particular emphasis is given to investigations in aerosols, cloud and precipitation physics, atmospheric electricity, climatology, atmospheric dynamics, radiative exchange mechanisms, remote sensing, and atmospheric chemistry.

The JEFFREY M. GOLDING CLINICAL RESEARCH UNIT (1984) of the College of Pharmacy is a two-bed, specially equipped facility located on the third floor of the college's new building. The primary objective of the unit is to provide clinical scientists at the University of Arizona with the opportunity to study the action of drugs in humans with the ultimate goal of developing...
improved methods of treatment. The unit consists of three rooms including a private office for conducting patient interviews or preliminary examinations, a patient waiting room and the main facility housing two hospital beds with cardiac monitors, two blood drawing chairs and a dual reading scale.

The **Karl Eller Center for the Study of the Private Market Economy** (1983) is a research and education organization within the College of Business and Public Administration. It has three broad objectives: (1) to promote research in basic market processes, (2) to sponsor an Entrepreneurial Studies Program for seniors and MBA students, and (3) to provide for business/academic exchange. Research is supported through the recruitment of Karl Eller Chair holders in the disciplines represented in the College. Faculty research fellowships are also available. The Entrepreneurial Studies Program offers both academic courses for students interested in entrepreneurship and practical courses on the development of business plans. Approximately 35 students are included in the program annually. Business/academic exchange occurs through an annual dialogue on significant national economic issues and through semiannual new venture forums where entrepreneurs present business plans.

The **Laboratory of Tree-Ring Research** (1937) is an outgrowth of the pioneering tree-ring studies initiated by Andrew Ellicott Douglass at the University of Arizona in 1906. A division of the College of Arts and Sciences, the Laboratory conducts a unique program of teaching and research in all aspects of dendrochronology. Graduate-level instruction is offered through cooperating academic departments, and a limited number of graduate research assistantships are available to qualified students. Current research efforts are directed toward the quantification of tree-ring parameters, the establishment of new tree-ring chronologies throughout the world, the understanding of basic tree growth and environmental relationships, the reconstruction of paleohydrologic and paleoclimatic variables, and the documentation and development of prehistoric chronological controls. Along with the world's largest collection of tree-ring specimens from living trees and ancient timbers, the Laboratory maintains a variety of specialized equipment and data files containing processed tree-ring chronologies, relevant climatic and hydrologic records, and archaeological tree-ring dates and site information.

The **Lunar and Planetary Laboratory** (1960) is the research institute associated with the Planetary Sciences Department. Laboratory staff engage in research and graduate instruction in conjunction with the Planetary Sciences Department and frequently undertake projects in collaboration with other campus units as well, including the Departments of Astronomy, Geosciences, and Physics, and the Steward Observatory.

Research programs at the Lunar and Planetary Laboratory are closely associated with the NASA space program and include numerous lunar and planetary missions. Several of the faculty of the department and the laboratory have been principal investigators or co-investigators on space experiments, including Apollo, Mariner, Voyager, and Pioneer spacecraft. Major ground-based research facilities include the University of Arizona telescopes (150 cm, 100 cm, 70 cm aperture reflectors on Mt. Lemmon; 154 cm aperture reflector and 46/71 cm Schmidt camera near Mt. Bigelow; 53 cm reflector on Tumamoc Hill; 220 cm Cassegrain reflector on Kitt Peak; and the multiple-mirror telescope on Mt. Hopkins), a scanning electron microprobe, a neutron activation analysis laboratory, and the Space Imagery Center. In addition, the Laboratory conducts high-altitude observational programs for solar, planetary, and stellar infrared spectroscopy using NASA jet aircraft.

Research interests of the laboratory and department include experimental and theoretical geochemistry and cosmochemistry, lunar and planetary geology, spacecraft imaging of planetary surfaces, the physics of planetary interiors, cosmic rays, the sun and solar wind, astrophysical plasmas, polarimetry and studies associated with the origin of the solar system, infrared Fourier spectroscopy, planetary atmospheres, infrared astronomy, and astrometry. The Laboratory is housed in the Gerard P. Kuiper Space Sciences Building.

**Microcampus** (1972) is an education delivery system which uses video cassettes and live, interactive microwave transmission to make University of Arizona classes available to students throughout the U.S. Students in remote locations who want University credit must be admitted to the University and register for classes in absentia. Successful completion of a course results in a University credit transcript entry. In addition to regular courses, videotaped short courses
provide up-to-date information on diverse subjects, but are not available for University credit. Developed in the College of Engineering, Microcampus has grown to include courses from many other colleges and is now part of the Division of Media and Instructional Services.

The MINERAL MUSEUM (1919) emphasizes Arizona's unique mineral heritage in a spectacular collection of minerals, fossils, and gems. The Museum, a part of the collections of the Department of Geosciences since its establishment, is open to students and the general public.

The OFFICE OF ARID LANDS STUDIES (1964), administratively within the College of Agriculture, is active in international studies, information systems, Indian programs, remote sensing, publications and education. The activities are conducted within the framework of the arid environment. The Office provides interdisciplinary project management and works closely with local and campus communities as well as with state, federal, and international government agencies. The Office administers the interdisciplinary Doctor of Philosophy degree with a major in arid lands resource sciences.

The OPTICAL SCIENCES CENTER (1967) is a graduate center for research in applied and theoretical optical physics. Areas in which research is currently being conducted include electro-optics, image formation, image processing, laser physics, materials, medical optics, non-linear optics, optical bistability, optical design, optical fabrication and testing, optical properties of materials, pattern recognition, quantum optics, remote sensing, spectroscopy, surface physics, and thin-film technology. Interdisciplinary programs in progress involve the departments of Astronomy, Chemistry, Civil Engineering and Engineering Mechanics, Electrical and Computer Engineering, Microbiology, Physics, Physiology, Planetary Sciences, and Radiology, as well as the Microelectronics Laboratory, Arizona Research Laboratory and the Optical Circuitry Cooperative.

Special facilities of the Optical Sciences Center include CVD and vacuum-deposition thin-film facilities, dark rooms, an electronics shop, infrared laboratory, instrument shop, massive-optics shop, small-optics shop, student/faculty machine shop, and teaching laboratories. In addition, a multitude of computing facilities are available for use in both research and training programs.

The RUTH E. GOLDING CLINICAL PHARMACOKINETICS LABORATORY (1977) in the College of Pharmacy is primarily an analytical laboratory where new assays are developed to quantify drugs and their metabolites from biological fluids. These assays are used in conjunction with animal and clinical research projects to better define the disposition of and response to drugs. The results of these studies along with the monitoring of drug plasma concentrations in patients are used to optimize therapy by individualizing drug administration.

The SOUTHWEST CENTER (1982) is a University unit which seeks to encourage and facilitate teaching, research, and the dissemination of information related to the history, culture, and ecology of the Mexican Northwest and the U.S. Southwest. The Center is affiliated with the Universidad Nacional Autonoma de Mexico, U.N.A.M. Courses on the Southwest are taught through many University departments and programs, including American Indian studies, anthropology, English, geography, history, Latin American studies, linguistics, Mexican American studies, political science, sociology, Spanish and Portuguese, and women's studies.

The SOUTHWEST INSTITUTE FOR RESEARCH ON WOMEN (SIROW) (1979) is a regional research and resource center within the Committee on Women's Studies. The Institute develops and conducts research on women in the Southwest (Arizona, Colorado, New Mexico, and Utah) or of interest to scholars in the region. SIROW publishes a newsletter and a working paper series, links researchers with community organizations and policy makers through a research clearinghouse, and provides professional development and training for people in education, research, business, and government.

The STEWARD OBSERVATORY (1916) was established by the generous gift from Lavinia Steward, in honor of her husband, George Steward. For many years, the Observatory's principal telescope was its 36-in. (91-cm) reflector, constructed with the aid of the Steward bequest. At this time, the primary research telescopes of the Observatory include the Multiple Mirror
Telescope (MMT), located on the Mt. Hopkins summit in the Santa Rita Mountains, the 90-in. (2.3-m) Ritchey-Chretien reflector at the Kitt Peak site, and the 61-in. (1.55-m) Cassegrain reflector found at the Mt. Bigelow station in the Santa Catalina Mountains. The MMT, operated jointly with the Smithsonian Astrophysical Observatory, represents an innovative and highly successful concept for construction of large optical telescopes; it has become the prototype for future large-aperture telescopes. The major telescopes are used with a wide variety of instrumentation and detectors and are supported by several smaller instruments used for teaching or special research projects.

The Steward Observatory offices and laboratories are located on the northeast part of the University campus adjacent to the original 36-in. dome which now houses a 21-in. instructional telescope. The main areas of research at the Observatory include extragalactic and galactic astronomy, with major specializations in the areas of quasars, degenerate stars, infrared sources, novae, and radio galaxies. Observational work is concentrated in the optical and infrared but includes work at radio, ultraviolet and x-ray wavelengths using other facilities. The Observatory is developing facilities for work at mm and sub-mm wavelengths in collaboration with the Max Planck Institute for Radio-astronomy in Bonn, West Germany. The research programs also include a wide range of theoretical studies in modern astrophysics, and an active involvement in astronomy in space, such as the Infrared Astronomy Satellite (IRAS), Space Infrared Telescope Facility (SIRTF).

Located across N. Cherry Avenue from Steward Observatory are the administrative offices and laboratories of the Kitt Peak National Observatory. The two observatories co-sponsor a weekly series of professional colloquia. Steward Observatory also maintains close working ties with the University's Lunar and Planetary Laboratory, the Department of Planetary Sciences, the Committee on Optical Sciences, the Department of Physics and the Grace M. Flandrau Planetarium. In addition, close collaboration is maintained through Steward facilities shared by the Vatican Observatory, Smithsonian Astrophysical Observatory, and the National Radio Astronomy Observatory.

The UNIVERSITY ANALYTICAL CENTER was established in response to the increasing need for various segments of the academic community to have access to modern chemical analysis methodology. The Analytical Center provides the University with a centralized system consisting of analytical equipment and personnel trained in various areas of chemical analysis. This facility is available to all University disciplines requiring or desiring to use various analytical procedures in teaching or research activities. The Analytical Center serves the University community by providing analytical equipment, analytical advice, methods development, sample analysis, and the training of both technical and nontechnical personnel in various aspects of analytical measurements. In addition, the Analytical Center maintains an active program of both basic and applied analytical research. The research activities provide a means of continuously expanding the Analytical Center capabilities and ensuring that equipment and personnel are kept at “state-of-the-art” levels in various analytical areas.

The UNIVERSITY OF ARIZONA COMPUTER CENTER (UCC) provides campuswide services and facilities in support of the instructional, research, and administrative computing needs of the University. The University's network of shared computers consists of a Control Data Corporation CYBER 175 computer, two Digital Equipment Corporation DECsystem-10 computers, and three VAX-11/780 computers. These computers are interconnected to allow data transfer between systems.

The UCC provides a campuswide data communications facility, the IDX-3000, for interconnection of terminals and computers. Interactive access to the university computers is available 24 hours a day. The Center provides terminal access centers at various locations on campus and dial-up ports for access to the university systems from individual laboratories and offices.

The UCC offers many services to assist users in taking advantage of available computing resources. Services include consulting on the use of the University's computers and various microcomputers; assistance in user acquisition of computing facilities; communications and networking between user-owned equipment and the University's systems; computer facility planning and preparation; selection, acquisition, and installation of microcomputer hardware and software; mainframe and microcomputer training facilities; programming and applications services; and dissemination of information through user publications, manuals, and program library documentation.
The UNIVERSITY OF ARIZONA MUSEUM OF ART—The University of Arizona is exceptionally fortunate in that it possesses several outstanding art collections. Housed in our modern building are the masterpieces of the Samuel H. Kress Collection, which include the surviving panels of the Retablo de Ciudad Rodrigo by Fernando Gallego and one of the finest university collections of Renaissance sixteenth- and seventeenth-century art in the United States. Contemporary international painting and sculpture are well represented in the Edward Joseph Gallagher III Memorial Collection; sixty-one sketches and models by Jacques Lipchitz which comprise one of the largest collections of his work in the world; the C. Leonard Pfeiffer Collection includes American paintings from the 1930s and was the first collection of art donated to the University. An active exhibition and educational program is available throughout the year. The Museum of Art is open to the public daily from nine to five and on Sunday from noon to five. There is no admission fee.

The UNIVERSITY OF ARIZONA PRESS (1959), founded as a department of the University of Arizona, is a nonprofit publisher of regional and scholarly books. As a delegate of the University of Arizona to the larger world, the Press publishes the work of scholars wherever they may be, concentrating upon scholarship that reflects the special strengths of the University of Arizona, Arizona State University, and Northern Arizona University.

From its early days as a small regional publisher, the Press has broadened its list to include scholarly titles in anthropology and archaeology, space sciences, arid lands studies, biology, Latin American studies, Asian studies, American Indian studies, and other fields. Also on the UA Press list are trade books on the Southwest borderlands, including accounts by scholars and professional writers of the natural history, geography, history, folklore, and lifeways of the region. The UA Press does not publish children's books or volumes of original fiction or verse.

The University of Arizona Press invites inquiries from the authors of works—whether scholarly books or works of general interest—that are appropriate to its list.

Also appearing under the Press imprint is the historical quarterly Arizona and the West, whose separate editorial and subscription office is in the UA Main Library.

The WATER RESOURCES RESEARCH CENTER (1965), an interdisciplinary organization formed in response to the U.S. Congress's Water Resources Act of 1964, is primarily devoted to assistance to water-related research activities at the three state universities. In addition, the Center conducts certain special research investigations within its organization. This work includes the harvesting of additional water from arid and semiarid watersheds; artificially recharging the groundwater aquifers; evaporation suppression; seepage control; urban hydrology; and operation and maintenance of the research facility on the Casa Grande Highway, and one undeveloped and three urbanized watersheds, all in or near Tucson. Lastly, the Center is responsible for the dissemination of results of water-related research in the state.
Admission to The University

The University of Arizona welcomes applications for admission from all individuals who qualify. Students with a record of success or high motivation to succeed will find the rich blend of academic and social opportunities for learning available at the University particularly well-suited to their needs.

The Office of Admissions and the Campus Visitors Center offer numerous opportunities for visiting the University which include campus tours, personal interviews, and meetings with faculty members. Prospective students should call the Office of Admissions at (602) 621-3237 to be informed of campus visitation programs and to arrange for personal appointments. To arrange a student-conducted campus tour, call the Campus Visitors Center at (602) 621-3641.

GENERAL INFORMATION

EQUAL OPPORTUNITY — The University of Arizona is committed to providing equal educational opportunity for all without regard to sex, race, religion, color, national origin, age, Vietnam Era veterans’ status, or handicapping condition. Inquiries may be referred to the Affirmative Action Officer, Administration Building, Room 501, (602) 621-3081.

APPLICATION FOR ADMISSION — Applications for admission may be obtained by writing or calling:

Director of Admissions
University of Arizona
Tucson, AZ 85721
(602) 621-3237

Inquiries regarding admissions policies and procedures should be directed to the Office of Admissions. Information about admission to the Graduate College, the College of Law, and the College of Medicine may be obtained from the admissions office of the respective college.

DEADLINE FOR APPLICATION — Priority is given to early applicants. Therefore, students should apply for admission well in advance of the semester they wish to attend. Graduating high school seniors should apply in the fall of their senior year. In all cases, the application for admission and all supporting transcripts must be submitted to the Office of Admissions no later than one month before the first day of registration for the fall semester or the spring semester concerned. Foreign students (non-immigrants) should note the application deadline dates indicated in the section “Admission of Foreign Students.”

ENTRANCE TEST — All entering freshman students must take the American College Test (ACT) or the Scholastic Aptitude Test (SAT) of the College Board, and have their scores sent to the Office of Admissions. Information regarding these tests may be obtained from high school counselors. Transfer applicants who have earned less than 12 semester hours of credit must also submit results from either the ACT or SAT examinations.

DOMICILE AFFIDAVIT — A student enrolling in the University of Arizona for the first time, or a student returning after an absence of one or more semesters, must file a Domicile Affidavit. This form is furnished to students with the admission or readmission application. Foreign students (non-immigrants) are classified non-residents of the State of Arizona for the duration of their enrollment, and a Domicile Affidavit is, therefore, not required.

HEALTH REGULATIONS — All new students and students absent from the University more than two semesters must submit a completed Admission Health Report to the Student Health Service. Additionally, it is recommended that the results of a tuberculin skin test taken within six months prior to registration be submitted. If the skin test is found to be positive, a chest
x-ray is recommended. Medical or nursing students should defer the chest x-ray until arrival at the University.

**READMISSION** — Students absent from the University for a regular semester or longer, regardless of reason, must make a formal application for readmission, applying to the Office of Admissions at least one month prior to the opening of the semester or summer term for which they wish to re-enroll. Students who withdraw for medical reasons and who are medically encumbered must have their readmittance approved by the Student Health Service. Medical withdrawal procedures should be initiated through the Student Health Service.

**CANCELLATION OF ADMISSION OR REGISTRATION** — The University reserves the right to cancel the admission or registration of an individual whose attendance at the University, in the opinion of the appropriate administrative officer and the president, would not be mutually beneficial to the student and to the institution.

**ACCOMMODATION OF RELIGIOUS OBSERVANCE AND PRACTICE** — In accord with Board of Regents' policy, no employee, agent or policy of the University of Arizona shall discriminate against any student, employee, or other individual because of that individual's religious belief or practice or any absence thereof. Administrators and faculty members are responsible for reasonable accommodation of individual religious practices. A refusal to accommodate is justified only when undue hardship would result from each available alternative of reasonable accommodation. Further, no administrator or faculty member shall retaliate or otherwise discriminate against any student, employee or prospective employee because that individual has sought a religious accommodation pursuant to this policy.

Persons wishing clarification of the nature or proper application of this policy should consult the Office of the Dean of Students or the Office of the Director of Personnel, as appropriate.

**ADMISSION TO FRESHMAN STANDING**

**SCHOLASTIC REQUIREMENTS** — A first-time freshman applicant for admission may be admitted if he or she has satisfactorily completed the required secondary-school subject units and:

1. Ranks in the upper 50% of the high school graduating class; or
2. Is an in-state applicant, obtains a minimum composite score of 21 on the American College Test or a minimum combined score of 930 on the Scholastic Aptitude Test of the College Board; or
3. Is an out-of-state applicant, obtains a minimum composite score of 23 on the American College Test or a minimum combined score of 1010 on the Scholastic Aptitude Test of the College Board; or
4. Has attained a high school grade-point average minimum of 2.5000 overall on a 4.0000 scale.

Applicants who do not meet the above freshman admission standards may appeal in writing to be admitted on the basis of at least one of the following additional criteria:

1. Has shown an upward grade trend during his or her high school career or an upward grade trend in the senior year;
2. Obtains positive recommendations from his or her secondary school administrators and/or a positive recommendation from a university counselor based upon academic potential, work experience, leadership ability, or extra-curricular activities;
3. Attains an average score on the General Education Development test (GED) of at least 50;
4. Demonstrates an ability to complete freshman-level academic courses by attaining a minimum grade-point average of 2.0000 on a 4.0000 scale in academic courses in English, social science, mathematics, science, foreign languages, or the humanities, as shown by at least 12 credit hours in a community college and/or summer or evening sessions of the University.
REQUIRED SECONDARY-SCHOOL SUBJECT UNITS

Applicants for admission must have completed a 4-year secondary-school course or the equivalent with a minimum of sixteen units in acceptable subjects. The definition of a unit is that used by the North Central Association of Colleges and Secondary Schools. This is the amount of credit given for the successful completion of a course which meets 40 minutes daily, five days per week, for at least 36 weeks, or the equivalent amount of time (120 clock hours) within the school year.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>4</td>
<td>(see Group I below)</td>
</tr>
<tr>
<td>(or English 3 and one foreign language 2)</td>
<td>5</td>
<td>(see Groups I and II below)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>2</td>
<td>(see Group III below)</td>
</tr>
<tr>
<td>American history &amp; social studies</td>
<td>2</td>
<td>(see Group IV below)</td>
</tr>
<tr>
<td>Laboratory science</td>
<td>1</td>
<td>(see Group V below)</td>
</tr>
<tr>
<td>Electives</td>
<td>7</td>
<td>(see Groups I through VI below)</td>
</tr>
<tr>
<td>(or depending upon English option)</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Beginning fall semester 1987, the mathematics and science requirements will be 3 units and 2 units respectively. The English requirement will remain 4 units, but the language substitution will be eliminated.

Classification of Acceptable Secondary School Subjects

Group I.   English: only courses with major emphasis upon grammar, composition, and literary analysis.

Group II.  Foreign language: a classical or modern foreign language. Less than one unit is not accepted. Two units or more are strongly recommended.

Group III. Mathematics: one unit of algebra must be presented. The second required unit may be either advanced algebra or plane geometry.

Group IV.  Social Studies: history, civics, economics, sociology, geography, and government (including United States and Arizona constitution).

Group V.   Laboratory science: courses in biology, chemistry, earth science, and physics, in which at least one regular laboratory period is scheduled each week.

Group VI.  Art, agriculture, bookkeeping, general science, home economics, arithmetic, business arithmetic, general mathematics, journalism, industrial arts, music, drama, speech, secretarial training, and other subjects commonly offered for credit by secondary schools.

Provision for Admission of Secondary-School Graduates Who Have Not Completed the Required Subject Units

Applicants who are otherwise admissible and who lack no more than two units of the required program may be admitted with deficiencies. There may be no more than one unit of deficiency in any subject area.

Because a student admitted with deficiencies may not be satisfactorily prepared for college, it is recommended that the deficient subject units be made up prior to college atten-
dance. The deficiencies must be made up, however, within one calendar year of the date of first
enrollment, either by additional high school courses (for example, correspondence study with
high schools, community colleges or state universities), or by college courses. When the
deficiencies have not been removed by the time the student first registers at the University, the
first course taken in the subject matter area will be used to remove that deficiency. Students
who fail to remove deficiencies within one calendar year of the date of their first enrollment will
not be permitted to register for future terms.

Additional Subject Units Recommended

The required pattern of subjects is that which, on the basis of experience, can reason-
ably be expected to provide satisfactory preparation for college when these subjects have been
completed with better-than-average grades. A well prepared high school student will have
completed at least 4 units of English, 2 units of one foreign language, 4 units of college
preparatory mathematics (to be selected from the areas of algebra, geometry, and trigo-
nometry), 3 units of history and social studies, and 2 units of laboratory science. One
mathematics and one English subject unit should be taken by the student during the senior
year of high school.

The University and Board of Regents are increasing the secondary school subject units
required for admission to the University beginning Fall 1987.

ADVANCED FRESHMAN PLACEMENT

ADVANCED PLACEMENT — Students who have completed college-level courses in secon-
dary schools and have taken the Advanced Placement Examinations of the College Entrance
Examination Board will be considered for advanced placement and for the granting of college
credit to count toward degree requirements.

The Advanced Placement Program recognizes that many students can complete
college-level courses while they are still in secondary school. Participating colleges encourage
and recognize this achievement. The Program provides course descriptions and professional
consultants to help schools establish college-level courses for their stronger students. It sets,
administers, and grades examinations in these courses. It sends the examination grades,
together with supporting materials, to the students' colleges, enabling the college to grant
appropriate placement and credit. See section on Advanced Placement from High School
under "Proficiency and Exemption Examinations, Credit by Examination" in chapter entitled
Academic Guidelines.

Students should consult their high school counselors or write to the College Entrance
Examination Board, Princeton, New Jersey, 08540 for more details.

PROGRAMS FOR SUPERIOR STUDENTS

Outstanding students may wish to consider participating in the University-wide Honors
Program. For a description of this program and of Honors, Awards and Prizes conferred to
outstanding students at the University, please refer to the section in this catalog titled
Provisions for Superior Students.

TRANSFER STUDENTS

APPLICATION FOR ADMISSION — Applications for admission may be obtained by writing or
calling:

Director of Admissions
University of Arizona
Tucson, AZ 85721
(602) 621-3237
Students transferring from other colleges and universities are required to file with the Office of Admissions official transcripts sent directly from all previously attended schools. Students may not disregard their records in other colleges and universities in order to apply for admission solely on the basis of their high school records. Any student who does so is subject to suspension from the University and, should requirements for a degree otherwise be met, subject to the withholding of the degree.

SCHOLARSHIP REQUIREMENT — Applicants for admission to advanced standing are required to present a minimum overall grade-point average on their previous college work of 2.0000(C) on a 4.0000 scale. Students transferring with less than sophomore standing will be subject to the same curricular requirements as regular admittees from high schools and must show evidence of having fulfilled the required secondary school subject units. Such units must be completed in high school or by equal or higher work at the college level in the same manner as designated for entering freshmen. Refer to the class standing table of the Academic Guidelines section of this catalog to determine the number of hours required for sophomore standing in your academic unit.

Note: The above statements do not necessarily apply to students seeking admission to certain divisions of the University which may have higher entrance requirements. See the sections stating requirements for admission to the College of Business and Public Administration, the College of Education, the College of Engineering, and the College of Pharmacy.

STUDENTS' COPIES OF TRANSCRIPTS — Transfer students are urged to bring with them to registration unofficial transcripts of their records at colleges and universities previously attended. These will be helpful for advising when the official transfer evaluation has not yet been completed by the Office of Admissions.

COLLEGE-LEVEL EXAMINATION PROGRAM — The University of Arizona grants credit for both the General Examinations and the Subject Examinations of the College-Level Examination Program of the College Entrance Examination Board.

TRANSFER OF CREDITS — The University of Arizona evaluates without prejudice applicants for admission from regionally accredited postsecondary institutions or postsecondary institutions which are candidates for accreditation on the individual merits of their academic achievements. Credit in courses in which the grade received was lower than C is not transferable. Grades earned in courses taken at other institutions are not included in calculation of the University of Arizona grade-point average.

Inquiries concerning the acceptance of transfer credit from foreign institutions should be directed to the Foreign Student Admissions Office, which is responsible for the evaluation of foreign credit in transfer.

CREDITS FROM COMMUNITY COLLEGES — Credits transferred from accredited community colleges will be accepted up to the maximum allowed by the University for the first two years in the corresponding University curriculum, provided these credits are in courses acceptable for transfer credit. (See "Maximum Units Allowed Per Semester" under Academic Guidelines.) While all courses offered for transfer will be accepted by the University subject to the above rule, the specific lower-division requirements of various curricula vary widely. In order to complete the baccalaureate program in the normal time span, the student should therefore consult the college section of this catalog that is appropriate for the student's curriculum, as well as the head of the appropriate University department to determine specific requirements of the program into which the student plans to transfer.

Normally a course completed in a community college whose content is offered at the University of Arizona in the upper division (carrying a course number of 300 or higher) will not be accepted in transfer as the equivalent of the University of Arizona upper-division course.
ADMISSION TO PARTICULAR COLLEGES AND SCHOOLS

ARCHITECTURE — Applicants are expected to present credit in mathematics and laboratory science as follows: 1 unit of elementary algebra, ½ unit of intermediate algebra, 1 unit of plane geometry, and 1 unit of physics with a lab. Students are strongly advised to include among their electives additional courses in mathematics such as trigonometry, advanced algebra, or solid geometry.

ARTS AND SCIENCES — Students are strongly urged to present one unit of algebra, one unit of intermediate algebra, one unit of plane geometry, and two units of a foreign language.

BUSINESS AND PUBLIC ADMINISTRATION — Applicants are strongly advised to offer entrance credit in mathematics as follows: one unit of elementary algebra, ½ unit of intermediate algebra, and ½ unit of advanced algebra. Upper-division courses in the college are open only to students who meet the requirements for advanced standing, as specified in the College of Business and Public Administration section of this catalog.

EDUCATION — Applicants for admission to the College of Education must have completed 56 semester units of credit applicable to a baccalaureate degree with a cumulative grade-point average of 2.5000 or better. Candidates for admission must also have a grade-point average above that for probation (2.0000) for all work taken at the University of Arizona. Admission to methods and student teaching in teacher training programs requires the passing of a basic skills proficiency examination in reading, mathematics and English grammar.

ENGINEERING — Applicants are required to present credit in mathematics as follows: one unit of elementary algebra, ½ unit of intermediate algebra, ½ unit of advanced algebra, one unit of plane geometry, ½ unit trigonometry. It is strongly recommended that one unit of physics and one unit of chemistry be presented. Students transferring into the college must have a cumulative grade-point average of 2.5000 in all previous university studies.

HEALTH-RELATED PROFESSIONS — Admission to the school is solely through acceptance into a specific program. Applicants are required to have completed 58-63 semester hours of college credit and to have maintained a 2.2500 grade-point average on all collegiate work attempted. Applicants must meet the school’s general prerequisites as well as those prerequisites established for the particular program of study for which the student is applying.

MINES — Applicants are required to present credit in mathematics and laboratory science as follows: one unit of elementary algebra, ½ unit of intermediate algebra, one unit of plane geometry, ½ unit of trigonometry, and ½ unit of advanced algebra; one unit of physics; one unit of chemistry.

NURSING — Applicants are strongly advised to offer entrance credit in intermediate algebra in addition to credit in elementary algebra. Otherwise, they will be required to complete Math. 116 before enrolling in Math. 117e. Two years in the College of Arts and Sciences are prerequisite to entrance into the College of Nursing. For further information, see the College of Nursing section of this catalog.

PHARMACY — Applicants are expected to complete in high school one unit of elementary algebra, one unit of plane geometry, ½ unit of advanced algebra, ½ unit of trigonometry. Two years of study in the liberal arts and sciences are prerequisite to entrance into the College of Pharmacy. For further information see the College of Pharmacy section of this catalog.

NONRESIDENT APPLICATIONS

ADMISSION APPLICATION FEE — Applicants for admission from states other than Arizona must pay an application fee of $10 (this fee does not apply to applicants for admission to the Graduate College). The application fee is also required of undergraduate foreign students who
reside within the United States but outside the state of Arizona. This should be paid in check or money order made payable to the University of Arizona, and must be submitted with the application for admission. Applications are not considered unless accompanied by this nonrefundable fee.

**ADMISSION OF FOREIGN STUDENTS** (Students who hold nonimmigrant visas) — Inquiries about undergraduate admission should be directed to the Foreign Student Admissions Office, Administration Building, Room 302. Foreign students are expected to have above average grades, must demonstrate proficiency in the English language, and must satisfy the financial guarantee requirements for each year of attendance.

All foreign applicants whose native language is other than English are required to take the Test of English as a Foreign Language (TOEFL). Results of the TOEFL are valid for two years. Applicants should request that TOEFL (Box 899-TR, Princeton, New Jersey 08541, USA) send their scores to the University of Arizona. The scores must be received before the application for admission can be considered.

Newly admitted foreign students may also be required to take a locally administered English placement or achievement test upon arrival and must take such further study in English as the test results indicate is necessary.

For those lacking college-level English proficiency, the Center for English as a Second Language (CESL) on this campus offers full-time English language training. The full semester sessions carry no college credit, but satisfactory completion of CESL study will meet the English proficiency requirement for admission. Request further information by writing to Foreign Student Admissions.

Foreign students on nonimmigrant visas must submit proof of adequate financial resources to support themselves while in residence at the University of Arizona. If sponsorship is through an organization or government agency, the Foreign Student Admissions Office should be notified directly by the sponsor of the terms of scholarship support, which must include instructions if the University of Arizona is to bill for tuition and fees. The address for billing must be through an embassy or other agent in the United States; otherwise, the students must pay their own fees at registration.

Foreign students on nonimmigrant visas are required by the University to have University of Arizona Student Accident and Sickness Insurance coverage. Information and costs of this coverage are sent to those foreign students who are accepted for admission. The cost of the insurance is included in the amount of the financial guarantee. Insurance coverage is required for each term of enrollment. Students are exempted from the University of Arizona insurance plan only when their government or sponsoring agency has submitted accident and sickness insurance plans acceptable to the University of Arizona, or when the student can show proof of having health insurance comparable with that available through the University.

Inquiries concerning the acceptance of transfer credit from foreign institutions completed by U.S. and non-U.S. citizens should be directed to the Foreign Student Admissions Office, which is responsible for the evaluation of foreign credit in transfer.

Application deadlines: May 15 for fall; September 15 for spring; April 1 for summer. To meet the deadlines, the application and other required official credentials and statements must be received in the Foreign Student Admissions Office by the above dates.

**ADMISSION OF IMMIGRANT AND REFUGEE-STATUS STUDENTS**

Application inquiries should be directed to the Undergraduate Admissions Office, Administration Building, Room 322.

Applicants whose native language is not English are required to take the Test of English as a Foreign Language (TOEFL), which is given at test centers worldwide under the direction of the Educational Testing Service. For test registration information, write: Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08541.

In Tucson, arrangements may be made to take the Institutional TOEFL at the University of Arizona by contacting the Center for English as a Second Language, Room 104, CESL Building. To take the International TOEFL, contact the Testing Office of the Student Counseling Service located in Old Main, Room 223.
ADMISSION OF DISABLED STUDENTS

The requirements for admission to the University of Arizona are the same for all students. The individual with a disability utilizes the same process as the non-disabled individual.

Prospective students who are disabled are encouraged to write or call the Disabled Student Services Program, University of Arizona, Tucson, AZ 85721, (602) 621-3268, in conjunction with the application process. A comprehensive program of academic support, rehabilitation health, and athletics/recreational services is available.

ADMISSION OF VETERANS AND CHILDREN OF DECEASED VETERANS

GOVERNMENT EDUCATIONAL PROGRAMS FOR VETERANS AND WAR ORPHANS — The University of Arizona is fully approved for the training of students under the several government educational programs for veterans and war orphans. Eligible students should apply directly to their nearest Veterans' Administration office for benefits to which they may be entitled under these laws.

EVALUATION OF MILITARY TRAINING — A Guide to the Evaluation of Educational Experiences in the Armed Services, published by the American Council on Education, has been adopted by the University of Arizona as a basis for evaluating training in the armed forces.

For active service terminated under honorable conditions in the Army, Navy, Marine Corps, Air Force, or Coast Guard credit is given as follows: for a period of at least six months and less than a year, the University allows four units of military science; for one year or more of active service, eight units of military science; for the rank of warrant officer earned in the service, six upper-division units of military science, naval science, or aerospace studies; and for a commission earned in the service at the rank of second lieutenant or higher (in the Army, Air Force, or Marine Corps) or ensign or higher (in the Navy or Coast Guard), twelve upper-division units in military science, naval science, or aerospace studies. Information concerning the evaluation of military training and experience may be obtained in the Transfer Evaluations Office.

EXEMPTION OF CERTAIN VETERANS FROM EFFECTS OF FAILING GRADES — By Arizona statute, in determining the admissibility to the University of a veteran, honorably discharged, who has served in the armed forces of the United States for a minimum of two years and who was previously enrolled at a university or community college in Arizona, no failing grades received by such veteran at any Arizona university or community college prior to military service may be considered. This policy applies to the admission decision only. Failing grades awarded at the University of Arizona remain on the record, and the graduation average is based upon the grades received in all course work attempted in residence.

The student admitted or readmitted to the University under this statute is subject to progression, retention, graduation, and other academic regulations and standards in this catalog.

THE TRAVELING SCHOLARS PROGRAM

The Traveling Scholars Program is designed so that students may take advantage of programs or special resources available at one of the three state universities not available at their own institution. Any undergraduate student with a 2.5000 grade-point average or any graduate student with a 3.0000 grade-point average enrolled at Arizona State University, Northern Arizona University, or the University of Arizona may be designated a Traveling Scholar by prior mutual agreement of the appropriate academic authorities at both the sponsoring and the hosting institution. Additional information and the application form may be obtained from the Director of Admissions.
Registration

Any student who makes use of classroom or laboratory facilities or of faculty time is required to register formally. Graduate students who have previously registered for all of the credit required for their degrees may enroll for supplementary registration in order to meet this requirement.

CLASSIFICATION OF STUDENTS

Students of the University of Arizona are classified as regular, unclassified, or non-credit.

REGULAR — A regular student follows a prescribed curriculum leading to a degree. All student programs must be approved by the college dean or the dean's representative.

UNCLASSIFIED — An unclassified student is not a candidate for a degree.

NON-CREDIT — Non-credit students do not take courses for credit. Such students are not required to meet admission standards but must obtain permission from the instructor before enrolling in a course. Non-credit students pay the same fees as credit students.

PROCEDURES

NEW STUDENT ORIENTATION — Orientation for new students is held during the summer and again in the fall and spring. New students receive information about these programs after the students have been admitted to the University. Students are encouraged to attend the Summer Orientation and Preregistration Program if possible. Orientation activities include counseling, academic advising, and an introduction to campus facilities and services.

REGISTRATION — Students must register for each class in which they will participate. Pre-registration is conducted during the fall and spring for the following semester. Students who do not preregister are required to register in alphabetical groups on designated days at the beginning of each semester. The period of late registration for credit classes closes one week from the opening of classes. See the calendar for the academic year in the front of this catalog.

PENALTY FOR LATE REGISTRATION — Students who fail to pay all fees during the designated walk-through registration period are charged a late registration fee.

IDENTIFICATION CARDS — As part of the registration process, each new student at the University of Arizona will be issued a photo identification card. This card, along with the current fee receipt, establishes the student's identity as a University of Arizona student and authorizes access to certain University facilities. This card must be obtained during the prescribed time at the beginning of each semester during the student's first term of enrollment or a late processing fee of $10 will be charged.

CLEARANCE OF ACCOUNTS — No student whose record indicates indebtedness to the University shall be permitted to register.

SPECIAL TESTING — Students may be required to take special tests as recommended by their college dean or the Dean of Students.
REGISTRATION ADJUSTMENTS

CHANGE OF SCHEDULE — Changes in a registration by adding or dropping courses must be initiated by the student by filing a change-of-schedule form with the University Cashier. A fee of $2.00 is charged unless the change is made for the convenience of the department.

After the last day of registration for credit, as stated in the Academic Calendar, a student may not add a course without special permission from the instructor of the course and the student's college dean.

Course withdrawals filed by the end of the fourth week of classes result in cancellation of registration in the course. Course withdrawals filed from the end of the fourth week of classes until the end of the tenth week of classes are subject to rules set forth in the section "Withdrawal Grade" under Academic Guidelines in this catalog.

The last day on which a student may drop a course is the last day of the tenth week during which classes are held, except for an extraordinary reason approved by the student's college dean (in the case of undergraduate students) or by the Graduate Council (in the case of graduate students) or by the Dean of Students (in the case of students withdrawing completely from the University). For students in the Colleges of Law and Medicine, withdrawals are governed by regulations established by the respective college faculty.

Each semester students are mailed written confirmation from the Office of Student Information, Registration and Records of the courses in which they are officially enrolled. If this official registration record does not agree with the student's own records, it is the responsibility of the student to go to the Office of Student Information, Registration and Records and correct his or her registration. An instructor has no alternative but to assign a failing grade ("E") to a student who has not participated in the course but whose name appears on the final grade report list.

TRANSFER TO LESS ADVANCED COURSE — Students unable to meet satisfactorily the requirements of courses in which they are registered may be transferred to less advanced courses in the same department if the head of the department and the instructor of the less advanced course approve. In all such cases, the transfer shall be made within five weeks after the beginning of classes using the change-of-schedule form. In certain departments this privilege extends only through the 14th day of classes.

CHANGE OF REGISTRATION FROM CREDIT TO AUDIT — After the fourth week of classes, a change in registration in a course from credit to audit will be permitted only if the student is doing passing work in that course and receives the approval of the course instructor and the student's college dean. No change from credit to audit will be permitted after the end of the tenth week of classes except with special permission from the student's college dean.

CHANGE OF COLLEGE — Students wishing to change colleges must consult the dean's office of the college to which they wish to transfer. Change from one college to another may be made by filing a change-of-college form with that college at least 30 days prior to the next registration. The change of college will be effective for the current term if filed within the first four weeks of classes during a regular semester. If filed after that date, the change of college will be effective the following semester.

CHANGE OF MAJOR — A student may change his or her major by contacting his or her college dean and completing the appropriate forms.

PETITIONS — Students may petition the University Petitions Committee for relief if they believe they deserve redress or exception to University rules, regulations, or policies regarding academic affairs, such as extension of incomplete grade, choice of catalog and degree requirements. Petition forms may be obtained in the Office of Student Information, Registration and Records or from the college dean. The completed form with all relevant facts and supporting evidence is submitted to the college dean for recommendation and forwarding to the Office of
Student Information, Registration and Records, after which it is forwarded to the University Petitions Committee for action. The decision of the University Petitions Committee is final.

Students may also petition for redress or exception to college policies or requirements. Petitions may address a change of program, approval for an overload, substitution of coursework, transfer credit, modification in degree program, or in certain instances, eligibility for registration or enrollment in the college. The necessary forms, instructions and assistance may be obtained in the office of the college dean. The decision of the dean is final.

LIMITATION OF REGISTRATION — Whenever lack of facilities in courses makes it necessary to limit the number of students admitted, preference will be given to students for whom these courses are required. Among these, priority is given in order to graduating seniors and students having superior records in prerequisite courses.

CANCELLATION OF COURSES — The University reserves the right to cancel any course not elected by an adequate number of students.

STUDENT RETENTION

An average of twenty percent of entering freshmen fail to register the first semester of the following year. In subsequent semesters, a portion of these students return while others drop out permanently or temporarily. Approximately one third of the entering freshmen graduate in four years and sixty percent eventually receive degrees from a four-year college or university.

RELEASE OF INFORMATION

The University complies with all provisions of the Family Educational Rights and Privacy Act of 1974 dealing with the release of education records. A copy of the full text of this act is on file in the Office of Student Information, Registration and Records, the Office of the Dean of Students, and the Special Collections division of the University Library, along with the University of Arizona's policy for implementation of the act.
Academic Guidelines

SCHOLARSHIP REQUIREMENTS

MINIMUM GRADE-POINT AVERAGE REQUIRED — One of the requirements for students to be eligible to continue in the institution is that they earn minimum cumulative averages as follows:

<table>
<thead>
<tr>
<th>Minimum grade-point average based upon university credit</th>
<th>Total units completed in residence and accepted in transfer carried at University of Arizona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer than 25 units ................................................. 1.7500</td>
<td></td>
</tr>
<tr>
<td>From 25 through 55 units ........................................... 1.9000</td>
<td></td>
</tr>
<tr>
<td>56 or more units .................................................... 2.0000</td>
<td></td>
</tr>
</tbody>
</table>

Graduate students (any student registered in the Graduate College), work carried for graduate credit only .................................. 2.6500

For scholarship requirements in the College of Law, see the College of Law section of this catalog.

GOOD STANDING — Good standing status denotes that a student is eligible to continue in or return to the University.

UNIVERSITY CREDIT — University credit is the term used to identify all credit offered by the University of Arizona with the exception of correspondence credit and credit by examination (whether or not for a grade). Only the grades of courses taken for university credit and by Special Examination for Grade are used in calculating the grade-point average.

DEFINITION OF UNIT OF CREDIT — Utilizing the definition that an hour of work is the equivalent of fifty minutes of class time (often called a contact hour) or sixty minutes of independent-study work, university policy requires at least 45 hours of work by each student for each unit of credit. Contact hours required for specific types of courses are as follows:

1. At least fifteen contact hours of recitation, lecture, discussion, seminar, or colloquium, as well as a minimum of thirty hours of student homework are required for each unit of student credit.
2. Workshops require at least fifteen through 45 contact hours and the appropriate number of homework hours to comprise a total of at least 45 hours of work for each unit of credit.
3. Studios require at least thirty contact hours and at least fifteen hours of homework for each unit of credit.
4. Laboratory courses must maintain a minimum of 45 contact hours per unit of credit.
5. Field trips are to be counted hour-for-hour as laboratory meetings.
6. Each unit of internship or practicum must require a minimum of 45 hours of work.

Since it would be virtually impossible for a student to satisfactorily complete 45 hours of work in less than one week, the policy regarding the duration of courses maintains that a course must cover at least a one-week period for every unit of credit given. During the summer session, however, six units of credit might be given over a five-week period.

It is understood that, when the official university calendar deviates from these guidelines, that calendar shall prevail.

It is also understood that the hour requirements specified above represent minimums for average students and that considerable deviation in excess of these requirements may occur, particularly at the graduate level.
MIDSEMESTER SCHOLARSHIP REPORT — A report of students (except in the College of Law) doing failing or below-average work is issued during the eighth week of classes each semester. Students listed on this scholarship report are warned that their work in the courses reported is deficient and their extracurricular activities may be restricted by their deans until the end of the semester.

ACADEMIC PROBATION AND DISQUALIFICATION

FAILURE TO EARN REQUIRED GRADE-POINT AVERAGE — Failure to meet grade-point average requirements listed above subjects the student to academic probation or disqualification. (Please see also the statement regarding “Probation or Disqualification by Special Action” which appears later in this section.)

PROBATION — Students on probation are subject to such restrictions with respect to courses and extracurricular activities as may be imposed by the dean of the college concerned. Students are removed from probation upon earning the minimum cumulative average required by the table listed under "Minimum Grade-Point Average Required" above, or by action of the dean of their college.

DISQUALIFICATION — Disqualification is of two types: from a particular college in the University, or from the University, the type to be established by the Deans' Council on the recommendation of the dean of the college in which the student was enrolled. The student recommended for disqualification from a particular college may seek immediate admission to another college in the University. Permission for admission to another college must be obtained in writing from the dean of the college into which the student plans to transfer. The letter of permission should be presented to the Office of Student Information, Registration and Records. Ordinarily permission will be granted only if the student plans to pursue a modified program in a curriculum of the new college and has demonstrated ability warranting such action. Those who have been given college disqualification are strongly urged to seek thorough academic and vocational counseling and guidance. Failure to secure approval to transfer to another college in the University is tantamount to University disqualification and the rules governing this type of disqualification then will apply.

A student disqualified from a particular college who may have secured subsequent permission to register in another college is automatically on scholastic probation in the new college. A student may be granted college disqualification only once in his or her academic career. Any later disqualification will be considered permanent disqualification.

FIRST UNIVERSITY DISQUALIFICATION — A student may be academically disqualified only after having been on probation for one semester or two summer terms, or by special action of the Deans' Council, as described below under "Probation or Disqualification by Special Action."

A student disqualified from the University is ineligible to register the following semester. A student disqualified at the close of the first semester may register in the summer session, but a student disqualified at the close of the second semester cannot register in the summer session or the first semester of the following academic year. Students under First University Disqualification are discouraged from taking credit course work elsewhere and should treat their period of disqualification as a time to reassess their goals while in a nonacademic environment.

SECOND UNIVERSITY DISQUALIFICATION — A student with two disqualifications may return to the University only on the basis of evidence that underlying conditions have materially improved and that he or she is now capable of serious intellectual effort. The student must furnish the Registrar with a letter from the dean of the college from which he or she was last disqualified stating that the dean approves the re-registration. If the student wishes to enroll in a college of the University other than the one from which he or she was last disqualified, approval must be obtained from both the dean of the college from which the student was disqualified and the dean of the college he or she wishes to enter.
PROBATION OR DISQUALIFICATION BY SPECIAL ACTION — Upon recommendation of the dean of the college and the approval of the Deans' Council, a student may be placed on scholastic probation or may be disqualified at any time for neglect of academic work. Such disqualification may be either temporary or permanent.

CREDIT RESTRICTIONS FOR STUDENTS UNDER UNIVERSITY DISQUALIFICATION — Students who are under disqualification from the University may not take University of Arizona courses for credit or establish credit by examination during their periods of disqualification, although they may remove incomplete grades. With the permission of the college dean concerned, students who have been disqualified from the University may register for audit enrollment and correspondence enrollment.

ACADEMIC RENEWAL

Under certain circumstances an undergraduate student may petition the Registrar for academic renewal. Academic renewal allows students to have grades for a particular period of time excluded from the grade-point average. If the qualifications are met, the student may have a maximum of four consecutive semesters of course work disregarded in all calculations regarding academic standing, grade-point average, and eligibility for graduation. If summer work is to be included in the work to be disregarded, a five-week summer term shall count as one-half semester.

Eligibility for academic renewal shall be subject to the following conditions:
1. At the time the petition is filed, a minimum of five years shall have elapsed since the most recent course work to be disregarded was completed.
2. In the interval between the completion of the most recent course work to be disregarded and the filing of the petition, the student shall have completed a minimum of thirty units of course work at the University with a minimum grade-point average of 2.5000 on all work completed at the University in that interval.

The petition shall specify the semester(s) or term(s) to be disregarded. If more than one semester or term is to be disregarded, these shall be consecutive, completed within a maximum of two calendar years, with no intervening enrollments at the University. The maximum of two calendar years may be extended by one semester if the time period includes a semester of involuntary absence by reason of disqualification.

If the petition qualifies under this policy, the student's permanent academic record shall be suitably annotated to indicate that no work taken during the disregarded semester(s) or term(s), even if satisfactory, may apply toward graduation requirements. However, all work will remain on the record, ensuring a true and accurate academic history.

Academic renewal may be effected only once during a student’s academic career.

ENROLLMENT POLICIES

MAXIMUM UNITS ALLOWED PER SEMESTER — Approval of the college dean is required for any student to exceed the maximum number of units allowed per semester as indicated below. The semester load includes all work carried in residence as well as concurrent registration in correspondence, extension, high school courses or approved courses at other institutions.

<table>
<thead>
<tr>
<th>College or School</th>
<th>Units</th>
<th>College or School</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>18</td>
<td>Graduate</td>
<td>16</td>
</tr>
<tr>
<td>Architecture</td>
<td>18</td>
<td>Health-Related Professions</td>
<td>18</td>
</tr>
<tr>
<td>Arts and Sciences</td>
<td>18</td>
<td>Law</td>
<td>17</td>
</tr>
<tr>
<td>(B.S. in Geosciences)</td>
<td>19</td>
<td>Mines</td>
<td>19</td>
</tr>
<tr>
<td>Business and Public Administration</td>
<td>18</td>
<td>Nursing</td>
<td>18</td>
</tr>
<tr>
<td>Education</td>
<td>19</td>
<td>Pharmacy</td>
<td>18</td>
</tr>
<tr>
<td>Engineering</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CLASS STANDING — Class standing in the various colleges and schools, based upon the number of units completed, is given in the table below. A student's class standing does not necessarily relate to the number of semesters or units required to complete degree requirements. Class standing is determined by the college in Medicine and Pharmacy.

<table>
<thead>
<tr>
<th>College or School</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>1 - 25</td>
<td>26 - 57</td>
<td>58 - 90</td>
<td>91+</td>
</tr>
<tr>
<td>Architecture</td>
<td>1 - 29</td>
<td>30 - 60</td>
<td>61 - 94</td>
<td>95+</td>
</tr>
<tr>
<td>Arts and Sciences</td>
<td>1 - 24</td>
<td>25 - 55</td>
<td>56 - 86</td>
<td>87+</td>
</tr>
<tr>
<td>B.S. in Geosciences</td>
<td>1 - 27</td>
<td>28 - 62</td>
<td>63 - 97</td>
<td>98+</td>
</tr>
<tr>
<td>Education</td>
<td>-</td>
<td>-</td>
<td>56 - 86</td>
<td>87+</td>
</tr>
<tr>
<td>Engineering</td>
<td>1 - 27</td>
<td>28 - 62</td>
<td>63 - 97</td>
<td>98+</td>
</tr>
<tr>
<td>Health-Related Professions</td>
<td>-</td>
<td>-</td>
<td>58 - 97</td>
<td>98+</td>
</tr>
<tr>
<td>Mines</td>
<td>1 - 27</td>
<td>28 - 62</td>
<td>63 - 97</td>
<td>98+</td>
</tr>
<tr>
<td>Nursing</td>
<td>-</td>
<td>-</td>
<td>65 - 100</td>
<td>101+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1st year</th>
<th>2nd year</th>
<th>3rd year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law</td>
<td>1 - 21</td>
<td>22 - 49</td>
</tr>
</tbody>
</table>

FULL-TIME STUDENT STATUS — Full-time status for an undergraduate student varies with the college and study program, but ordinarily requires a load of at least 12 units per semester. Full-time status for graduate students is more widely variable, depending upon assistantship or associateship duties and the composition of the individual student's program. Students in doubt about their standing should check with the dean of the college.

GRADING SYSTEM

The grading system used by the University of Arizona follows:

- A — Excellent
- B — Good
- C — Fair
- D — Poor
- E — Failure
- P — Passing (see paragraph on "Special Grades" and section on "Pass-Fail Option")
- F — Failure (see section on "Pass-Fail Option")
- S — Superior (see paragraph on "Special Grades")
- I — Incomplete
- K — Course in progress
- W — Approved withdrawal
- O — Audit
- CR — Credit

All medical students are graded on a pass-fail basis for courses taken in the College of Medicine.

INCOMPLETE GRADE — The grade of I may be awarded only at the end of a semester, when all but a minor portion of the course work has been satisfactorily completed. The grade of I is not to be awarded when the student is expected to repeat the course; in such a case, the grade of E must be assigned. Incomplete grades do not enter into the calculation of the grade-point average for one year from the date of award. If the incomplete is not removed by the instructor within one year, the I grade will revert to a failing grade. For undergraduate courses, the one-year limit may be extended for cause approved by the instructor with the concurrence of the dean of the college in which the student is registered. For courses taken for graduate credit, such approval may be granted only by the Graduate Council.
COURSE IN PROGRESS — The grade of K may be awarded by the instructor for 900-level courses when the course continues for longer than one semester. Time limit for completion of such work for full credit for the master's degree is six years; for the doctoral degree, ten years. K grades remain on the student's permanent record until removed with a final grade but do not enter into the calculation of the grade-point average.

The grade of K is awarded by the Office of Student Information, Registration and Records, at the end of the semester, for College of Medicine and College of Nursing courses which require more than one semester for completion. It is also awarded by the Office of Student Information, Registration and Records for all supplementary registrations (930). Following the completion of the final semester or supplementary registration, the grade of CR will be awarded for the terminal semester only.

WITHDRAWAL GRADE — Prior to the end of the fourth week of classes, official withdrawal (drop) of a course cancels the registration for the course; dean's signature not required. Weeks five through ten, the grade of W is awarded to students who are passing at the time of withdrawal; the grade of E is awarded to students not passing at the time of withdrawal. Also during weeks five through ten, a dean's signature is required and the withdrawal grade shows on the student's permanent record. After the tenth week of classes, the grade of W can be awarded only with the approval of the student's academic dean, and only under exceptional circumstances. For other regulations concerning withdrawal, see the section on "Change of Schedule." The W may also be awarded in the case of complete withdrawal from the University. (See the section on "Formal Withdrawal."

SPECIAL GRADES — Grades for university-wide "house-numbered" courses, including individual studies, vary from the regular university grading system. For explanation of these grades, see the Department and Courses of Instruction section elsewhere in this catalog.

Honors courses numbered 299Ha and 299Hb (Readings), and those numbered 399Ha, 399Hb, and 399Hc (Independent Study) may receive only regular letter grades instead of following the special grading policy for individual studies courses.

AUDIT GRADE — The grade of O is awarded for courses taken for audit. This grade is not awarded unless the student is registered for audit.

AVERAGING OF GRADES — For the purpose of computing grade-point averages, grade points are assigned to each grade as follows: A, 4 points for each semester unit; B, 3 points; C, 2 points; D, 1 point; and E, 0 points. To calculate the grade-point average, the unit value for each course in which a student receives one of the above grades is multiplied by the number of grade points for that grade. The sum of these products is then divided by the sum of the units of A, B, C, D, and E. The grade-point average is based only on work attempted in residence at the University and upon the results of Special Examinations for Grade. (See provision for "Graduation Average" in Graduation Requirements section.)

CHANGE OF GRADE — Final grades may be changed by the instructor on a grade-change form only if there has been an error in computation. The grade change must be approved by the head of the instructor's department and the Registrar, or by the Deans' Council if the Registrar deems it necessary. Requests for changes of grade for reasons other than errors in computation must be submitted by the student on a general petition.

APPEAL OF GRADE — A student who feels that a grade has been unfairly awarded may appeal. To initiate the appeal procedure, the student must contact the course instructor no later than the end of the fifth week of classes of the first regular semester after the semester or summer term in which the grade was awarded. The entire procedure to be followed is described in detail in the Student Handbook and in the Faculty Manual.

REPEATING A COURSE — Undergraduate students may repeat courses, with the exception of Engl. 100, in which they have not earned credit as many times as necessary to establish credit. They may repeat only once any courses in which they previously earned grades of C, D, or P, and may not repeat courses in which they have earned grades of A or B, except as specifically provided by departments on a course-by-course basis. All grades for repeated courses will be included in computing the grade average. Credit will be allowed only once, however, for successful completion of a course, unless the course is designated "repeatable for credit" by the department. For the policy regarding Engl. 100, see "University Requirements in Composition" elsewhere in this section.
PASS-FAIL OPTION — For certain courses, a qualified student may elect to register under the pass-fail option. Under such registration, the only final grades available to the student are P (pass) or F (fail).

Undergraduate students may elect to take courses under the pass-fail option only after they have attained sophomore standing and only if they have earned grade-point averages of 2.0000 or better. They must also have the approval of their advisers to register for a course under the pass-fail option.

Students registering for a course under the pass-fail option must meet the prerequisites or otherwise satisfy the instructor of their ability to take the course.

Undergraduate students may register under the pass-fail option for not more than two courses per semester up to a maximum of twelve courses. Further, they must carry a minimum of twelve units of regular grades other than P/F during each semester in which they elect courses under the pass-fail option. Any exceptions to this policy must be approved by the student's academic dean.

Courses taken under the pass-fail option must be electives only, and may not be used to fulfill major, minor, or other specified curriculum requirements.

The pass-fail option is not generally available to graduate students. The only exceptions to this proscription are: (a) admission deficiencies which the student has prior specific, written approval to take on a P/F basis (only the department head or the departmental graduate adviser may give such approval, which must be on file in the Graduate College office before registration); (b) any undergraduate nondeficiency course available for P/F grading; and (c) any course offered by the College of Law.

Each department decides which of its courses will be available under the pass-fail option. Pass-fail courses in the 500, 600, or 700 series may be offered only in law and to candidates for the M.D. degree. Further, the instructor of the course must approve of its being offered pass-fail. The instructor shall be informed by the Registrar which students are enrolled under the pass-fail option.

Students may change from pass-fail enrollment to enrollment for a regular grade, or vice versa, only during the time period prior to the last day of the fourth calendar week during which classes are held, except with special permission of the student's college dean.

If a course is taken under the pass-fail option, the grade of P or F will be permanently recorded. However, neither grade will be included in the average. If the course is passed, the units of credit will be applied toward graduation.

Note: Pass/fail grades are the only grades available for Elem. 493a and S.Ed. 493a. Enrollment in these courses will not reduce the amount of work for which a student can otherwise enroll under the pass-fail option as described above.

All courses in the College of Medicine are graded on a pass-fail system for medical students.

UNIVERSITY REQUIREMENTS IN COMPOSITION

The University of Arizona has long regarded sound training in writing as indispensable to the academic development of an educated person; clear, intelligent writing is a skill required of all University graduates. Freshman Composition, the Upper-Division Writing-Proficiency Examination, and a writing-emphasis course are required of all students.

I. Freshman Composition

All students working toward degrees must meet the freshman composition requirement by completing one of the following sequences: Engl. 100-101-102; Engl. 101-102; Engl. 103-104; Engl. 106-107-108; Engl. 107-108. There is no exemption from the freshman-composition requirement; any substitutes must be approved by the Director of Composition, Department of English. The freshman composition requirement may not be satisfied by correspondence work.

Placement in freshman composition takes into account the student's performance on two examinations: (1) A written placement essay administered at the time a student first
registers for a course in freshman composition; (2) the English section of the American College Test or the Test of Standard Written English score on the Scholastic Aptitude Test. Both of these examinations require fees. Students with superior ratings based on the above examinations enroll initially in Engl. 103; students whose scores indicate inadequate preparation initially enroll in Engl. 100 and pass this course before they enroll in Engl. 101. A student who fails Engl. 100 twice may not take the course again; instead the student must pass the essay placement examination with a score high enough to justify placement in Engl. 101.

II. The Upper-Division Writing-Proficiency Examination

After earning at least 45 credit hours toward a degree and before completion of the semester during which 75 hours of degree credit are earned, each student must take the Upper-Division Writing-Proficiency Examination. This examination is administered by the Department of English. Results of examinations are reported to students and to students' major departments.

Students must have completed the freshman-composition requirement before taking the examination. A fee is required.

III. Writing-Emphasis Classes

Every undergraduate degree program includes at least one required writing-emphasis course. Writing-emphasis courses are regular courses in an academic discipline, but at least half the grade awarded is determined by written work appropriate to the academic discipline. Such courses are identified with the phrase "writing-emphasis course" at the end of the course description listed in the Departments and Courses of Instruction section of this catalog. All undergraduate students must take the Upper-Division Writing-Proficiency Examination prior to enrolling in a writing-emphasis course. Prerequisite to a writing-emphasis course is satisfactory performance on the Upper-Division Writing-Proficiency Examination or, in the case of students who do not satisfactorily complete the examination, permission of the student's major department. Students not completing the examinations satisfactorily should consult their major advisers for information regarding departmental requirements.

EXAMINATIONS

MID-SEMESTER EXAMINATIONS — It is expected that all mid-sememter examinations will occur during a regularly scheduled class period of the course. For those multiple-section courses in which it is impossible to offer mid-semester examinations during the regular class period, the following requirements for offering the examination at an alternate time must be met: (1) the course shall be identified in the schedule of classes as requiring combined hourly examinations at a time different from the regular class period; (2) the times at which combined hourly examinations will be given shall be listed in the schedule of classes; (3) the controlling academic dean shall approve such action in advance; and (4) students whose schedules conflict with the time scheduled for the combined examination shall be provided an alternate time for taking the examination.

EXAMINATIONS REQUIRED — All courses offered for credit shall include a final examination given at the regularly scheduled examination time. Examinations are prohibited on scheduled class days during the week in which regularly scheduled final examinations begin. Specific exceptions for certain courses may be granted by obtaining prior approval from the appropriate department and academic dean. Students shall be informed of any such exceptions prior to the end of the fourth week of classes.
PROFICIENCY AND EXEMPTION EXAMINATIONS, CREDIT BY EXAMINATION

Students may establish credit or proficiency in various disciplines at the University under any of several modes. They are:

I. The Advanced Placement program administered by the College Entrance Examination Board;

II. The College-Level Examination Program (also administered by the College Entrance Examination Board);

III. Departmental exemption or proficiency examinations;

IV. Special Examination for Credit or Grade.

In no case may the sum of credits earned through the above examinations and/or University of Arizona correspondence courses exceed sixty units toward an undergraduate degree. No graduate credit may be established in this manner.

I. Advanced Placement from High School

The Advanced Placement program recognizes that certain students are often able to complete college-level courses while attending high school. The College Entrance Examination Board provides course descriptions and professional consultants to help schools establish college-level courses. The program administers and grades the examinations and sends the results to the students' prospective colleges.

Successful completion of these examinations, which are administered in the student's high school, entitles the student to be considered for advanced placement, or to be granted college credit, or both depending upon the area and the examination scores. Advanced placement without credit never reduces the total units remaining to be earned for the bachelor's degree, but allows the student to commence studies in the particular field at a higher level than otherwise possible. Advanced placement with credit reduces the units remaining to be completed for a degree. Final decision regarding credit or placement is in all cases the prerogative of the department concerned. The three top scores on Advanced Placement examinations are 5, 4, and 3; in many cases, a Placement score of at least 3 will suffice for advanced placement and credit.

The following is a list of the Advanced Placement examinations offered and their course equivalents at the University:

<table>
<thead>
<tr>
<th>Name of Advanced Placement Exam</th>
<th>Univ. of Arizona Course Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>American History</td>
<td>Hist. 130a-130b</td>
</tr>
<tr>
<td>Art</td>
<td>Art 117, 118, 119</td>
</tr>
<tr>
<td>History of Art</td>
<td>To be determined</td>
</tr>
<tr>
<td>Studio art</td>
<td>Intro. biology, 4-8 units of credit</td>
</tr>
<tr>
<td>Biology</td>
<td>Chem. 103a-103b, 104a-104b</td>
</tr>
<tr>
<td>Chemistry</td>
<td>C.Sc. 115</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Engl., three units of lower-division credit</td>
</tr>
<tr>
<td>English</td>
<td>Hist. 101a-101b</td>
</tr>
<tr>
<td>European History</td>
<td>Fren. 201a-201b, 305a-305b</td>
</tr>
<tr>
<td>French Language</td>
<td>Fren. 201a-201b, 250a-250b</td>
</tr>
<tr>
<td>French Literature</td>
<td>Ger. 101a-101b, 201a-201b, 315a-315b</td>
</tr>
<tr>
<td>German</td>
<td>To be determined</td>
</tr>
<tr>
<td>Latin Virgil, Latin Lyric</td>
<td>Math. 123 or 125a</td>
</tr>
<tr>
<td>Math-Calculus AB</td>
<td>Math. 125a-125b</td>
</tr>
<tr>
<td>Math-Calculus BC</td>
<td>Music 107 or 130a-130b</td>
</tr>
<tr>
<td>Music Literature</td>
<td>Music 100, 120a-120b</td>
</tr>
<tr>
<td>Music Theory</td>
<td>Phys. 102a-102b</td>
</tr>
<tr>
<td>Physics B</td>
<td>Phys. 110, 116</td>
</tr>
<tr>
<td>Physics C</td>
<td>Span. 201a-201b, 305</td>
</tr>
<tr>
<td>Spanish Language</td>
<td>Span. 201a, 201b, 306, 399</td>
</tr>
<tr>
<td>Spanish Literature</td>
<td></td>
</tr>
</tbody>
</table>
No grades are recorded for courses credited through the Advanced Placement program. University policy encourages prospective students to avail themselves of any Advanced Placement programs suitable to their college goals, since successful achievement in them will substantially increase students' freedom in designing their university programs of study.

II. College-Level Examination Program (CLEP)

The examinations offered under the CLEP were designed primarily to allow people who may not have been formal students for many years to achieve college-level credit for knowledge acquired through self-education and experience. By successful performance on CLEP examinations, many have been encouraged to pursue further a college or university education.

Additionally, these examinations are seen increasingly as of value to students formally engaged in degree programs, as a means of satisfying certain course or area requirements, or for earning extra course credits, without having to enroll formally in the courses. Students should consult their academic advisers or the offices of their college deans for information as to how their examination credits can be most effectively applied.

All CLEP examinations are available through the Testing Center in Tucson. A limited list of CLEP examinations is available also through the testing centers in Tempe and Flagstaff. Resident students at the University of Arizona should contact the Testing Center at the Student Counseling Service for additional information regarding these examinations.

The University of Arizona accepts for college credit both the General and the Subject examinations of the CLEP, providing satisfactory scores are attained. Scores of 500 or better on the General examinations (610 or better in English Composition) will entitle the student, upon registration at the University, to six units of credit in each of the five General examinations: (1) English Composition; (2) Humanities; (3) Mathematics; (4) Natural Sciences; (5) Social Sciences-History.

Three to sixteen units of credit, depending upon the examination, may be earned by scores of 50 or better on Subject examinations (41 for College French Levels I and II and College Spanish Levels I and II). The number of units of credit earned is listed in parentheses following the corresponding test indicated below.

<table>
<thead>
<tr>
<th>Test Title</th>
<th>Units of Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afro-American History</td>
<td>3</td>
</tr>
<tr>
<td>American Government</td>
<td>3</td>
</tr>
<tr>
<td>American History I (Early Colonization to 1877)</td>
<td>3</td>
</tr>
<tr>
<td>American History II (1865 to Present)</td>
<td>3</td>
</tr>
<tr>
<td>American Literature</td>
<td>6</td>
</tr>
<tr>
<td>Analysis and Interpretation of Literature</td>
<td>6</td>
</tr>
<tr>
<td>General Biology</td>
<td>8</td>
</tr>
<tr>
<td>Calculus w/Elementary Functions</td>
<td>10</td>
</tr>
<tr>
<td>College Algebra</td>
<td>3</td>
</tr>
<tr>
<td>College Algebra —Trigonometry</td>
<td>5</td>
</tr>
<tr>
<td>Computers and Data Processing</td>
<td>3</td>
</tr>
<tr>
<td>Educational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>Elementary Computer Programming — FORTRAN IV</td>
<td>3</td>
</tr>
<tr>
<td>College Composition</td>
<td>3</td>
</tr>
<tr>
<td>English Literature</td>
<td>6</td>
</tr>
<tr>
<td>Foreign Language</td>
<td></td>
</tr>
<tr>
<td>College French I, II</td>
<td>8</td>
</tr>
<tr>
<td>College German I, II or (16)</td>
<td></td>
</tr>
<tr>
<td>College Spanish I, II</td>
<td>8</td>
</tr>
<tr>
<td>Other examinations will be added as they become available.</td>
<td></td>
</tr>
</tbody>
</table>

Note: A maximum of six semester hours of general elective credit will be allowed for completion of one or more of the following: Subject Examination in College Composition, Subject Examination in Freshman English, General Examination in English Composition. Whether this credit will satisfy the University Freshman English requirement is determined by the Director of Composition following interview and written performance.
CLEP credit in English, in Composition or Literature, may not be applied toward either an English major or minor.

For both prospective and currently enrolled students utilizing CLEP examinations, duplicate credit will not be awarded in subjects at the same level. In addition, resident students will not be awarded credit through CLEP for courses equivalent to, or at a lower level than, other courses they have already established in formal course work.

Passing scores for subjects credited through the CLEP are recorded simply as CR (credit), and may not necessarily be stated in terms of a specific course equivalent. No record is made of failing scores.

III. Exemption or Proficiency Examinations

A number of colleges and departments regularly offer exemption or proficiency examinations covering introductory or basic areas of their disciplines. These examinations are designed and graded by the individual departments. No credit is awarded on the basis of successful performance on these, but they allow a student two privileges: (a) the opportunity of enrolling in advanced-level courses in the area of proficiency; or (b) the opportunity of satisfying various college or departmental “area” or proficiency requirements without taking prescribed courses.

Proficiency or exemption examinations for many courses are available to any student currently enrolled in a degree program at the University. Capable students wishing to increase their elective freedom are encouraged by University policy to examine the opportunities provided through the various proficiency examinations.

At the discretion of the department, the proficiency examination may include laboratory projects or other evidence of satisfactory skills in addition to or instead of the written examination. A fee is normally charged for these examinations.

FOREIGN LANGUAGE PROFICIENCY EXAMINATIONS: It is possible for students to meet the language requirements in whole or in part by passing a noncredit proficiency examination at the two- or four-semester level.

Foreign students will be allowed credit by transfer in their native language only for those courses taken during the years equivalent to the United States college years.

The completion of the course levels set in this paragraph satisfies the requirement: Or.S. 404b (Arabic); Or.S. 400b (Modern Chinese); Fren. 201b, 302b; Ger. 201b; Clas. 202b (Greek); Or.S. 403b (Hebrew); Or.S. 408b (Hindi-Urdu); Ital. 201b, 302b; Or.S. 402b (Japanese); Clas. 201b (Latin); Or.S. 405b (Persian); Port. 201b, 202b; Russ. 201a or 201b; Span. 201b, 202b, or 373.

Passing the proficiency examination at the required level in a foreign language fulfills the language requirement in colleges requiring a foreign language. Passing a course for which the required level is prerequisite also establishes proficiency in that language. Credit may not be earned merely by passing the proficiency examination.

PROCEDURES AND GENERAL REGULATIONS FOR EXEMPTION OR PROFICIENCY EXAMINATIONS

1. Proficiency or exemption examinations are available only to students enrolled in degree programs.
2. In no case does passing an exemption or proficiency examination lower the total number of units required for the bachelor's degree.
3. In normal circumstances, a student may not take a proficiency examination for the same course more than twice.
4. Proficiency or exemption examinations are normally given early in the semester or during summer orientation. The student must contact the appropriate department concerned for additional information and instructions.
5. Students wishing to sit for a proficiency or exemption examination in a language not normally taught must contact the Office of the Dean of Arts and Sciences for information.
6. The exemption or proficiency examinations are administered only on the University of Arizona campus.
7. The results of exemption or proficiency examinations, if successful, are reported in writing directly to the Office of Student Information, Registration and Records, with a copy to the student.
8. The remarks portion of the student's academic record will be annotated with a statement indicating the student passed the proficiency examination at the appropriate level.

IV. Special Examination for Credit or Grade

Any student currently enrolled or previously withdrawn in good standing at the University of Arizona may earn credit toward an undergraduate degree through the use of special examinations. The responsibility for preparing for these examinations rests entirely with the student; faculty members are under no obligation to assist with such preparation.

Undergraduate courses currently offered by the University and designated in the catalog "CDT" may be taken for credit by examination. Courses designated "GRD" may be taken for grade by examination or credit by examination. Other courses generally have been excluded from this option; at department discretion, however, any course may be made available for grade by examination or credit by examination.

OPTIONS:
1. Special Examination for Credit: Passing grades, recorded as "CR" (credit), become a permanent part of the student's record but are not used in computing the cumulative grade average. Failing grades are not recorded.
2. Special Examination for Grade: All grades, whether passing or failing, are permanently recorded and used in computing the cumulative grade average.

LIMITATIONS:
1. The credit so earned may not duplicate units already presented for admission to the University, either collegiate or subcollegiate.
2. The credit may not be in a course which is equivalent to, or more elementary than, another course in which the student is enrolled or for which the student has already received credit. The head of the examining department has the responsibility of determining the application of this limitation in each student's case.
3. No credit may be earned by this type of examination for beginning or intermediate language courses in the native language of the applicant.

Special examinations are constructed and administered by the department concerned. They are designed to reflect and explore the scholastic equivalent of the course, and are more comprehensive than the usual "final exam." The examinations may be written or oral, or both, and they may include course projects, laboratory projects, written reports, or other evidence of proficiency.

PROCEDURES:
1. Applications for Special Examination for Credit or Special Examination for Grade may be obtained from the Registrar.
2. The application must be approved by the student's adviser.
3. The examining instructor and the head of the examining department must determine the eligibility of the applicant and sign the application.
4. The application is returned to the Registrar, and the $21-per-unit fee is paid to the University Cashier. No department may schedule a special examination until notified by the Cashier that the fee has been paid.
5. The examination is scheduled by the faculty member responsible, normally during the same semester in which the application is made.
6. The grade (CR or letter grade) is reported to the Registrar. The examination, together with the student's graded examination paper and any appropriate evaluations of oral performance or projects, is then filed with the department for at least one year.
7. The student may change the type of special examination for those courses designated "GRD" in the catalog any time before the scheduled hour of the examination by filing a new application. No additional fee will be charged.
GRADUATE CREDIT FOR SENIORS

A senior within fifteen units of completing requirements for graduation may register for graduate work if recommended by the head of the department and approved by the Dean of the Graduate College. A petition for graduate credit in excess of senior requirements must be filed with the dean at the time of registration or within ten days thereafter. The number of units of graduate credit for which a student may petition is limited to the difference between the sixteen-unit maximum of the Graduate College and the number of units needed to complete bachelor's degree requirements.

The Dean of the Graduate College will not approve a petition unless the senior has a grade average of 3.000 or better on all work already completed in the University, is proceeding toward graduation as directly as possible, and does not propose a semester load to exceed sixteen units.

ABSENCES

Students are expected to be regular and punctual in class attendance. The University believes that students themselves are primarily responsible for attendance. Instructors will provide students with written statements of their policies with respect to absences. Excessive or extended absence from class is sufficient reason for the instructor to recommend to the college dean that the student be administratively dropped from the course. For those courses in which enrollment is limited, missing the first class session may be interpreted as excessive absence. If this action is filed by the end of the fourth week of classes, it will result in cancelation of registration in the course. If the student is administratively dropped after the end of the fourth week of classes, it will result in a failing grade being awarded in that course.

The student is encouraged to notify the Office of the Dean of Students when an absence from class of one week or more is unavoidable. The office will maintain a file of such reports available to instructors upon request.

DISHONEST SCHOLASTIC WORK

The Code of Academic Integrity places full responsibility on the student for the content and integrity of all academic work submitted as homework, examinations, etc. The first step in dealing with an alleged violation of the code is a student-faculty conference with the Dean of Students. More serious cases or student appeals of a student-faculty hearing may be referred to the University Hearing Board, which is composed of faculty and student members representing all colleges of the University. Additional information or a copy of the complete code may be obtained from the Office of the Dean of Students.

LEAVING THE UNIVERSITY

FORMAL WITHDRAWAL — Formal withdrawal from the University is initiated in the Office of the Dean of Students. The effective date of withdrawal is the date withdrawal papers are taken from that office. Seven class days are allowed for completion. No withdrawal may be initiated after the last day of classes of any semester.

DISMISSAL FROM COURSES OR FROM THE UNIVERSITY — Reprehensible conduct or failure to comply with University regulations may result in a student's dismissal from a course or from the University at any time. The Dean of Students Office is responsible for this procedure. Such action is posted on the student's academic record. Students suspended from the University are denied student privileges during the period of suspension, and may not register
for correspondence work except with permission of the dean of the college in which they have
previously registered. They may not enroll in Continuing Education courses, nor establish
credit by examination during the period of suspension.

MEDICAL WITHDRAWAL — Medical withdrawal is initiated from the Student Health Service.
Adequate medical documentation must be supplied by the student. Students who withdraw
from the University for medical reasons and who are medically encumbered must have their
readmittances approved by the Student Health Service.

RETROACTIVE WITHDRAWAL — Under appropriate circumstances a student may petition for
withdrawal after completion of classes for a term. If the student has experienced severe
physical or psychological stress of such nature as to prevent satisfactory completion of course
work in the semester or term in question, the student may petition for relief for that semester
or term. This petition must be accompanied by adequate documentation.

TRANSCRIPTS — Official transcripts are issued to other institutions, offices or agencies
designated by the student. When the student is required by the institution or agency to present
an official transcript personally, it will bear the notation “issued to student.” (See “Transcript
Fee” in Expenses and Fees section.)
Graduation Requirements

THE UNIT SYSTEM — Credit for a degree is based upon a unit system. The unit of credit is the semester hour. The unit system is described under "Scholarship Requirements" in the Academic Guidelines section. Minimum units required for bachelor's degrees are:

<table>
<thead>
<tr>
<th>Degree</th>
<th>Units Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Architecture</td>
<td>167</td>
</tr>
<tr>
<td>Bachelor of Arts</td>
<td>125</td>
</tr>
<tr>
<td>in Art</td>
<td>125</td>
</tr>
<tr>
<td>in Drama</td>
<td>125</td>
</tr>
<tr>
<td>in Education</td>
<td>125</td>
</tr>
<tr>
<td>in Music</td>
<td>125</td>
</tr>
<tr>
<td>in Radio-Television</td>
<td>125</td>
</tr>
<tr>
<td>in Speech Communication</td>
<td>125</td>
</tr>
<tr>
<td>Bachelor of Fine Arts (except major in Art Education, 127 units)</td>
<td>125</td>
</tr>
<tr>
<td>Bachelor of Landscape Architecture</td>
<td>160</td>
</tr>
<tr>
<td>Bachelor of Music:</td>
<td></td>
</tr>
<tr>
<td>Major in Performance (Guitar)</td>
<td>128</td>
</tr>
<tr>
<td>Major in Performance (Keyboard)</td>
<td>126</td>
</tr>
<tr>
<td>Major in Performance (String Instrument)</td>
<td>126</td>
</tr>
<tr>
<td>Major in Performance (Voice)</td>
<td>130</td>
</tr>
<tr>
<td>Major in Performance (Wind Instrument &amp; Percussion)</td>
<td>125</td>
</tr>
<tr>
<td>Major in Jazz Studies</td>
<td>127</td>
</tr>
<tr>
<td>Major in Music Education (Choral)</td>
<td>125</td>
</tr>
<tr>
<td>Major in Music Education (Instrumental)</td>
<td>133</td>
</tr>
<tr>
<td>Major in Theory &amp; Composition</td>
<td>132</td>
</tr>
<tr>
<td>Bachelor of Science</td>
<td>125</td>
</tr>
<tr>
<td>in Aerospace Engineering</td>
<td>130</td>
</tr>
<tr>
<td>in Agricultural Engineering</td>
<td>131</td>
</tr>
<tr>
<td>in Agriculture</td>
<td>130</td>
</tr>
<tr>
<td>in Business Administration</td>
<td>125</td>
</tr>
<tr>
<td>in Chemical Engineering</td>
<td>137</td>
</tr>
<tr>
<td>in Civil Engineering</td>
<td>134</td>
</tr>
<tr>
<td>in Computer Engineering</td>
<td>133</td>
</tr>
<tr>
<td>in Education</td>
<td>125</td>
</tr>
<tr>
<td>in Electrical Engineering</td>
<td>130</td>
</tr>
<tr>
<td>in Energy Engineering</td>
<td>132</td>
</tr>
<tr>
<td>in Engineering Mathematics</td>
<td>132</td>
</tr>
<tr>
<td>in Engineering Physics</td>
<td>128</td>
</tr>
<tr>
<td>in Family and Consumer Resources</td>
<td>130</td>
</tr>
<tr>
<td>in Geological Engineering</td>
<td>138</td>
</tr>
<tr>
<td>in Geosciences</td>
<td>134</td>
</tr>
<tr>
<td>in Health Sciences:</td>
<td></td>
</tr>
<tr>
<td>Major in Health Education</td>
<td>128</td>
</tr>
<tr>
<td>Major in Medical Technology</td>
<td>142</td>
</tr>
<tr>
<td>Major in Occupational Safety and Health</td>
<td>137</td>
</tr>
<tr>
<td>in Hydrology</td>
<td>135</td>
</tr>
<tr>
<td>in Industrial Engineering</td>
<td>129</td>
</tr>
<tr>
<td>in Materials Science and Engineering</td>
<td>133</td>
</tr>
<tr>
<td>in Mechanical Engineering</td>
<td>127</td>
</tr>
<tr>
<td>in Mining Engineering</td>
<td>137</td>
</tr>
<tr>
<td>in Nuclear Engineering</td>
<td>133</td>
</tr>
<tr>
<td>in Nursing</td>
<td>140</td>
</tr>
</tbody>
</table>
CHOICE OF CATALOG UNDER WHICH STUDENTS MAY BE GRADUATED — Candidates for bachelor's degrees may elect to fulfill degree requirements as outlined in any one catalog in effect during their dates of registration for university credit at the University of Arizona, with the following exception: Students who withdraw from the University for more than two consecutive semesters must meet degree requirements as outlined in the catalog in effect at the date of their reenrollment for university credit or any subsequent catalog in effect during their dates of registration for university credit. Students admitted to the University directly from an Arizona community college may, provided not more than two consecutive semesters have elapsed since their attendance at the community college, elect to fulfill degree requirements as outlined in any one catalog in effect during their dates of attendance at the Arizona community college, or any subsequent catalog in effect during their dates of registration for university credit. This provision does not apply to the grade average requirements for graduation, which are governed solely by those in effect during the student's dates of attendance for university credit at the University of Arizona.

Students should decide as early as possible which catalog is to be used in meeting degree requirements, and follow carefully the curriculum outlined therein.

GRADUATION AVERAGE — A graduation average of 2.000 for all university-credit course work undertaken and for any work satisfied by the Special Examination for Grade is required for the bachelor's degree. Note: The graduation grade average is based only on credit earned in residence at the University of Arizona.

MAJOR AVERAGE — The Colleges of Architecture, Arts and Sciences, Business and Public Administration, Education, Engineering, Mines, Nursing, and Pharmacy as well as the School of Health-Related Professions and certain departments require an average of 2.000 or better for all university credit work undertaken in the major field or for any work satisfied by the Special Examination for Grade if in the major.

UNIVERSITY CREDIT REQUIREMENT — A minimum of thirty units of University credit from the University of Arizona is required for the bachelor's degree. It is further required that eighteen of the final thirty units offered toward the degree be University credit. Various departments have specific University-credit requirements for their majors, and students should consult individual departmental information sections for this information. Correspondence credit and/or credit by examination is not University credit.

UPPER-DIVISION UNIT REQUIREMENT — All students graduating in spring 1985 and thereafter are required to have a minimum of 30 upper-division units (300, 400, or 500 level courses) for graduation. It is recommended that these units be included among the final units taken toward the degree (see section on University Credit Requirement.)

CORRESPONDENCE STUDY — A maximum of sixty units toward a bachelor's degree may be earned through correspondence instruction and/or credit by examination.

APPLICATION FOR BACHELOR'S DEGREE CANDIDACY — The University awards degrees three times annually: in May, in August (at the close of the summer session), and in December (at the close of the fall semester). Candidates for bachelor's degrees are required to file at the degree certification section of the Student Information, Registration and Records office for degree candidacy according to the following schedule:
Date of Degree — Application to be filed no later than —
May .......................... May 1 of the year preceding graduation
August .......................... Dec. 1 of the year preceding graduation
December ........................ March 1 of the year of graduation

A fee of $10 (nonrefundable) is required to be paid when the application is filed. A fee of $2 will be charged for late filing. Late applications will not be accepted within the final month prior to the official award date.

Each senior is provided with an official check of remaining degree requirements, following filing of the application for degree candidacy, under the curriculum designated in such application. A fee of $5 will be charged for any additional degree check necessitated by a student's subsequently changing catalog or curriculum.

Changes in Degree-Application Information — Once the application has been filed, applicants are required to notify the degree-certification section promptly of subsequent changes in the following information, as originally submitted: (1) anticipated date of graduation; (2) degree, major, minor, catalog being used; (3) name, local address and telephone number, permanent address. Failure to do so may result in delay in awarding of degree.

Completion of Degree Requirements in Absentia — Degree candidates who find it necessary to leave the University and complete final course requirements through correspondence or transfer work are required to notify the degree-certification section of such plans, preferably before leaving the University. In any case, the degree-certification section must be notified of the intent to complete the degree in absentia no later than one month before the desired degree date.

Continuing Education Students — Before a continuing education student can become a candidate for a degree, he or she must submit to the office of Admissions transcripts from all colleges and universities previously attended and must be regularly admitted to one of the University's colleges.

Second Bachelor's Degree — Candidates for a second bachelor's degree at the University must offer no fewer than thirty units in addition to the units required for the first degree, and must meet all requirements for the second degree. The additional units may be completed concurrently with those applying on the first degree; however, at least 30 units of University credit must be completed for each degree.

Averaging of Grade for Final Nonuniversity Credit Course — Students who lack not more than a one-semester course toward the fulfillment of curriculum and minimum-graduation-average requirements, may apply, as the final course to complete the degree, a single one-semester course either in residence at another accredited institution or in correspondence work through the University of Arizona. Permission must be obtained from the academic dean, prior to enrolling for the course, to apply the grade received in such a course toward the graduation average. This provision may be applied also to the required separate average of 2.0000 in the major field if prior permission is obtained from the major professor and the academic dean.

Clearance of Accounts — Degree candidates are required to clear any indebtedness to the University before completion of degree requirements will be officially certified or the diploma released.
Expenses and Fees

The Board of Regents reserves the right to change all fees and charges without notice if necessary. Fees cited in the catalog are based on information available at the time of publication. Students wishing current information should contact the Office of Admissions.

The University cannot extend credit. Therefore, all students must have sufficient funds upon entering to defray their immediate expenses. An estimate of the amount required for the first month in residence, covering board for one month, room for one semester on the campus, registration, tuition, incidental fees, books, supplies, etc., is $1350.00 for residents of Arizona. For nonresidents, the estimated amount is $2775.00.

EXPENSES AND FEES — PER SEMESTER
1985-1986

Registration fee
Seven or more units ........................................... $495.00
One through six units ........................................... $53.00 per unit

Nonresident tuition*
Twelve or more units ........................................... $1,427.00
Seven units ...................................................... $833.00
Eight units ....................................................... $952.00
Nine units ......................................................... $1,071.00
Ten units .......................................................... $1,190.00
Eleven units ....................................................... $1,309.00
One through six units .......................................... waived

*In addition to the registration fee required of all students.

PAYMENT OF FEES — All fees are payable through preregistration or on registration day as the final step in the registration procedure. The University accepts checks for the amount due at the time of registration — do not send checks in advance — but cannot advance cash on checks. The University cannot accept installment payments, and all fees for the semester must be paid in full at the time of registration. The registration of a student whose check is returned by the bank unpaid is considered incomplete, and a $10.00 late fee will be assessed.

CONCURRENT ENROLLMENT — NONRESIDENT TUITION — It is unlawful for any nonresident student to register concurrently in two or more public institutions of higher education in this state, including any university, college, or community college, for a combined student credit-hour enrollment of seven semester hours or more without payment of nonresident tuition at one of such institutions.

Any nonresident student desiring to enroll concurrently in two or more public institutions of higher education in this state, including any university, college, or community college, for a combined total of more than six semester hours, who is not subject to nonresident tuition at either of such institutions shall pay the nonresident tuition at the institution of his choice in an amount equivalent to nonresident tuition at such institution for the combined total of semester hours for which the nonresident student is concurrently enrolled.

NONCREDIT FEE — Fees for “no-credit” or “audit” units are the same as regular credit units, including the nonresident tuition, if applicable.

LATE REGISTRATION FEE — A student who fails to complete payment of all fees during the two-day registration period will be assessed a late fee of $10.00. The late fee is not refundable.
CLASSIFICATION OF PERSONS FOR TUITION PURPOSES

The Arizona Board of Regents is required by law to establish for the universities under its jurisdiction and control uniform guidelines and criteria for the classification of students for payment of tuition. Attention is invited to relevant provisions of the constitution, statutes, and laws of Arizona, including Sections 3 and 6, Article 7 of the Constitution (which provisions have been held by the Supreme Court of Arizona to govern domicile for all purposes), Sections 15-1625, 15-1626, and 15-1801 through 15-1805 Arizona Revised Statutes, as amended.

A. A person who does not qualify to enroll as an in-state student and who is taking seven or more units must pay a nonresident tuition, in addition to other established fees and charges that are required for all students. An out-of-state student enrolling for twelve or more units on campus must pay an out-of-state tuition fee each semester in addition to a registration fee. Out-of-state tuition is waived for students enrolling for no more than six units.

B. A person may not be classified as an in-state student for purposes of registration and payment of fees and expenses at the University until the student has been domiciled in this state for one year next preceding the last day of registration for credit published by the University, except for students domiciled in this state whose parent's domicile is in this state and who may be claimed by that parent as a dependent for tax purposes.

C. Mere presence of a person in the state of Arizona for one year does not necessarily establish a domicile for classifying that person as an in-state resident. No person shall be deemed to have gained or lost a domicile by reason of his or her presence or absence while a student at any institution of learning.

D. The person must have his or her domicile determined prior to registration and payment of fees. The responsibility of registration under proper status is placed upon the individual. Prompt filing of the required domiciliary information will enable the University to determine classification prior to registration. The Board of Regents has promulgated a publication entitled: Information and Guidelines for Determining Tuition Status, which is incorporated by reference in this catalog, and the attention of all persons concerned with classification for tuition purposes is directed to this publication available in the office of the domicile classification officer in Room 305, Administration Building. (These materials include: (a) definitions related to domicile; (b) guidelines, rules, and regulations applied to determine domicile; and (c) information on procedures for appeal.)

An affidavit must be completed and filed prior to any decision concerning domicile. The affidavit is required upon original registration or upon a desired change in classification or after an absence for a semester or more.

In all cases where the records indicate that the student's domicile is not in Arizona, out-of-state tuition will be assessed. Any student found to have made a false or misleading statement concerning his or her domicile shall be subject to dismissal from the University.

E. Classification officers of the University shall be designated to determine domicile. If there is any question as to domicile, the matter should be brought to the attention of the classification officers and passed upon prior to registration and payment of fees. The same classification officers can, during the registration period published by the University or at other times, pass upon the domicile of a person.

F. The President of the University shall appoint one or more appeals committees to hear the cases of individuals who believe that the decision regarding their domicile is not consistent with the laws of the State of Arizona or the guidelines promulgated by the Arizona Board of Regents. An appeal shall be filed in the office of the domicile classification officer. It shall be written, signed by the student, and accompanied by a sworn written statement of all facts relative to the matter. Notice of appeal shall be filed at any time within 35 days from the last day of registration published by the University. The person appealing shall have the right to appear and testify before the committee and to be represented by an adviser.
SUMMARY OF MINIMUM ANNUAL ESTIMATED EXPENSE FOR FULL-TIME CAMPUS STUDENTS, 1985-86

The Board of Regents reserves the right to change all fees and charges without notice, if necessary.

LEGAL RESIDENTS OF ARIZONA:

Registration fee* .......................................................... $990.00
($495.00 per semester)
Residence halls, minimum rate*** ................................. $614.00
Meals in university cafeteria ........................................ $1600.00
Books and supplies ...................................................... $230.00

Total minimum annual expense ...................................... $3434.00

*The registration fee for seven or more units includes services and facilities of student activities, Student Union, Health Service, Parking, Alumni Association and Artist Series. Students taking fewer than seven units pay $55.00 per unit per semester. The fee includes Health Service and Parking.

**For seven through 11 units of course work, the nonresident tuition per semester is: $833.00 for 7 units; $962.00 for 8 units; $1,071.00 for 9 units; $1,190.00 for 10 units; $1,309.00 for 11 units. The nonresident tuition is waived for students taking fewer than 7 units.

***Residence hall rates range from $614.00 to $1,280.00 per student per year and are subject to increase for the 1985-86 and 1986-87 academic years.

All students should add to this list incidental personal expenses as needed and a room reservation deposit of $50.00. Students taking military science should add a deposit of $25.00.

All fees are payable through preregistration or on registration day as the final step in the registration procedure. Do not send checks in advance. Residence-hall rent should be paid by the semester, at the beginning of the semester.

NONRESIDENTS OF ARIZONA:

Nonresident registration fee* ........................................ $990.00
($495.00 per semester)
Nonresident tuition fee** ............................................. $2854.00
($1427.00 per semester)
Residence halls, minimum rate*** ................................... $614.00
Meals in university cafeteria ......................................... $1600.00
Books and supplies ..................................................... $230.00

Total minimum annual expense ..................................... $6288.00

*The registration fee for seven or more units includes services and facilities of student activities, Student Union, Health Service, Parking, Alumni Association and Artist Series. Students taking fewer than seven units pay $55.00 per unit per semester. The fee includes Health Service and Parking.

**For seven through 11 units of course work, the nonresident tuition per semester is: $833.00 for 7 units; $962.00 for 8 units; $1,071.00 for 9 units; $1,190.00 for 10 units; $1,309.00 for 11 units. The nonresident tuition is waived for students taking fewer than 7 units.

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All fees are payable through preregistration or on registration day as the final step in the registration procedure. Do not send checks in advance. Residence-hall rent should be paid by the semester, at the beginning of the semester.

RESIDENCE HALL RESERVATION — Accompanying the notification of admission is a request for residence hall application and information. This should be filled out immediately and mailed to the Department of Residence Life. The Residence Life office will forward residence hall information and an application/contract. The student should complete the application/contract and return it with the $50.00 deposit to the Department of Residence Life. Do not send cash. The University cannot be responsible for any cash deposits sent through the mail. Make checks payable to the University of Arizona. Room deposits should not be submitted until notice of admission is received from the Admissions Office. The room deposit, in addition to being a guarantee against cancellation of housing application, applies against damage or loss to University property or to other debts to the University. It does not apply on the rent. It is refunded when a student leaves the residence hall, if all charges for loss or damage and debts to the University have been paid.

Notification of residence hall assignments for the fall is mailed to applicants in the early part of June. Demand regularly exceeds available space and therefore early application is encouraged.

Residence in halls is ordinarily restricted to students registered for twelve or more units of regular University work and is not open to noncredit or correspondence students. Exceptions must be approved by the Department of Residence Life.
Deposits on rooms will not be refunded for cancellations after July 1 preceding the fall semester, nor after January 5 for the second semester, except in case the University is unable to provide accommodations.

RESIDENCE HALL FEES — The University prefers that rent be paid by the semester in advance; however, payments as set forth in the terms and conditions of the residence-hall contract are permissible.

RESIDENCE HALL RATES, effective 1984-85
(subject to increase for 1985-86 and 1986-87)

<table>
<thead>
<tr>
<th>RESIDENCE HALLS:*</th>
<th>Entire Academic Year</th>
<th>Fall Semester Payment</th>
<th>Spring Semester Payment</th>
<th>Spring Semester ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconino, Manzanita-Mohave, Maricopa, Apache-Santa Cruz, Graham, Greenlee, Kaibab-Huachuca, Yavapai, Arizona-Sonora</td>
<td>$887.00</td>
<td>$532.00</td>
<td>$335.00</td>
<td>$444.00</td>
</tr>
<tr>
<td>Coronado, International House, Comstock</td>
<td>$938.00</td>
<td>$563.00</td>
<td>$375.00</td>
<td>$469.00</td>
</tr>
<tr>
<td>Gila, Yuma, Hopi, Papago</td>
<td>$614.00</td>
<td>$368.00</td>
<td>$246.00</td>
<td>$307.00</td>
</tr>
<tr>
<td>Pima</td>
<td>$561.00</td>
<td>$337.00</td>
<td>$224.00</td>
<td>$281.00</td>
</tr>
<tr>
<td>Cochise, Sierra</td>
<td>$669.00</td>
<td>$401.00</td>
<td>$268.00</td>
<td>$335.00</td>
</tr>
<tr>
<td>Navajo, Pinal</td>
<td>$737.00</td>
<td>$442.00</td>
<td>$295.00</td>
<td>$369.00</td>
</tr>
<tr>
<td>Babcock (std. single occupancy)</td>
<td>$1143.00</td>
<td>$686.00</td>
<td>$457.00</td>
<td>$572.00</td>
</tr>
<tr>
<td>Babcock (std. double occupancy)</td>
<td>$1080.00</td>
<td>$648.00</td>
<td>$432.00</td>
<td>$540.00</td>
</tr>
</tbody>
</table>

II. SUMMER RATES:
Five-Week Summer Session
Manzanita-Mohave | $137.00 each session
Comstock, International House | $151.00 each session
Babcock (std. double occupancy) | $170.00 (minimum) each session
Conference Groups:
Daily and Weekly (over four weeks) | Rates available on request.

Effective 1984-85;
(Subject to increase for 1985-86 and 1986-87)

III. FAMILY HOUSING RATES:
Family Housing Complex (Per Month) — Includes Utilities:
Efficiency Unfurnished | $179.00
Efficiency Furnished | $208.00
One-Bedroom Unfurnished | $257.00
One-Bedroom Furnished | $282.00
Two-Bedroom Unfurnished | $308.00
Two-Bedroom Furnished | $342.00

*Rates for single rooms when available: 160% per person of the regular rental rate in all halls except Arizona and Sonora.
Guaranteed double rooms, when available, in Arizona and Sonora: 140% per person of the quadruple rate.

BOARD — The University cafeterias, located in the Student Union Memorial Building and the Park Student Center, are operated on a self-sustaining basis for the convenience of students. The cost of food for the average student is approximately $200 a month. Students and members of the University staff may purchase meal tickets, or may pay in cash at the time the meal is served. No credit, however, will be extended. The University charges for board only a sufficient amount to cover its cost and reserves the right to increase the charges to meet any increase in the costs of foodstuffs and service.
The University reserves the right to prescribe rules under which its students shall board at the University cafeteria, with private families, in fraternity houses, or elsewhere, whether these rules are or are not published in its General Catalog.

MILITARY UNIFORMS AND EQUIPMENT — The Departments of Army, Navy and Air Force of the United States government supply uniforms without cost to students taking military training. Each student in military science or aerospace studies must deposit $25 to cover damage to or loss of uniform or equipment. This deposit, less any charge for damage or loss, is refunded at the close of the year or upon withdrawal from the course. To obtain refund, property must be turned in to the Military Property Custodian within seven days after withdrawal from or completion of the military course, and the refund order obtained from the Military Property Custodian must be cashed before the following June 30 or be forfeited. Property must be turned in or its total money value be paid to the University.

BREAKAGE DEPOSIT — A breakage deposit is required of each student registered for laboratory work in certain departments. This deposit, less the value of apparatus broken by the student, is returned upon completion of the course.

LABORATORY PENALTY FEE — Students who, upon the termination of their work in a course, fail to check their desks and clear their accounts with the department concerned will be assessed a penalty of $5.

FIELD-TRIP FEES — Trips to nearby mines, mills, smelters, and power plants are made during the year by students in mining, metallurgy, and geology, and in mechanical, civil, and electrical engineering. Trips to ranches and ranges are made by students in agriculture courses, and to points of historic and prehistoric interest by students in anthropology. Students in economics may make trips to industrial plants and business houses. Students pay their transportation and personal expenses.

Students registered for Chemical Engineering 304 pay a field trip fee of approximately $150 to cover transportation and lodging.

CHANGE OF SCHEDULE — For any change in schedule other than withdrawal with a failing grade of E, a fee of $2 will be charged. This fee is effective immediately upon completion of registration.

CREDIT-BY-EXAMINATION FEE — A fee of $21 per unit is charged for all special examinations for credit.

COLLEGE-LEVEL EXAMINATION FEE — The fees for examinations administered under the College Level Examination Program (CLEP) are $25 each for the Subject examinations and $25 for each General examination; plus a $3 administration fee.

FOREIGN LANGUAGE EXAMINATION FEE — A fee of $10 is charged to take any one foreign language examination. Examinations in French, German, Russian, and Spanish are administered nationally by the Educational Testing Service. The fee is paid to ETS at the time of registration. For other foreign language examinations, the fee is paid to the University Cashier at the time of registration.

MUSIC FEES — A fee of $40 each semester for one half-hour per week or $60 per semester for a one-hour-per-week private lesson in applied fields of piano, organ, voice, band, or orchestral instrument is charged. A music major registering for more than one weekly lesson will pay a maximum fee of $60 each semester.

MUSIC INSTRUMENT RENTAL — Students enrolled for individual instruction may rent instruments, if available, for a rental fee each semester. The complete schedule of rental fees is listed in the Departments and Courses of Instruction section of this catalog under "Music."

STUDENT TEACHING FEE — The student teaching experience is scheduled generally during the fall or spring semester. It will not be available, except in rare instances, during the summer session. For those exceptional circumstances when student teaching is provided during the
summer session, the student will be assessed an additional fee of $200 to cover costs of supervision. In any event, approval for student teaching during the summer session must be obtained early in the fall semester of the previous year.

**LIBRARY IDENTIFICATION CARD REPLACEMENT FEE** — Library borrower identification cards, if lost or stolen, must be reported to the librarian's office. They can be replaced at a fee of $1.

**TRANSCRIPT FEE** — Each student is entitled, upon request, to one transcript without cost. For each additional transcript $1 is charged. The fee for instantaneous service is $3. Transcripts will not be issued for students whose records indicate indebtedness to the University.

**PHOTO I.D. REPLACEMENT FEE** — I.D. photo cards, if lost or stolen, must be reported to the Registrar. They can be replaced at a fee of $10.

**FEE RECEIPT REPLACEMENT FEE** — If student's fee receipt is lost or stolen, a duplicate may be obtained by payment of a $10 fee.

**GRADUATION EXPENSES**

**DEGREE CANDIDACY** — Every candidate for a degree is required to pay a fee of $10 (non-refundable) at the time of filing application for degree candidacy. A fee of $2 will be charged, in addition, for late filing for bachelor's-degree candidacy (see Graduation Requirements section). Each senior is provided with an official check of remaining degree requirements, following filing of the application for degree candidacy, under the curriculum designated in such an application. A fee of $5 will be charged for any additional degree check necessitated by a student's subsequently changing catalog or curriculum. A fee of $1 will be charged for duplicate copies furnished.

**PROCESSING THESIS** — A fee of $10, to cover the cost of binding two copies of the thesis or dissertation for the Library, is required of each graduate student at the time of submitting the thesis or dissertation.

**DISSERTATION MICROFILM FEE** — $25.

**CAP AND GOWN FEE** — Degree candidates participating in the commencement exercises are required to wear the prescribed academic costume, which may be obtained through the University Bookstore at fees varying from $13 to $35.

**REFUNDS OF TUITION AND FEES**

All refunds and deposits that may be due a student will be first applied to encumbrances owed the University. Refunds due will be forfeited unless called for on or before the following June 30.

**TUITION, REGISTRATION, MUSIC AND SPECIAL COLLEGE FEES** — See Schedule below.

<table>
<thead>
<tr>
<th>Days</th>
<th>1-5</th>
<th>6-10</th>
<th>11-15</th>
<th>16-20</th>
<th>21-25</th>
<th>Thereafter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td></td>
<td>days</td>
<td></td>
<td>days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td></td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>.20%</td>
<td>none</td>
</tr>
</tbody>
</table>

"The refund schedule begins with the first day of class and applies to weekdays only (Mon. - Fri.). Sufficient time must be allowed for final clearance of registration fee payment checks before refunds will be made."
CANCELLED REGISTRATION — A student whose registration is cancelled because of scholarship failure the preceding semester will be refunded his or her fees in full. A student on the delinquent scholarship report for the first semester (failing to maintain the grade average required for his or her class and thereby automatically placed on probation) who completes registration for the second semester may, upon filing a withdrawal within two weeks of such registration, be refunded fees in full. This refund must be approved by the Registrar.
Scholarships and Financial Aid

The University of Arizona provides access to a full range of federal, state, and privately donated financial aid funds to its students through the Office of Student Financial Aid (OSFA). Assistance is available to students based on financial need, academic merit, and program of study. The application process for financial aid begins with the completion of an American College Testing (ACT) application for student financial aid, entitled The Family Financial Statement. For students interested in scholarships, a separate supplemental form is required.

Each year the Office of Student Financial Aid offers $30 million in aid to about 13,000 students of the University. Awards are competitive so early application is urged. Students should apply as soon as possible after January 1 of the year in which they will begin their academic career. The ACT application forms are widely available from high school counselors, community colleges, and the OSFA. Students must file a separate application for the Guaranteed Student Loan Program, as described below.

FEDERAL AID PROGRAMS

Federal aid programs comprise over 80 percent of the total aid available through the University of Arizona. For undergraduate students, the base of funding begins with the Pell Grant Program. For graduate students, the Guaranteed Student Loan usually is the first source of funding.

SUPPLEMENTAL EDUCATION OPPORTUNITY GRANTS — The SEOG Program is a direct grant to undergraduate students demonstrating exceptional financial need. Eligibility is determined by the Office of Student Financial Aid.

COLLEGE WORK STUDY — The College Work Study Program allows students to defray part of their cost of education through work experience. Many job placements are career related, offering both valuable experience and income to the student. The recipient may work up to 20 hours per week in an on-campus or off-campus placement.

HEALTH PROFESSIONS STUDENT LOANS — The Health Professions Student Loan Program is intended to assist medical and pharmacy students in meeting their educational expenses. Loans are at nine percent interest with a nine-month grace period after graduation before repayment to the University begins. The amount of the loan award is determined on the basis of the student's calculated need.

NURSING STUDENT LOANS — Loans are available to students enrolled in the College of Nursing at an interest rate of six percent. The amount of the loan is determined on the basis of the student's financial need, and repayment of the loan begins six months after the student leaves school.

PELL GRANTS — The Pell Grant Program is funded by the federal government in order to provide primary access for students for their undergraduate degrees. Eligibility is established by the federal government and students are funded at the level appropriate to their dependency status, living accommodations, and enrollment level.

GUARANTEED STUDENT LOANS — The Guaranteed Student Loan Program is available to both graduates and undergraduates to meet educational expenses. Loans are made by local lending institutions, including banks, credit unions, and other financial institutions. The loans are federally insured for repayment and lenders are paid a subsidy on the interest rate charged at eight percent as long as the student is enrolled in school. Repayment begins six months after the borrower leaves school and continues over a five-to-ten-year repayment period. Applications are available from the Office of Student Financial Aid or from local lenders.
NATIONAL DIRECT STUDENT LOANS — The National Direct Student Loan Program allows students to borrow for undergraduate or graduate education at five percent interest. The amount of the loan is determined on the basis of financial need and repayment begins six months after the borrower is no longer enrolled in school. Various deferment provisions for service, death or disability are available.

INSTITUTIONAL STUDENT AID

Various departments on campus employ students in non-work-study positions to perform a variety of functions. The employing department decides on the selection of the student. Student financial aid recipients must be aware that institutional earnings from all sources are required to be reported to the Office of Student Financial Aid. In limited circumstances, students' financial aid packages may require adjustment in order to coordinate the earnings with other offers of aid.

SCHOLARSHIPS — Academic scholarships are offered on the basis of financial need, grade-point average, leadership qualities, and community service. Funds are provided by private donors to the University of Arizona. Most scholarships are intended for undergraduate students who are residents of the State of Arizona. Scholarship selection is dependent on the student's overall achievement and may be limited to specific fields of study. Through submission of a single application, the student applicant will be considered for all of the scholarships available. Students should also contact their individual departments or colleges regarding funds which may be available through those sources.

TEMPORARY LOANS — The Temporary Loan Program is intended to assist students with short-term funding problems. Generally, loan amounts are limited to $150.00 to assist students in meeting extraordinary costs for a 90-day period of time. Registration loans are also available for students for whom financial aid is pending but not yet paid at the time of registration.

All students are encouraged to apply for financial aid, regardless of their parents' financial status. The broad range of financial aid resources available to the Office of Student Financial Aid provides access on a variety of levels. Students who do not have financial need may still qualify for academic scholarships, temporary loans, or other programs. Therefore, please feel free to contact the Office of Student Financial Aid for further information. In addition, each high school and community college in the State of Arizona has available a copy of the catalog of scholarships at the University of Arizona for students' review.
Provisions for Superior Students

UNIVERSITY-WIDE HONORS PROGRAM

Under the supervision of the University Honors Coordinating Board, the Honors Program has been developed to provide special opportunities and encouragement to superior undergraduate students. Graduating high school seniors who have distinguished themselves in their high school studies are eligible to apply for participation in the program beginning in their freshman year. In addition, other outstanding students may be invited to participate in the program at any point during their undergraduate years. Although academic achievement is an important criterion in the selection of Honors students, it is in no instance the sole factor determining acceptance into the program. Careful consideration is also given to a prospective participant’s leadership ability, emotional maturity, initiative, enthusiasm, open-mindedness, intellectual curiosity, creativity, and potential for self-direction.

Special opportunities for Honors students are formally provided through special classes, independent-study projects, small-group discussions, topic-centered colloquiums, faculty-student dialogues, extended library privileges, and outstanding student and project awards. In addition, Honors students may petition to carry units in excess of the normal maximum load and, with the instructor’s permission, may take courses regularly open to more advanced students. Informal opportunities include "peer-help” activities, tutorial work, and other service-oriented projects.

Responsibility for the University-wide Honors Program is shared between academic departments and the Honors Program. In general, the departments assume responsibility for the majority of Honors experiences available which are primarily academic and specific to the disciplines of the respective departments. The Honors Program seeks to complement those offerings by assuming major responsibility for academic opportunities which are interdisciplinary in focus, and for those noncredit learning opportunities which have a service dimension.

Prior to registering for any course designated as an “H” section, students should check with the University-wide Honors Program to see if admission to the program is a prerequisite for the course. The following courses require such admission before registration in the course: Honors 280H, 295H, 380H; Ed.F.A. 495Ha, 495Hd; Ed.P. 495Hb, etc.; Engl. 495Ha, 495Hb (must be taken twice); as well as the following courses available in most undergraduate departments — 299Ha, 299Hb, 396Ha, 399Ha, 399Hb, 399Hc.

In general, the Honors Program permits qualified students to extend the boundaries of their academic programs beyond the scope of the standard degree requirements. Moreover, it provides for greater opportunity to interact with faculty than is otherwise the case. Fundamental to the program is the commitment that Honors work should enhance the development of the “whole” person — that individual who is sensitive, clear-thinking, humane, knowledgeable, responsible, just, and self-reliant.

Further information regarding Honors Program offerings may be obtained by contacting departmental Honors advisers or the Honors Center staff.

HONORS, AWARDS, AND PRIZES

UNIVERSITY SCHOLARSHIP HONORS are conferred annually to encourage sound scholarship. They are awarded to every undergraduate student attaining the required proficiency during one complete academic year. To be eligible for University scholarship honors, students — other than those in the College of Law — must have completed a minimum of thirty units of work during the two semesters of the regular academic year with a grade average for those two semesters that placed the student in the top 10 percent of the undergraduates enrolled in his or her college. A student in the College of Law must have completed a minimum of 24 units. A
student enrolled in a cooperative education program must have completed a minimum of thirty units of work during the consecutive two semesters of the regular academic years in which he or she was enrolled for full-time study, must have earned a grade average for those two semesters placing the student in the top 10% of the undergraduates enrolled in his or her college, and must have completed the intervening period of industrial cooperative education in a satisfactory manner.

CLASS SCHOLARSHIP AWARDS — The University has established an award for each class to be given to the students who earn the highest grade average for the year. To be eligible, a student must have completed a minimum of thirty graded units of work during the two semesters of the regular academic year. Engraved silver bowls are awarded.

GRADUATION WITH DISTINCTION in three categories is awarded for superior scholarship in work leading to the bachelor's degree and the juris doctor degree. This honor, based upon the graduation grade average, is awarded upon graduation and appears on the diploma of the recipient.

For bachelor's degrees, With Highest Distinction is awarded to candidates whose grade average is 3.9000 or higher; With High Distinction, to candidates whose average is 3.8999 to 3.700; With Distinction, to candidates whose average is 3.6999 to 3.5000. In computing these averages only work in residence is considered. To be eligible for distinction at graduation, bachelor's degree candidates must have completed at least sixty units in undergraduate residence at the University of Arizona, with letter grades that carry a grade-point value in a minimum of forty-five units.

For juris doctor degrees, With Highest Distinction is awarded to candidates whose grade average is 3.5000 or higher; With High Distinction, to candidates whose average is 3.4999 to 3.2500; With Distinction, to candidates average is 3.2499 to 3.0000. In computing these averages only work carrying university credit and applicable to the juris doctor degree is considered. To be eligible for distinction at graduation, juris doctor degree candidates must have completed at least forty units of such work.

AWARDS AND PRIZES are given in recognition of outstanding achievement. In some cases, financial need is also a consideration. All communications with respect to scholarship awards and prizes should be addressed to the Director, Office of Student Financial Aid. For further information please consult the Catalog of Scholarships and Financial Aids.
Student Services

COUNSELING AND ADVISING

The University offers varied guidance services for students. The faculty, the faculty advisers, the heads of departments, and the deans of the colleges keep regular office hours for consultation. The Health Service provides health counsel; the Student Counseling Service provides psychological counsel; the Placement Service office compiles records for possible employment; and the Office of Student Information, Registration and Records directs admissions, keeps cumulative files of student achievements, and issues the schedule of classes which students should read in order that they may plan their courses and obtain necessary information about the University.

DEANS OF THE COLLEGES — Information regarding the selection of a proper academic program, including both required and elective courses, is obtained in the office of the dean of the college in which the student is enrolled.

DEAN OF STUDENTS — The student's life outside the classroom demands attention and concern as part of the learning experience. The office, through its staff and related service areas, provides support and advisement in housing, personal problems, activities, clubs, Greek Life and student conduct. Continual encouragement is given to new programs that meet students' needs. Emphasis is placed on better ways to communicate with students, parents, and the public regarding educational programs currently in progress. The creation of a "helping relationship" is the cornerstone on which service to the total campus community is based, and each member of the staff is dedicated to this concept. The Dean of Students Office is located on the second floor of Old Main.

Many students enrolled at the University of Arizona live off-campus and commute daily to the campus community. Recognizing that these students face issues which are unique and distinct from the campus resident, the UA has established an Off-Campus Student Center which provides information, develops programs, and delivers services to those not residing on campus. The coordinator for the University's Off-Campus Center is located in Old Main.

STUDENT RESOURCE CENTER — The Student Resource Center, located in the Old Main Building, houses six separate programs aimed at strengthening the students' academic efforts. The main goal of these programs is to increase the likelihood that students will do well academically from the moment they are admitted as students. A description of these programs and their location follows:

Counseling — The Student Counseling Service (SCS) is staffed by psychologists who provide services to students seeking help with career, academic, personal or relationship problems. These services include individual vocational assessment and career planning, individual and group counseling, short courses and workshops dealing with skill development, and consultation with students' groups and organizations. SCS staff members also offer consultation to University faculty and staff regarding matters relating to student welfare and well being, in or out of the classroom.

Most of these services are free to registered University students. Exceptions include a fee for testing, for counseling which extends beyond ten sessions, and a fee for enrollment in the seven-week, one-credit career exploration course, Self and the World of Work.

Regular hours of SCS operation are 8:00 – 5:00, Monday through Friday. A counselor from Continuing Education is also available Tuesday and Wednesday evenings from 5:00 – 7:00. Students are asked to drop in at SCS, Second Floor, Central, Old Main, or call for an appointment.
Testing — The Testing Center (TC) provides all out-of-class testing services needed by students. The Center administers two credit-by-exam programs (CLEP and DANTES) where students receive college credit by demonstrating college-level proficiency in various areas of study. Qualifying exams, such as the Law School Admissions Test, Graduate Record Exam, Medical College Admissions Test, etc., as well as preparation courses for such exams, are available through the Center. The American College Test and math placement testing is also provided. Other services available include career planning testing, correspondence and employment application test administration, handicapped test administration and information about dates and locations of off-campus testing of interest to university students.

Study Skills — The Academic Learning Skills Center (ALSC) offers classes in both developmental and remedial reading, and seminars promoting efficient study habits. The classes, of approximately six-week duration, start near the beginning and middle of each semester. Advanced learning skills in math and science are included. Individual study counseling is also available. A special program for students with learning disabilities called SALT (Special Academic Learning Techniques) is managed through the auspices of ALSC. SALT is a support service that provides assistance in academic planning, study skills, research and writing skills, special test administrations, personal and group counseling, career counseling and job search skills. Special admission consideration is given to such students when the university application indicates the diagnosis of a learning disability. Application for the SALT program is made directly to ALSC, Old Main.

Placement — The Career and Placement Service (CPS) provides a centralized university career development and placement center for students and alumni. The office assists individuals with: (1) career exploration and decision making, (2) acquisition of experiences to test their career interests and develop employment skills, (3) development of job seeking skills, and (4) facilitation of contact with prospective employers. Numerous programs are offered to meet these comprehensive career development objectives. The Cooperative Education program, which provides work-study opportunities, is also administered by CPS.

Career exploration may be conducted through the use of various media in the Career Resources Center, including the computerized DISCOVER program, videotapes and printed occupational materials. Individual assistance is available through counseling sessions with staff.

Career interests may be explored and tested further through full- and part-time summer and semester positions. The Summer Technical Employment Program (STEP), the Cooperative Education Program, the Internship Program and the job listings in the Job Center provide several means to obtain career-related experiences.

Over 250 school districts, government agencies and businesses interview candidates for permanent positions as well as part-time, cooperative education and summer employment. In addition, referral of credentials to employers and publicity of vacancy announcements to students, as well as alumni, is offered.

Orientation and Advising — The Orientation, Advising and Retention Office (OAR) administers all campus-wide orientation programs, coordinates all information regarding academic advising, and develops strategies for maintaining student retention. The Orientation staff provide campus tours, meetings with academic advisers, preregistration, placement exams and special interest sessions as part of the summer and fall orientation programs. Students having questions that relate to their entry to the various academic programs on campus can seek initial assistance here. Peer advising, support systems and special programs aimed at encouraging student academic achievement are coordinated through this office.

Evaluations — The Student Research Office provides information to the Student Affairs Division of the University to assist in the evaluation and planning of student services. Research efforts instrumental in maintaining high student retention are the central focus of this office.

THE OFFICE OF MINORITY STUDENT AFFAIRS (OMSA) — The purpose of the Office of Minority Student Affairs is to recruit minority students to the University and to retain those minority students who enroll. Through the OMSA recruitment component, prospective minority students may receive assistance with the completion of admission and financial aid applications and with other procedures leading to enrollment at the University. The OMSA retention component provides matriculated minority students with an orientation to the University through the New Start Summer Program for new freshmen and continues support
through tutoring in math, English and general subject areas, professional and peer counseling, career awareness services, study skills programs and other related services. Additionally, the Office coordinates several developmental programs at the senior and junior high school levels and works with several summer enrichment programs at the University. OMSA is located in Old Main, rooms 101 and 134.

DIRECTOR OF THE INTERNATIONAL STUDENT OFFICE — The Director of the International Student Office is generally responsible for coordinating services to international students and scholars. The Director works closely with students in the areas of adjustment to campus and community life and adjustment in academic procedures and requirements. Individuals are referred, when appropriate, to academic advisers, counseling staff, health staff, and others. The International Student Office is located on the second floor of the Nugent Building.

AMERICAN INDIAN STUDENT ADVISER — This official assists American Indian students in their transition from the home environment into the University community by counseling at both the academic and personal-adjustment level and by soliciting wider campus involvement in the programs and affairs of the American Indian student. This office provides support for successful progress through the University. Located in the Office of the Dean of Students, Old Main.

DISABLED STUDENTS SERVICES PROGRAM — Through its support services, this program seeks to expand opportunities for disabled students to participate fully in the educational process and broader campus life. Individualized services promote independence and responsibility. Also, ongoing programs provide the campus and the community with opportunities for increased understanding of disabling conditions.

SWITCHBOARD — Supported by ASUA, this service is designed to help people help themselves by providing them with resources upon which they can draw. Switchboard is located on the second floor of the Student Union in Room 209A and can be contacted at 621-1000 for crisis help and referral.

CLINICAL SERVICES

SPEECH AND HEARING CLINIC — The Department of Speech and Hearing Sciences maintains a speech and hearing center where University students may receive services. Diagnostic and referral assistance for any Arizona citizen is offered.

The STUDENT HEALTH SERVICE helps students maintain their physical and mental health, and is a campus resource for counseling on health problems. Regularly enrolled students become eligible for care at the beginning of the semester for which registration fees have been paid. Continuing dissertation students, thesis students and special students become eligible upon payment of the Optional Eligibility Fee.

Every entering student is requested to submit a completed Admission Health Report Form and a record of immunizations. It is recommended that all students provide proof of freedom from pulmonary tuberculosis by submitting the results of a tuberculin skin test. The Student Health Service provides the tuberculin skin tests on a voluntary basis to students for a nominal charge. Also, vaccine for measles and rubella is available to students without charge.

Services — In general, the services available at the Student Health Center approximate those of the family physician. The Student Health Service offers an essentially prepaid plan of limited, defined benefits. Nominal charges are made for laboratory tests, X-ray services, and prescriptions filled at the Student Health Service pharmacy. While immediate payment for charges is recommended, delayed payment can be arranged. In addition, Visa and MasterCard are accepted for payment. During regular school sessions, general medical care is provided; however, the Student Health Service is unable to provide all services during academic holidays, vacation periods, summer sessions, and semester breaks.

Special Clinics available at the Student Health Center include orthopedics, gynecology, dermatology, allergy, immunization and minor surgery.
Chronic and pre-existing illnesses, as well as problems requiring complex therapeutic and rehabilitative care, may require outside consultation and referral to the local medical community. In such cases, where services exceed the benefits of the prepaid program, the cost must be assumed by the student. Occasionally, an illness involving hazard to self or others may require temporary withdrawal from the University.

Vehicular accident victims receive first care, and are then referred to outside physicians, or hospitals, for further treatment. Cost of such outside care must be borne by the student. Dental and ophthalmologic services are not available at the Student Health Center. Ambulance service is also not provided.

Mental Health — The Mental Health Section of the Student Health Service is a voluntary, confidential, counseling service open to all students who are eligible for care at the Student Health Service. The Mental Health Section offers short-term individual, couple, and group therapy, as well as workshops in health and mental health-related areas.

Health Education — The Student Health Service places strong emphasis on health education and prevention. Health educators and staff are available for individual counseling and group presentations. Special programs on self-care are offered in the Self-Care Center located adjacent to the reception area in the Student Health Center.

Insurance — The Student Accident and Sickness Insurance Plan, separate from the Student Health Service, is available to all students regularly enrolled at the University. This insurance is not necessary for services at the Student Health Center, but is intended to help offset the direct cost of extended medical care.

Medical Records — The relationship between a Student Health Service physician and a student is a personal one and professional confidence is carefully maintained. Release of information may be obtained only by specific written authorization from the student concerned.

STUDENT UNION POST OFFICE

Only students living in campus halls will be assigned a Student Union Post Office box upon request after being assigned to a dorm. These boxes are free to the students living in halls as a service of the University. Until such time as a post office box has been assigned, students with reservations in one of the campus residence halls may have their mail addressed to General Delivery, Student Union Post Office, Tucson, Arizona 85720. This does not include, however, newspapers, magazines, and circulars. New students should refrain from having these sent until their correct post office box numbers can be placed on them.

Returning residence hall students who had Student Union Post Office boxes in the spring semester will have them automatically reserved for the next year only by paying their residence hall deposit before July 1.

Any student who has not been given residence hall assignment before coming to the University, and whose local address is uncertain, should have his or her mail directed to General Delivery, Main Post Office, Tucson, Arizona 85701, until a definite residence is determined. Immediately after the student has established his definite residence, he should send change-of-address cards to all individuals and organizations from which he may expect to receive mail. These cards are available at the Student Union Post Office. There are a limited number of boxes available to rent to full-time students who live off campus. These must be applied for in person at the Student Union Post Office.

THE UNIVERSITY LIBRARIES

The University Library system contains more than 5,000,000 items, including books, periodicals, microforms, maps, government publications, manuscripts, and non-book media. Basic holdings cover all fields of instruction, and there are especially strong collections in anthropology, geology, Spanish and Latin American language and literature, American agriculture, Southwestern Americana, Arizoniana, 20th century photography, history of science, science fiction, and 18th and 19th century British and American literature. Through the library
the University is a member of the Center for Research Libraries and the Association of Research Libraries. The library is also a member of the AMIGOS Bibliographic Network and through that and other agencies can borrow materials for student and faculty research on interlibrary loan.

The University Library system consists of the Main Library which houses the Central Reference Department, Government Documents, the Media Center, the Map Collection and the Current Periodicals, Newspapers, and Microforms Room; the Science-Engineering Library; and the following Branch Collections: the Oriental Studies Collection, the Music Collection, the Center for Creative Photography, the Southwest Folklore Center, and the Library Science Library. Four large but separate library facilities are the College of Law Library, the Architecture Library, the Arizona Health Sciences Center Library and the Arizona State Museum Library. In addition, several other departmental libraries, such as the Division of Economics and Business Research Library, the Steward Observatory Library, the Herbarium, and the Lunar and Planetary Sciences Library, have been established to serve special research needs.

CENTRAL REFERENCE — Houses the library's main card catalog and reference materials for the social sciences, fine arts and humanities.

GOVERNMENT DOCUMENTS — A regional depository for U.S. government documents; houses almost a million items.

MEDIA CENTER — Houses all the library's non-book materials except microforms and music tapes and records.

MAP COLLECTION — A depository for USGS maps, houses a fully cataloged collection of 130,000 maps on every subject.

CURRENT PERIODICALS, NEWSPAPERS, AND MICROFORMS — Displays current issues of the 5200-plus periodicals received in the Main Library, subscribes to over 150 newspapers and has a collection of microforms which numbers nearly 2 million.

SCIENCE-ENGINEERING LIBRARY — Houses all materials on science and technology; has over 360,000 volumes, over a million microforms, and displays current issues of its 3000-plus periodicals.

MUSIC COLLECTION — Houses the library's collection of 50,000 scores, 26,000 sheet music and 25,000 recordings. Facilities for listening are provided.

CENTER FOR CREATIVE PHOTOGRAPHY — Houses the library's archive of over 100 famous 20th century photographers. The Center's collections are internationally known.

SOUTHWEST FOLKLORE CENTER — Houses musical tapes and manuscript archives of Southwest music and folklore.

LIBRARY SCIENCE LIBRARY — Houses the library's collection of professional library literature in support of the Graduate School of Library Science.

SPECIAL COLLECTIONS — Houses the library's collections of Arizoniana and Southwestern Americana, science fiction, rare books, fine printing, manuscripts and the University of Arizona archives. The Lecomte du Nouy Memorial Room is located here and preserves the manuscripts and first editions of the works of Pierre Lecomte du Nouy and of other important figures in the history of scientific development.

ORIENTAL STUDIES COLLECTION — Houses books, periodicals and newspapers in the Chinese, Japanese, Arabic, Persian, Hindi, Urdu, Turkish and other Oriental languages; has over 182,000 items.
LAW LIBRARY — This library now contains over 110,000 volumes, including the reported cases of all the jurisdictions in the United States and substantially all the English reported cases; American and English statutory law; decisions of federal administrative agencies; complete sets of leading legal periodicals; a carefully selected collection of legal encyclopedias, digests, treatises, and textbooks; and a developing collection of civil law with emphasis on Latin America.

HEALTH SCIENCES CENTER LIBRARY — This specialized library, which serves the University Hospital as well as the Colleges of Medicine, Nursing and Pharmacy, contains over 75,000 cataloged volumes and receives approximately 3,000 serial titles. The collection includes books, journals, and nonprint materials in the health sciences.

ARCHITECTURE LIBRARY — This specialized library houses a collection with emphasis on the topics of design, architectural history and theory, graphic communication, and building technology including over 10,000 cataloged volumes, 120 periodicals and over 24,000 slides for architecture faculty use. This library is open to the University community and general public on a reference basis.
Housing Facilities, Student Conduct and Campus Life

The University recognizes the importance of residence life as a part of the total educational program. Thus, to the extent possible, University housing is made available to students so they may experience the companionship, cultural environment, and social opportunities which enrich university life. The twenty-two residence halls are clustered in four residential communities and offer a variety of living options.

One of the valued aspects of university life is the opportunity to meet students of varied cultures and interests. By the mutual exchange of views, students learn from one another, gain a fresh outlook and new ideas, and enlarge their experience in human relationships. This phase of university life is shared most fully by hall residents. Lifelong friendships are formed among residence companions, and students gain worthwhile experience in community living. Each residence hall elects its own student officers and plans programs of social and recreational activities.

Head Residents and Resident Assistants in each hall are skilled in helping new students adjust to campus life and in providing mature guidance when needed.

MEN'S RESIDENCE HALLS — Located on the south side of the campus, the nine men's residence halls are Cochise, Graham, Hopi Lodge, Kaibab-Huachuca, Navajo, Papago Lodge, Pinal, Sierra, and Yavapai.

WOMEN'S RESIDENCE HALLS — Two of the seven residence halls for women — Greenlee and Coronado — are on the south side of the campus. The women's halls on the north side of the campus, set among olive and palm trees, are Coconino, Gila, Maricopa, and Yuma. Pima is near the Colleges of Medicine, Nursing and Pharmacy.

COEDUCATIONAL HOUSING — Arizona-Sonora and Apache-Santa Cruz house undergraduate students of all classes. Manzanita-Mohave is reserved for sophomore, junior and senior students. Men and women live in separate sides of the building but share common areas. Comstock House is reserved for graduate students and the International House for foreign and American students of all class standings. Men and women in these two halls live on separate floors and share common areas. Babcock Inn is reserved for sophomore, junior, and senior students and special undergraduate groups. Each room in Babcock has an outside entrance.

COOPERATIVE RESIDENCE HALL — Pima Hall is operated by women students and is the only hall in which meals are served. In order to reduce the cost of overhead, students living in this hall do all cleaning and cooking. The working schedule requires of each student nine to twelve hours of service weekly in the hall and is so arranged that it does not conflict with class hours. The hall is supervised by the head resident. The cost of board fluctuates with the price of food and usually approximates $275 per semester. The hall accommodates forty students who have financial need.

DISABLED STUDENT HOUSING — The following halls are accessible for wheelchairs and have other special equipment for disabled students: Coconino, Yuma, Papago, and Yavapai.

SINGLE GRADUATE STUDENTS — Comstock is available for graduate students. This facility is modern and fully air-conditioned. A request for graduate-student housing form is included in the admissions packet.

RESIDENCE HALL FACILITIES — Rooms in residence halls are completely furnished, including pillows. Students are requested not to bring additional furniture with them but do need to provide their own blankets, sheets, pillowcases, and bedspread. Window curtains are
not provided except in Arizona, Sonora, Coronado, Manzanita, Mohave, and Maricopa halls. Students care for their own rooms; custodial service, however, is supplied for other portions of the halls.

**RESIDENCE HALL CONTRACT** — All students assigned to residence halls are required to sign a housing contract pledging to remain in the residence hall for the academic year. Exceptions to occupancy requirements are provided in the terms and conditions of the contract.

**OCCUPANCY OF ROOMS** — Residence hall rent should be paid by the semester in advance. The rental does not cover occupancy in the fall prior to the day preceding Orientation Week or during the Christmas recess. All halls are kept open for students during spring recess. All halls will be closed during the Christmas recess with the exceptions of International House, Babcock Inn and Comstock House. The occupancy of rooms at any time other than while the University is in session shall be only by permission of the Department of Residence Life.

It should be understood that when students give up their rooms during vacation periods for which they are not paying, the University may feel free to use these rooms for the housing of other students or groups.

Students are required to vacate their rooms and check out of the hall within 24 hours after their last final exam, withdrawal, suspension, academic disqualification or disciplinary removal from the hall.

Students who pledge a fraternity or sorority recognized by the University may transfer to its chapter house for residence not later than September 1 of the fall semester or not later than February 1 of the spring semester.

No change of residence hall may be made until approved by the Department of Residence Life.

The University reserves the right to change the residence of any student, or to deny or cancel accommodations in cases where such action is deemed desirable.

The University is not responsible for loss of students' personal property.

**CHANGE OF ADDRESS** — It is the student's responsibility to keep the University informed at all times of his or her current Tucson address. Change-of-address forms are available in the Office of Student Information, Registration and Records.

**TEMPORARY HOUSING** — Temporary housing is available through "Gimme Shelter," ASUA Switchboard, Student Union.

**HOUSING OFF THE CAMPUS** — Listings of off-campus housing are available in the Associated Students office (above the Bookstore) through the ASUA Tenants' Association. Numerous such listings are also given in Tucson's daily newspapers.

**HOUSING FOR MARRIED STUDENTS AND SINGLE-PARENT FAMILIES** — The Family Housing complex of 420 apartments is located in northeast Tucson about 12-15 minutes from the University. Applications may be submitted after a person has been officially admitted to the University. Additional information and application forms may be obtained from The Family Housing Office, 3401 N. Columbus, Tucson, Arizona 85712.

**THE UNIVERSITY CAFETERIA** — The University operates numerous dining facilities in the Student Union Memorial Building, as well as a dining hall located in the Park Student Center on the corner of Fifth Street and Park Avenue.

The University reserves the right to prescribe rules under which its students shall board in the University cafeteria, with private families, in fraternity and sorority houses, or elsewhere, whether these rules are or are not published in this catalog.
STUDENT CONDUCT

GENERAL RESPONSIBILITY — When a student accepts admission to the University of Arizona, the University assumes that the student thereby agrees to conduct himself or herself in accordance with its standards. The University reserves the right, on the recommendation of the Dean of Students and with the approval of the president, to terminate at any time the enrollment of a student who proves to be an undesirable member of the student body. Evidence of unsatisfactory citizenship may be an overt violation of a specific standard, or social behavior that is not acceptable.

For a detailed statement of University regulations refer to the Code of Conduct available in the Office of the Dean of Students.

USE OF NARCOTIC DRUGS — The use by a student, or the sale, possession, or giving as a gift by him or her of narcotic drugs, sedatives, stimulants, psychotherapeutic drugs, psychedelic agents of any variety, prescription drugs other than such as may be prescribed by a physician for the student's individual use, or of any of the foregoing in violation of federal or state law, is incompatible with and inimical to the social, health, and safety standards and educative purposes of the University, and shall be cause for disciplinary measures, including suspension or expulsion, regardless of action or inaction by civil authorities with respect to violations of the law above mentioned.

USE OF AND CONDUCT UPON UNIVERSITY PROPERTY — The grounds and properties of the three universities of the state of Arizona are owned by the state through the Arizona Board of Regents for the use and benefit of the respective institutions. Such properties are devoted to and maintained for the sovereign function of supplying higher education to the people, and are not places of unrestricted public access.

Neither the state nor the Board is obligated to furnish or supply in such grounds and properties a forum or locale for the commission of crime, disorders, violence, injuries to persons or property, or the incitement or encouragement thereof, or any conduct or activity whatsoever which will interfere with or is harmful, disruptive, or inimical to the educational function aforesaid.

Accordingly, in the light of the foregoing and in the exercise of the jurisdiction and control vested in it by law, the Arizona Board of Regents has formally adopted and promulgated the following ordinance and regulation:

No person or persons may enter upon the grounds, buildings, roadways, or properties of the University of Arizona, Arizona State University, or Northern Arizona University, nor may a person or persons there be or remain, for the purpose of or in the actual or threatened commission of, any one or more of the following: a breach of the criminal laws (state or national); violent, obscene, or disorderly conduct; injury to or destruction of property; interference with free access, ingress, or egress; injury to person or persons; seizure or exercise of unpermitted control of properties of the institution; trespass; conduct harmful, obstructive, or disruptive to, or which interferes with, the educational process, institutional functions, contractual arrangements, or the public peace and tranquility; conduct likely to foment uproar or violence; or the incitement, support, encouragement, aid, or abetment of any or all of the foregoing.

Access to, enjoyment of, and presence upon or within the areas aforesaid are conditioned upon compliance with the foregoing ordinance and regulation. Any and all persons not in compliance with the foregoing, or in threatened or actual violation thereof, will be denied entry to or upon such areas, or will be evicted therefrom, as the case may be. More specific details regarding conduct appropriate to a university campus are found in the separately published Code of Conduct.
AUTOMOBILES, MOTORCYCLES, BICYCLES

MOTOR VEHICLE REGISTRATION — Any vehicle operated and parked on University property must display a current temporary or permanent University parking permit, regardless of the vehicle's ownership or the length of time the vehicle will be used on campus (e.g., one (1) day or less). To obtain a permanent parking permit, students must: (1) present a current valid fees receipt; (2) submit a completed application form including positive vehicle identification, e.g., make, model, year, license plate, ownership, if applicable; (3) present a University housing receipt if dormitory parking is desired; (4) clear all outstanding citations by name and/or vehicle; and (5) pay required fee, if applicable. (Most students are not required to pay a fee. See current edition of University Parking and Traffic Regulations.)

Temporary permits may be issued for cases when a permanent permit cannot be issued. Registration is not complete until the permit has been properly affixed to the vehicle.

Registrations are valid for an academic year. Registrations are valid during academic recess periods (e.g., Thanksgiving break, Spring break, final exams), between semesters and summer sessions.

Registration of motor vehicles is limited to two per person (motorcycles and mopeds are exempt from this limitation). The courtesy extended through issuance of a second permit is intended to accommodate only alternate vehicles — that is, that only one vehicle will be on campus at any one time. A nonrefundable fee is charged.

Permits may be obtained at Parking Services, Physical Resources Building, Room 112, Monday through Friday, 7:30 am - 5:00 PM, except University holidays.

BICYCLES — Bicycles shall not be parked in other than approved bicycle parking lots. Bicycles attached to handicapped ramps or blocking pedestrian access are subject to removal. Bicyclists shall not ride upon sidewalks and shall obey all rules of the roadway.

Bicycle registrations are processed at the University Garage, Monday through Friday, 7:00 AM - 11:00 AM, except University holidays.

PENALTIES — Regulations are subject to enforcement at all times including academic recess periods (e.g., Thanksgiving break, Spring break, final exam week), between semesters and summer sessions. On official University holidays permit restrictions will not be enforced but general regulations will be enforced. It is the responsibility of the user to obtain a copy of the regulations and comply with them. Failure to do so may result in issuance of a citation; removal of the vehicle; encumbrance of academic records; oral or written reprimand; withdrawal or suspension of campus vehicle privileges; or regular institutional discipline.

LIMITED PARKING — The University provides limited parking space for faculty, staff and students. All members of the University community are encouraged to consider alternative modes of transportation for reaching the campus.

ELIGIBILITY FOR EXTRACURRICULAR ACTIVITIES

Extracurricular activities relate directly to and encompass membership in University-recognized student organizations and groups, professional honoraries, coordinating councils, service groups and special events and projects. Intercollegiate athletics for men (NCAA and PAC-10) and intercollegiate athletics for women (NCAA and PWC) are governed by their own standards of eligibility for participation.

Any student, undergraduate or graduate, who is currently enrolled in the University may participate in these activities. However, where specified in these activities, a student may be required to meet additional qualifications and criteria for membership or participation. All elected or appointed officers of these activities, to be eligible to hold these leadership positions, must at the time of their election or appointment be in good academic standing and currently
enrolled in the University for a minimum of seven units. When a student continues in office from one semester to the next, the student must have successfully completed a minimum of seven units the previous semester.

Exceptions to these provisions must be approved by a review committee made up of three students appointed by the President of the ASUA and three faculty members appointed by the Vice President for Student Affairs. More specific details regarding eligibility are found in the Code of Conduct, the Student Handbook, and the Rules and Regulations Handbook.

INTERCOLLEGIATE ATHLETIC POLICY — Intercollegiate athletics are sponsored primarily as an aid to the educational purposes of the University. Full control of all phases of this program remains with and is administered by the faculty and staff of the University. Students participating in athletics must have conformed to normal entrance requirements and must maintain acceptable progress toward a college degree.

Requirements for participation in and regulations covering conduct of intercollegiate athletics are administered under standards set by the Arizona Board of Regents, the National Collegiate Athletic Association, and the Pacific-10 Conference (men) and the Pacific West Conference (women).

Scholarships awarded to properly qualified students who participate in athletics are administered solely by a committee of the Office of Student Financial Aid under standards applying to all such awards. All funds for the support of the athletic program, regardless of source, are accounted for by the University Comptroller and are included in the annual audits.

ASSOCIATED STUDENTS

The student body is organized under the title, Associated Students of the University of Arizona. The purpose is to enable students to assume the privileges and responsibilities of self-government, and the direction and management of student activities and enterprises. Governing authority of the Association is vested in the Student Executive Council, the Senate, and the Student Courts.

The functions of the ASUA are classified under publications, activities, committees, special events, and operations.

Official publications of the Associated Students are the Arizona Daily Wildcat (newspaper), the Desert (yearbook), Summer Wildcat (summer newspaper), Student Handbook, Campus Calendar, Student and Faculty-Staff Directory, and the Renters' Handbook.

Just a few activities receiving financial support from the Associated Students through the Student Relations Budget Committee and the ASUA Senate are: the Traditions Committee, the debate team, moot court team, the Army and Air Force ROTC Drill Teams, Camp Wildcat, Switchboard, Liaison for Neighborhood Knowledge, the Black Student Union, Movimiento Estudiantil Chicano de Aztlan, the Amerind Club, and various foreign-student organizations. Examples of sports clubs receiving financial support include rodeo, soccer, rugby, lacrosse, and bowling.

Student government acts as a liaison and communications vehicle with students, faculty, administration, regents, and legislature through the following programs and services: Projects Council, Polls and Surveys, Speakers Board, Special Events, Spring Fling, Concerts, Voter Action, Public Relations, Campus Athletic Board, Escort Service, Discount Card Program, Tutoring Service, Lecture Notes, Legal Aid, Student Health Advisory Committee, Switchboard, Teacher/Course Evaluation, Tenants Association, Whistle-Stop, Women's Center.

The ASUA Executive Council appoints students to several all-University committees such as Campus Community Relations, Cultural Events, Lectures, Parking and Traffic, and Registration Procedures.

The student activities office is responsible for planning and management of several special events and coordination of honoraries on campus: Parents' Day, A-Day, Airport Meet, and the Intercollegiate Rodeo. The Associated Students operate the ASUA Bookstores, located on campus, in Park Center, and in the Arizona Health Sciences Center.
FRATERNITIES AND SORORITIES

Fraternity and sorority membership is an adjunct to a university education. It takes over where the university's role leaves off in the classroom. It is an experience in living together and sharing maintenance, self-government, and personal relations in a community that profits socially and intellectually. In addition, fraternities and sororities offer opportunities for leadership, campus participation, community involvement and involvement as alumni/alumnae. They organize the social lives of their members to promote their educational objectives. Mutual selection based upon congeniality and common purposes forms the basis for these organizations. The University of Arizona recognizes the need for the total growth of the individual during his or her academic experience and, therefore, has made a strong commitment to organized activities such as social fraternities and sororities. These groups are considered University-recognized student organizations and, therefore, are subject to policies set by the University Activities and Eligibility Committee.

FRATERNITIES — Alpha Epsilon Pi, Alpha Gamma Rho, Alpha Kappa Lambda, Alpha Phi Alpha, Alpha Tau Omega, Delta Chi, Delta Tau Delta, Kappa Alpha Order, Kappa Sigma, Lambda Chi Alpha, Omega Psi Phi, Phi Delta Theta, Phi Gamma Delta, Phi Kappa Psi, Phi Sigma Kappa, Pi Kappa Alpha, Sigma Alpha Epsilon, Sigma Chi, Sigma Gamma Chi, Sigma Phi Epsilon, Tau Kappa Epsilon, Zeta Beta Tau.

SORORITIES — Alpha Chi Omega, Alpha Delta Pi, Alpha Epsilon Phi, Alpha Kappa Alpha, Alpha Phi, Chi Omega, Delta Gamma, Gamma Phi Beta, Kappa Alpha Theta, Kappa Kappa Gamma, Phi Beta Phi, Sigma Kappa.

HONOR SOCIETIES, PROFESSIONAL AND OTHER ORGANIZATIONS

SCHOLASTIC HONOR SOCIETIES

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PROFESSIONAL ORGANIZATIONS

<table>
<thead>
<tr>
<th>Organization</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Business Club</td>
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</tr>
<tr>
<td>Alpha Epsilon Delta</td>
<td>Premedical</td>
</tr>
<tr>
<td>Alpha Kappa Psi</td>
<td>BPA</td>
</tr>
<tr>
<td>Alpha Tau Alpha</td>
<td>Agricultural Education</td>
</tr>
<tr>
<td>American Home Economics Association</td>
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<tr>
<td>American Institute of Architects</td>
<td></td>
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<tr>
<td>American Institute of Chemical Engineers</td>
<td></td>
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<tr>
<td>American Institute of Industrial Engineers</td>
<td></td>
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<tr>
<td>American Institute of Mining, Metallurgical and Petroleum Engineers</td>
<td></td>
</tr>
<tr>
<td>American Marketing Association</td>
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<tr>
<td>American Medical Student Association</td>
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<tr>
<td>American Nuclear Society</td>
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<tr>
<td>American Pharmaceutical Association</td>
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<tr>
<td>American Society of Civil Engineers</td>
<td></td>
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<tr>
<td>American Society of Interior Designers</td>
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<tr>
<td>American Society of Landscape Architects</td>
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<td>American Society of Mechanical Engineers</td>
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<tr>
<td>Kappa Psi</td>
<td>Pharmacy</td>
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<td>Lambda Alpha Beta</td>
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<td>Linguistics Circle</td>
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<td>MBA Student Association</td>
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<td>Management Information Systems Association</td>
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<tr>
<td>Minority Pre-Law Association</td>
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<td>Movimiento Estudiantil Chicano de Aztlan (M.E.Ch.A.)</td>
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<td>Muslim Student Association</td>
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<td>Personnel Club</td>
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<td>Phi Beta Lambda</td>
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<td>Phi Chi Theta</td>
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<td>Phi Delta Chi</td>
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<td>Phi Delta Phi</td>
<td>Law, Men</td>
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<td>Pi Alpha Alpha</td>
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American Water Resources Association
Angel Flight
Animal Sciences Graduate Students
Anthropology Club
Arizona Association of Student Nurses
Arnold Air Society
Associated Students of Agricultural Engineering and Agricultural Mechanics
Association of Student Planners — Planning
Audio Engineers Society
BPA Student Council
Black Engineering Science Students Today
Coordinated Council of Nursing Students
Fashions Dimensions Club
Featherless Bipeds (Philosophy)
Food Science Club
Higher Education Students Organization
History Graduate Association
Kappa Beta Pi — Law, Women's Association
Kappa Epsilon — Pharmacy
Pi Lambda Theta — Education
Plant Pathology Club
Public Administration Students Association
Recreation Club
Sigma Alpha Iota — Music, Women
Sigma Delta Chi — Journalism
Society for Range Management
Society of Automotive Engineers
Society of Criminal Justice
Society of Physics Students
Society of Professional Journalists
Society of Reliability Engineers
Society of Women Engineers
Soils Club
Student Chapter of the Wildlife Society
Undergraduate Geology Club
University of Arizona Dietetics Club
University of Arizona Student Nurse’s Association

DEPARTMENTAL ORGANIZATIONS — A number of University departments have organizations, some open to all students taking courses in the department, some limited to majors in the department, and some with only elected membership.

STUDENT LEADERSHIP AND SERVICE SOCIETIES

Blue Key — Senior Men
Bobcats — Senior Men
Chain Gang — Junior Men
Chimes — Junior Women
Mortar Board — Senior Women and Men
Order of Omega — Greek Men and Women
Preludes — Freshman Women
Primus — Freshman Men
Sophos — Sophomore Men
Spires — Sophomore Women
Wranglers — Undergraduate Women

RELIGIOUS ACTIVITIES

Organizations on the campus which are designed to foster the spiritual, intellectual, and social interest of various religious faiths or denominations are: American Baptist Student Movement, Advance for Christ, Baha’i Youth Organization, Baptist Student Union, B’nai B’rith Hillel Foundation, R. S. Beal Memorial Student Center (Sound Foundation), Campus Crusade for Christ, Christian Science Organization, Episcopal Campus Fellowship, Humanist Association, InterVarsity, L. D. S. Student Association, Little Chapel of All Nations, Lutheran Campus Parish (ALC-LCA-Missouri), Muslim Student Association, The Navigators, Newman Catholic Student Association, Quaker University Organization, United Campus Christian Fellowship, United Liberal Religious Youth (Unitarian), University Nazarene Fellowship, Wesley Foundation (Methodist).

The University Religious Council, representative of the various organizations, coordinates campus religious activities, works toward understanding and tolerance among religious groups, and fosters interest in religion among students.

The interdenominational Little Chapel of All Nations is located near the campus, and students are welcome at all the churches of the city. Upon entering the university, students are urged to contact their own denominational groups on the campus. For additional information regarding various religious organizations active on campus, contact the Coordinator of University Religious Affairs, located in the Office of the Dean of Students.
SPECIAL CULTURAL OPPORTUNITIES

UNIVERSITY ARTIST SERIES — The University of Arizona Artist Series has become the pace-setter for diversified programs in music, dance and theatre with outstanding national and international artists and companies. The programs provide a unique opportunity for the entire student body to experience more deeply the fine arts, and supplement regular instruction for students working more directly with music, dance, and drama.

The programs are consistent with the University's overall goals of higher education and remain within the University's financial resources. Special ticket arrangements are available for the regular student body (all students registered for at least seven units). Dates are carefully coordinated with other activities on campus and allow for selective special events throughout the season.

UNIVERSITY OF ARIZONA MUSEUM OF ART — The Museum presents a continuous series of temporary exhibitions that complement the Museum's excellent permanent collection which spans the Middle Ages through the 20th century. (For further information, see the Divisions of Research and Special Public Service section.)

ARIZONA STATE MUSEUM — Open to students and the public. Prehistoric and recent Indian cultures of Arizona and the Southwest are interpreted through permanent exhibitions. Special temporary exhibits are presented throughout the year.

THE UNIVERSITY OF ARIZONA POETRY CENTER — A gift of Ruth Stephan, the Center contains a continually growing collection of poetry in a house near the campus where students and faculty may read and where groups may gather informally for poetry readings and discussion. The collection includes poetry of all ages and various nations, with emphasis on American and British poets. It also includes books about poetry and poets. The Center regularly sponsors readings by nationally known poets throughout the year.

THE LECOMTE DU NOUY MEMORIAL ROOM — This room is the gift of Madame du Nouy, preserving the manuscripts and first editions of the works of Pierre Lecomte du Nouy and of other important figures in the history of scientific development. Located in the Special Collections Department of the University Library, the collections are available for the use of graduate students and faculty members.

THE ANNIE W. RIECKER LECTURESHIP FOUNDATION — Established in 1953 by Mrs. Eleanor Riecker Ritchie as a memorial to her mother, the original endowment of $10,000 has been increased by the contribution of a friend of the University to a total of $15,000. The income provides for one lecture during each academic year, delivered by a visiting speaker approved by the Board of Regents. The subject of the lecture is one of interest to the faculty and student body but not a part of any formal University course. The first Riecker Memorial Lecture was delivered during the academic year 1954-55.

DRAMA SERIES — The Department of Drama offers a University Theatre Season each year. The Mainstage Series presents classical, contemporary and musical theatre productions showcasing versatile theatre artists which are an integral extension of the educational process. The Studio Series is primarily an outlet for student talent with an eclectic repertoire designed to promote the professional growth of the students.

MUSIC SERIES — The School of Music offers a wide range of special programs throughout the year, many of them free to the public. Sunday afternoon concerts by University orchestras, bands, and choirs are held in the University Auditorium, while faculty and student solo and chamber recitals as well as smaller ensemble concerts are held in Crowder Hall. Selected concerts by guest artists and opera productions by the School of Music's Opera Theatre are offered at a nominal cost to all students and faculty.
Through special arrangements with the University, the following organizations offer programs of interest to faculty and students periodically throughout the year.

INTERNATIONAL ARTS SOCIETY — A cinema club, Society membership is open to the faculty, staff, and student body of the University. A program of outstanding American and foreign films is presented throughout the academic year.

ARIZONA EARLY MUSIC SOCIETY — Sponsors concerts by ensembles and soloists performing medieval, Renaissance, and Baroque music.

ARIZONA FRIENDS OF MUSIC — These concerts present distinguished chamber music ensembles.

PIANISTS' FOUNDATION OF AMERICA SERIES — Concerts by artist-pianists presented in Crowder Hall of the School of Music.
The University of Arizona Alumni Association

The University of Arizona Alumni Association was organized June 2, 1897. It is incorporated under Arizona state law and operates in accordance with the Articles of Incorporation and By-Laws adopted by the membership in open meeting at Homecoming October 27, 1956, and amended October 20, 1981.

MEMBERSHIP — All persons who have received a degree from the University of Arizona or former students who have completed at least 30 units are members of the Alumni Association and receive all of the publications and services afforded by the association.

In 1982 the Alumni Association initiated the Endowed Membership Program. An endowed membership costs $1,000 for an individual or $1,500 per couple. The principal of the endowment will remain intact and only the interest will be used toward essential Alumni Association programs. Purchase of an endowed membership is not required for the former student to receive the services afforded by the Alumni Association.

OBJECTIVES — The objectives of the Alumni Association generally are to promote the interest and welfare of the State of Arizona and the cause of education. More specifically they are “to promote the objectives of the University of Arizona, Tucson, Arizona, through the establishment and maintenance of contact between the University, its graduates and its students — present, former, prospective, and otherwise.” The Association operates as a liaison between the University and former students. It is the former student's immediate and direct contact with his or her alma mater. Its basic motivating principle is service, both to the former student and the University. Because of the large number of alumni in Phoenix and southern California, an office is maintained in Phoenix and another is to be opened in the Los Angeles area in 1985.

STRUCTURE — The Alumni Association is guided by a board of directors. Vacancies on the board are filled through a general election held each summer and by appointment by the president. The activities of the association are managed by a full-time Director of Alumni responsible to the board of directors and a staff of 18. The director maintains (manages) the central alumni office on campus, the Phoenix office, and an office to be opened in Southern California in 1985. The campus office, headquarters for all alumni activities, houses computerized record files of more than 280,000 graduates and former students.

ACTIVITIES — The Alumni Association fosters the involvement of alumni with their alma mater in several ways:

   Clubs — There are active University of Arizona alumni clubs in twenty-six cities throughout the United States, with immediate plans to organize in an additional sixteen cities. The clubs assist the University in its student recruitment efforts, raise funds for and award scholarships, and support University events in their cities. The Alumni Office provides speakers from campus, video tapes, and films for club meetings, as well as mailing event notices. Students and former students may obtain information about the club in their home area from the Alumni Office.

   Councils — Eight of the twelve colleges within the University of Arizona have organized alumni councils, which serve to strengthen the ties between the college's students, its faculty, and its alumni. The Councils provide service both to the community and to the college.

   Homecoming and Reunions — Alumni are encouraged to return to the University to interact with other alumni and students and to view the progress of their alma mater.

   Travel — The Association sponsors an international travel program designed to meet educational objectives of alumni, while generating revenue for the Alumni Office.

   Awards and Recognition — Each year alumni are honored for outstanding service to the University and/or for outstanding personal achievement.
Publications — The Alumni Office publishes the Arizona Alumnus, the official publication of the Alumni Association. Published four times a year, it is sent to all members. This publication represents the most immediate contact for alumni with University programs and progress, with news of former classmates, all alumni activities, and news about the University and its faculty and staff. An alumni club newsletter will be published beginning in 1985.

The Alumni Association, recognizing the need to inform current students about the mission of the Association, sponsors a student alumni organization, Alum 21. The objective of the organization is to involve current students in alumni activities, thereby promoting the concept of a lifelong commitment to the University through Alumni Association programs.

All students and alumni are invited to visit the alumni office in the Slonaker Alumni building. Their opinions, suggestions and needs will receive full attention.
The University of Arizona Foundation

Every institution of higher learning, whether supported by public or by private funds, needs a group of friends who have a special interest in its welfare. The need is great and the opportunities are many for contributions of private funds to improve and develop educational and research programs outside the limited scope of state funds and tuition income.

In Arizona and elsewhere many people, aware of these needs, are assisting the University of Arizona. In order to unite these efforts, the University of Arizona Foundation was established in 1958 as a private, nonprofit corporation intimately associated with the University. The Foundation is governed by a board of directors. Membership in the Foundation is dependent upon becoming a member of The Presidents Club.

The Presidents Club came into being in 1967 to recognize the generosity of especially dedicated donors and to provide the framework for substantial and continuing support. Membership in the Presidents Club is by invitation only, and nominees may become eligible with a gift of $10,000 or more in a variety of other ways involving deferred gifts, including bequests.

The principal objectives of the Foundation and the Presidents Club are:
1. To acquaint its members and the public with programs, plans, and needs of the University, and
2. To attract gifts and bequests to the Foundation which may be directed into the University's activities as advantageously as possible.

Monthly luncheons are held where members of the University faculty and administration discuss topics of concern and interest to the University and to Foundation members. Awards and grants to support University research and educational programs are also announced each month.

The Foundation assists prospective donors and testators in planning trust and will arrangements for the Foundation. The Foundation invests, manages and controls the gifts in accordance with the terms of the trust instruments and deeds of gift. This united effort of friends of the University is helping to meet the changing requirements of education and to enrich higher education for the ultimate benefit of the people of Arizona.

THE UNIVERSITY OF ARIZONA FOUNDATION
Board of Directors

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Warren Rustand .................................................. President
D. M. Lovitt ...................................................... Vice President
John L. Mascarella .............................................. Treasurer
Marcia Grand ................................................... Secretary
Richard F. Imwalle .............................................. Executive Vice President

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Sidney S. Woods

EX OFFICIO MEMBERS
Allan Beigel, M.D.
Cedric W. Dempsey
Kent Rollins
Colleges
MAJOR FIELDS FOR BACHELOR'S DEGREES

Major work leading to a bachelor's degree is offered in each of the following fields:

accounting  
aerospace engineering  
anthropology  
architecture  
art education  
art history  
astrophysics  
biochemistry  
business economics  
business education  
chemical engineering  
chemistry  
child development and family relations  
civil engineering  
classics  
clothing and textiles  
computer engineering  
consumer studies and home management  
creative writing  
criminal justice administration  
dance  
drama education  
drama production  
dramatic theory  
early childhood education  
earth science*  
economics  
ecology and evolutionary biology  
electrical engineering  
engineering mathematics  
engineering physics  
English  
entomology  
extended English*  
finance  
food science  
food service management  
French  
general agriculture  
general biology  
general business administration  
general fine arts studies  
general home economics  
general studies  
geography  
geological engineering  
geosciences  
German  
Greek  
health education  
health services administration  
history  
home economics and journalism  
home economics education  
home economics extension education  
horticulture  
human services administration  
hydrology  
industrial engineering  
interior design  
irrigation  
Italian  
jazz studies  
journalism  
landscape architecture  
language arts—social studies*  
Latin  
Latin American studies  
linguistics  
management information systems  
marketing  
materials science and engineering  
mathematics  
mechanical engineering  
medical technology  
merchandising and fashion promotion  
Mexican American studies  
microbiology  
mining engineering  
music  
music education  
natural resource recreation  
nuclear engineering  
nursing  
nutritional sciences  
occupational safety and health  
operations management  
Oriental studies  
performance  
personnel management  
pharmacy  
philosophy  
physical education*  
physics  
plant pathology  
plant sciences  
political science  
Portuguese  
psychology  
public management  
public recreation  
admission  
radio-television  
range management  
real estate  
regional development  
rehabilitation  
religious studies  
Russian  
secondary education  
social studies*  
sociology  
sound and water science  
Spanish  
speech and hearing sciences  
speech communication  
studio art  
systems engineering  
teaching and composition  
teaching and promotion  
watershed management  
wildlife and fisheries science  
women's studies

*Teaching majors only.
College of Agriculture

The College of Agriculture provides professional education for a wide range of career opportunities in agriculture, natural resources, and in family and consumer resources. The various curricula offer professional preparation for careers in agri-business, private industry, public agency management, conservation and environmental organizations, farming and ranching, research, extension, communications or educational programs. A broad knowledge base in professional aspects is combined with foundation courses in the natural and social sciences, the humanities and communication skills to develop a well-rounded educational experience.

College responsibilities include instruction, research and extension. The academic units of the college include nine departments and two schools. The departments are: Agricultural Economics; Agricultural Education; Animal Sciences; Entomology; Nutrition and Food Science; Plant Pathology; Plant Sciences; Soils, Water, and Engineering; and Veterinary Science. The School of Renewable Natural Resources is organized into four divisions — Forest-Watershed Resources; Landscape Resources; Range Resources; and Wildlife, Fisheries and Recreation Resources. The School of Family and Consumer Resources is organized into three divisions — Child Development and Family Relations; Clothing, Textiles and Interior Design; and Home Economics Education/Consumer Studies. The college also participates in the management of the University Departments of Biochemistry, Microbiology and Immunology, and Molecular and Cellular Biology where several college faculty hold joint appointments.

DEGREES

The college offers the Bachelor of Science in Agriculture, the Bachelor of Landscape Architecture (B.L.A.), the Bachelor of Science in Family and Consumer Resources, and the Bachelor of Science in Renewable Natural Resources. Each student is assigned a faculty adviser who provides undergraduate guidance and counseling.

The College of Agriculture offers graduate studies leading to both the Master of Science and the Doctor of Philosophy degrees with majors in a large number of disciplines. In addition, a Master of Agricultural Education, a Master of Home Economics Education, and a Master of Landscape Architecture are available.

University credit may be earned in certain graduate courses at the University of Arizona facilities away from Tucson.

UNDERGRADUATE MAJORS

Agricultural Communications  Home Economics Education
Agricultural Economics  Home Economics Extension Education
Agricultural Education  Horticulture
Agronomy  Interior Design
Animal Health Science  Irrigation
Animal Sciences  Landscape Architecture
Child Development & Family Relations  Merchandising & Fashion Promotion
Clothing and Textiles  Natural Resource Recreation
Consumer Studies & Home Management  Nutritional Sciences
Early Childhood Education  Plant Pathology
Entomology  Plant Sciences
Food Science  Range Management
Food Service Management  Soils and Water Science
General Agriculture  Watershed Management
General Home Economics  Wildlife and Fisheries Science
Home Economics and Journalism
For a major in general agriculture, contact the Associate Dean and Director of Instruction.

If interested in the preveterinary program, contact the Department of Veterinary Science.

The following options are designed to qualify students in specialized professional areas within a major. For turfgrass management, see listings under Plant Sciences; Entomology; Plant Pathology; and Soils, Water and Engineering. For international agriculture, contact the Associate Dean and Director of Instruction.

GENERAL CURRICULA

All undergraduate students in the College of Agriculture will select one of the following six curricula depending on their career objectives. All undergraduate students in the School of Renewable Natural Resources will follow the natural resources curriculum with the exception of landscape architecture students, who will follow the requirements for the Bachelor of Landscape Architecture degree. Undergraduate students in the School of Family and Consumer Resources will follow the family and consumer resources curriculum.

I. AGRICULTURE — This curriculum offers broad preparation in the field of agriculture with the major emphasis on technical aspects of agriculture.

II. AGRICULTURAL SCIENCE — This curriculum is for students who desire more intensive education in the basic and agricultural sciences as well as those who wish to prepare for professional schools and graduate study.

III. AGRICULTURAL BUSINESS — This curriculum is for students who require a substantial knowledge of some phase of technical agriculture but wish to prepare themselves for ultimate careers in middle- or upper-level management of agricultural enterprises and related industries.

IV. FAMILY AND CONSUMER RESOURCES — This curriculum is for students interested in preparation for professional positions in one of the many and varied areas in family and consumer resources. It also provides an excellent general education for personal and family living and prepares students to be informed, effective and competent citizens. Students should consult the listing for the School of Family and Consumer Resources.

V. LANDSCAPE ARCHITECTURE — This curriculum provides students with a professional program of study in the planning, design and management of landscape resources.

VI. NATURAL RESOURCES — This curriculum is for students interested in the management and aesthetics of water, wood, range, recreation, wildlife, and fisheries. Students should consult the listing for the School of Renewable Natural Resources.

MINIMUM REQUIREMENTS FOR UNDERGRADUATE DEGREES IN AGRICULTURE

B.S. in Agriculture — Curriculum in:

<table>
<thead>
<tr>
<th>Group</th>
<th>Ag.</th>
<th>Ag.Sci.</th>
<th>Ag.Bus.*</th>
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<tr>
<td>I. GENERAL COURSES</td>
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<tr>
<td>Fr. Comp.</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Communications</td>
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<tr>
<td>a. Sp.C. 102</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>b. Elec. (oral or written Engl.)**</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Upper-division writing-proficiency examination*** (Group Total)</td>
<td>(12)</td>
<td>(12)</td>
<td>(12)</td>
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<td>II. AGRICULTURE****</td>
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<tr>
<td>A.Ec.†</td>
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### III. BIOLOGICAL & PHYSICAL SCI

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<tr>
<td>Bio.</td>
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<tr>
<td>Chem.</td>
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</tr>
<tr>
<td>Phys., Atmo., Geos.</td>
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<tr>
<td>Math. or Stat.†</td>
<td>3</td>
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<tr>
<td>Electives*†</td>
<td>10</td>
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<tr>
<td>(Group Total)</td>
<td>(28)</td>
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</tbody>
</table>

*In the business curriculum, the student must complete M.A.P. 275 and one of the following: M.A.P. 373 or 375 or A.Ec. 439; and Math. 119 and 123 (Acct. 300a or 310 may be substituted for Math. 123). The business core includes Acct. 200, 210; Econ. 201b, 300, 330; Fin. 311 or A.Ec. 450, M.A.P. 305 or A.Ec. 215; M.A.P. 320; M.I.S. 111; Mktg. 361 or A.Ec. 213; an additional course in one of the departments listed in the business core. Students in the business curriculum have an adviser in their chosen majors as well as an adviser in the Department of Agricultural Economics. A.Ec. majors must follow the same requirements as the agribusiness curriculum with the exceptions described under the department.

**Elective units are to be selected from a college-approved list.

---

### IV. SOCIAL SCI. & HUM.#

<table>
<thead>
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<th>Units</th>
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<tr>
<td>Econ. 201a</td>
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<tr>
<td>Electives</td>
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</tr>
<tr>
<td>(Group Total)</td>
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</table>

**The required social science/humanities units are to be selected from at least two of the following: anth., art., child development and family relations, clas., dram., econ., ed., EngL, ethnic studies, foreign lang., geography, hist., Hum. 250a-250b-250c, jour., mus., Or.s., phil., pol., psyc., reli., soc., sp.c., and w.s.

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### V. ELECTIVES — Electives vary. At least nine units must be taken outside the College of Agriculture.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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<tr>
<td>BUSINESS CORE</td>
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<td>TOTAL REQUIRED FOR GRADUATION</td>
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**In the business curriculum, the student must complete M.A.P. 275 and one of the following: M.A.P. 373 or 375 or A.Ec. 439; and Math. 119 and 123 (Acct. 300a or 310 may be substituted for Math. 123). The business core includes Acct. 200, 210; Econ. 201b, 300, 330; Fin. 311 or A.Ec. 450, M.A.P. 305 or A.Ec. 215; M.A.P. 320; M.I.S. 111; Mktg. 361 or A.Ec. 213; an additional course in one of the departments listed in the business core. Students in the business curriculum have an adviser in their chosen majors as well as an adviser in the Department of Agricultural Economics. A.Ec. majors must follow the same requirements as the agribusiness curriculum with the exceptions described under the department.

**Elective units are to be selected from a college-approved list.

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### GENERAL INFORMATION

The College of Agriculture participates in several international programs. Current activities include projects in Portugal, Cape Verde, Brazil, The Gambia, Yemen, Mexico, Peru, and Egypt. Interaction with Peace Corps, the Agency for International Development, and the U.S. State Department through the Office of International Programs provides unique opportunities for student and faculty evaluation of world resource problems.

The College includes the following resource facilities: Agricultural Communications, Agricultural Statistics, Remote Sensing, Council for Environmental Studies, and the Office of Arid Lands Studies.

**Fellowships, Scholarships, and Awards** — The College awards numerous scholarships and fellowships to undergraduate and graduate students enrolled in programs of study in agriculture, natural resources, and family and consumer resources.

**Outstanding Senior Awards** — Each year the faculty selects an outstanding senior in each department and school.

**Dean's Honor List** — This honor is reserved for students who carry no fewer than twelve units of work in a semester and attain a grade-point average of 3.5000 or better.

**Scholastic Societies** — The College recognizes the scholarship societies of Alpha Tau Alpha, Alpha Zeta, Gamma Sigma Delta, and Omicron Nu.
Honors Program — The College participates in the University-wide Honors Program.

Internship — The College of Agriculture provides internship opportunities to qualified students who wish to receive training and practice in actual service with technical, business, or government establishments.

Peace Corps — The Peace Corps office at the University of Arizona is a function of the Office of International Agriculture Programs in the College of Agriculture. The Peace Corps Office provides international volunteer placement counseling and processes Peace Corps and United Nations Volunteer Program applications from University students and staff.

Cooperative Education — The College participates in the University Cooperative Education Program.

SCHOOL OF FAMILY AND CONSUMER RESOURCES

The School of Family and Consumer Resources is concerned with personal and group values that are desirable outcomes of successful family life through the use of personal, family and social resources for the attainment of these values. It deals with social, economic, aesthetic, managerial, health, and ethical aspects of family relations, child development, clothing, and housing.

The undergraduate program has as its major objectives: (1) general education for personal and family living, (2) specialization in various aspects of family and consumer resources in preparation for professional positions, and (3) courses to enrich the professional preparation of students in other colleges.

The School is organized into three divisions — Child Development and Family Relations; Clothing, Textiles, and Interior Design; and Home Economics Education/Consumer Studies.

The School offers the degree of Bachelor of Science in Family and Consumer Resources with majors in child development and family relations (emphasizing child studies, family studies, or a combination of the two); early childhood education; clothing and textiles; interior design (design track or merchandising track); merchandising and fashion promotion; home economics education; home economics extension education; consumer studies and home management; general home economics; and home economics and journalism.

Requirements for the various curricula appear within the division offering the major (See Departments and Courses of Instruction section of this catalog). The course requirements listed with each curriculum are patterned from the outline below for the Bachelor of Science in Family and Consumer Resources degree.

GENERAL REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN FAMILY AND CONSUMER RESOURCES

<table>
<thead>
<tr>
<th>Group</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. MAJOR AREA AND ELECTIVES</td>
<td>77</td>
</tr>
<tr>
<td>II. GENERAL REQUIREMENTS</td>
<td></td>
</tr>
<tr>
<td>Freshman Comp.</td>
<td>6</td>
</tr>
<tr>
<td>Physical Education</td>
<td>2</td>
</tr>
<tr>
<td>III. HUMANITIES</td>
<td>8-9</td>
</tr>
<tr>
<td>IV. COMMUNICATIONS</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Upper-Division Writing Proficiency Test*</td>
</tr>
<tr>
<td>V. BEHAVIORAL AND SOCIAL SCIENCE</td>
<td>9</td>
</tr>
<tr>
<td>VI. BIOLOGICAL AND PHYSICAL SCIENCE</td>
<td>8-9</td>
</tr>
<tr>
<td>VII. ADDITIONAL UNITS IN ONE GROUP FROM III, IV, V, OR VI</td>
<td>9</td>
</tr>
<tr>
<td>TOTAL UNITS REQUIRED FOR GRADUATION</td>
<td>130</td>
</tr>
</tbody>
</table>

*Students awarded an unsatisfactory mark must complete an additional writing course from a College-approved list.
HONOR IN SCHOLARSHIP AND PARTICIPATION — Each year the faculty of the School chooses the outstanding senior home economics student. The name of the student so honored is engraved on the permanent Home Economics Plaque.

HONORS PROGRAM — The School of Family and Consumer Resources participates in the University-wide Honors Program.

Home Economics Organizations

THE UNIVERSITY OF ARIZONA STUDENT SECTION OF THE AMERICAN HOME ECONOMICS ASSOCIATION is open to all home economics students. It is the organization for college-age individuals affiliated with their professional organization.

THE UNIVERSITY OF ARIZONA STUDENT CHAPTER OF THE AMERICAN SOCIETY OF INTERIOR DESIGNERS — Any interior design major, with a 3.0000 or better grade average, may be a member of the society upon acceptance by the national organization.

DIRECTOR'S COUNCIL is a student committee which acts as a liaison between the home economics faculty and the student body. It is composed of representatives from the freshman and sophomore classes; each of the three divisions; graduate students; presidents of AHEA, ON, ASID, ICAHR, and Fashion Dimensions Club.

THE FASHION DIMENSIONS CLUB is open to anyone interested in fashion and merchandising.

ICAHR — Individuals Concerned for the Advancement of Human Relations — is a service organization which emphasizes volunteer activities and service projects in child development and growth.

OMICRON NU — a chapter of the national honor society. Junior, senior, and graduate students with high scholastic records are eligible for consideration of election to membership.

SCHOOL OF RENEWABLE NATURAL RESOURCES

The principal goals of the School are: (1) to provide students with educational opportunities that will enable them to assume positions of responsibility and leadership in management, planning, design and study of renewable natural resources; and (2) to provide a foundation of basic general education that will enable graduates, regardless of their professional pursuits, to function as responsible citizens in their communities.

The School is organized into four divisions — Forest-Watershed Resources; Landscape Resources; Range Resources; and Wildlife, Fisheries and Recreation Resources.

The School offers the degrees of Bachelor of Science in Renewable Natural Resources with majors in watershed management, range management, natural resource recreation, and wildlife and fisheries science and the Bachelor of Landscape Architecture with a major in landscape architecture.

Specific requirements for the various curricula appear with the majors listed under Renewable Natural Resources (see Departments and Courses of Instruction section).
MINIMUM UNIT REQUIREMENTS FOR UNDERGRADUATE DEGREES IN RENEWABLE NATURAL RESOURCES AND LANDSCAPE ARCHITECTURE

Group | B.S. in R.N.R. | B.L.A.
--- | --- | ---
I. GENERAL COURSES | | |
Freshman Comp. | 6 | 6
Sp.C. 102 | 3 | 3
Comm. Elec. (oral or writ. Engl.) | 3 | 3
Econ. 201a | 3 | 3
Upper-division writing-proficiency examination* | | |
II. MAJOR AND COLLEGE | | |
Major Subject | 16 | 73
S.W. 200, 201 | 4 | 4
Electives** | 3 | 10
III. BIOL. & PHYS. SCI. | | |
Ecol., M.C.B. | 4 | 10
Chem. | 8 | 4
Math. or Stat.*** | 3 | 8
Phys. Atmo., Geos. (incl. Phys. 102a) | 4 | 4
Electives† | 6 | 0
IV. SOCIAL SCI. & HUM.# | 12 | 21
V. ELECTIVES — At least 9 units must be taken outside the College of Agric. | | |
TOTAL REQUIRED FOR GRADUATION | 130 | 160

*Students awarded an unsatisfactory mark must complete an additional writing course from a college-approved list.
**Must be from any division in R.N.R. or F.C.R. or from any department in the College of Agriculture.
***The math. or stat. requirements can be fulfilled by M.A.P. 275; any math. department course except 101, 105a-105b, 106, 116, 122, 150, 396a, 402, or 405. Math. 402 and 405 may be used as Group II electives; 101, 105a-105b, 116 and 150 may be listed in Group V.
†Electives in the biological and physical sciences are to be selected from the following: astr., chem., c.sc., ecol., ento., geos., hydr., math., micr., m.c.b., phys., plp., or s.i.e. The following courses may be selected and counted as Group III electives: P.L.S. 100, 228, V.Sc. 250, An.S. 213, N.F.S. 406a-406b.
#The required social science/humanities units are to be selected from at least two of the following: anth., art, cdfr., clas., dram., econ., educ., Engl., ethnic studies, foreign lang., geog., hist., Hum. 250a-250b-250c, jour., ling., m.a.p., mus., Or.s., ping., phil., pol., psyc., reli., soc., and w.s.

Honors Information

The School encourages outstanding students to participate in the University-wide Honors program.

Each year the faculty of the School honors the outstanding graduating senior in each division. The awards are supported by the Natural Resources Students Scholarship Fund.

Professional Student Organizations

Students in the School are encouraged to actively participate in their respective student chapters of national organizations and to attend and participate in national and local meetings of the professional societies whenever possible.

Active student Chapters of the Society of American Foresters, the Society for Range Management, the Wildlife Society, the American Fisheries Society, and the American Society of Landscape Architects are available to students in the School.
College of Architecture

Architecture is the art and science of building. As a meeting place of the arts and sciences, it is innately interdisciplinary and has continuing vitality as a field of study or a life career. Students of architecture investigate both the broad relationships between human and natural forces and the relationships between materials and technologies required to realize architecture as built form. The college program is organized with the design studio as the element of focus.

Today, the architect may be involved with the design of a new community, a complex of buildings, an individual structure, or the smallest details of interior space. Architects may also be involved in programming and pre-design activities, site analysis, financial feasibility, user need analysis, management, administration, and related issues. The College of Architecture prepares students to participate in this broad spectrum of challenges in the shaping of our built environment to facilitate the needs of its inhabitants.

DEGREES

The College of Architecture offers a five-year program leading to the professional degree of Bachelor of Architecture. The program is divided into four areas of emphasis: design, technology, practice and management, and history and theory. The first year is the preprofessional phase. The professional phase is composed of two parts: the core design area (consisting of the second, third, and fourth years), and the fifth year, which includes areas of study derived from the emphases listed above. These areas include building design, community design, design development, economics and politics in architecture, historic preservation, housing design, building technologies, energy-conscious design, and design in arid regions. Offerings may be limited by faculty availability.

The college also offers a program of study leading to the degree of Master of Architecture. Two years of full-time study are normally recommended; however, students with a five-year Bachelor of Architecture degree from an accredited school of architecture may be able to complete the degree in less time. See the Graduate Catalog for additional information.

REQUIREMENTS

Admissions

PREPROFESSIONAL PHASE (FIRST YEAR) — See University admission requirements in Admissions section of this catalog. The special nature of architectural education necessitates the extension of the general requirements for admission to the University. Admission to full standing in the College of Architecture requires all entering first-year students to present sixteen units of acceptable high school credit as follows:

<table>
<thead>
<tr>
<th>Subject</th>
<th>High School Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>4 (or 5)</td>
</tr>
<tr>
<td>(or English, 3 units, and one foreign language, 2 units)</td>
<td></td>
</tr>
<tr>
<td>Elementary Algebra</td>
<td>1</td>
</tr>
<tr>
<td>Intermediate Algebra</td>
<td>½</td>
</tr>
<tr>
<td>Plane Geometry</td>
<td>1</td>
</tr>
<tr>
<td>American History and Social Studies</td>
<td>2</td>
</tr>
<tr>
<td>Physics (with Lab)</td>
<td>1</td>
</tr>
<tr>
<td>Electives (depending on English option)</td>
<td>6½ (or 5½)</td>
</tr>
</tbody>
</table>
Applicants are advised to include among their electives additional courses in mathematics, such as trigonometry and advanced algebra. Applicants with strong backgrounds in mathematics are encouraged to consider taking the University examinations for exemption and/or credit for all or part of the College of Architecture mathematics requirement. Applicants entering with an ACT score of 28 or higher in mathematics will not be required to take additional mathematics in the College of Architecture and may use the required mathematics units for additional open elective opportunities.

Students who have made a decision to pursue a professional education in architecture are strongly advised to seek admission to the College of Architecture at their first opportunity in order to minimize the time required to complete the professional degree.

Students deficient in one or more of the high school courses listed above will be permitted to enter the College of Architecture. Applicants with deficiency in physics should take Physics 102a or 106. Applicants with a deficiency in intermediate algebra should take Math. 116. All entrance deficiencies must be removed prior to admission to the professional phase of the program.

Students in the preprofessional phase may not enroll in required professional phase courses except upon petition to the Student Affairs Committee. Preprofessional students may, however, enroll in architecture elective courses.

PROFESSIONAL PHASE (SECOND-FIFTH YEARS) — There is a second selection process before the student can be admitted to the professional phase of the program. In order to enter this phase, the student must have completed the preprofessional course of study, have earned a cumulative grade-point average of 2.0000 (C) or better, and have removed any high-school deficiencies.

Since enrollment in architecture courses is limited, completion of the preprofessional courses with a 2.0000 average does not assure a student of admission to the professional phase. The number of applicants admitted to the professional phase is limited by the resources of the college.

Selections for professional phase admission are made in summer for the fall term. College resources do not allow mid-year admission into the first semester of the professional phase. Minimum course requirements in the professional phase include the following areas:

Architectural design and graphic communication — 201, 202, 301, 302, 401, 402, 451, 452 (6 units each), 222a-222b (3 units each) — 54 units.

Architectural practice and management — 270, 429, 439, 459 (3 units each) — 12 units.

Architectural technology — 228a-228b, 235, 236, 335, 336, 338a-338b (3 units each) — 24 units.

Architectural history and theory — 324a-324b, 424a-424b (3 units each); 444, 474 (2 units each) — 16 units.

General education elective requirements — fine arts (3), social sciences and humanities (6), science and technology (6), business, management and government (6), architecture (6), open (9) — 36 units.

TRANSFER STUDENTS — Applicants who are applying for transfer from other colleges or universities must present the same high school units as required for admission to the preprofessional phase and also must meet the general University and college admission requirements as stated in this catalog. Except in cases of demonstrated merit, transfer credit for required College of Architecture courses will be allowed only for work taken in an architectural program that is accredited by the National Architectural Accrediting Board. Transfer students must also meet the requirements as noted for admission to the professional phase of the program.

Applicants who are applying for transfer of architecture units earned in a NAAB-accredited program must forward portfolios of their work to the College of Architecture at the time their applications for admission are forwarded to the Admissions Office. The portfolios will be considered along with the official transcripts in the admission decision. If the applicant
is admitted to advanced standing, the portfolio and transcripts will also be reviewed by a college committee which will make recommendations regarding placement in the program and in specific courses.

Students transferring from community colleges, other disciplines, or programs not accredited by NAAB will normally be required to spend a minimum of one semester in the preprofessional phase and should consider enrolling at mid year, in January, if they wish to be considered for admission to the professional phase for the following August. Prospective transfer students should correspond directly with the College for advice regarding their status. Selections for professional phase admission are made in summer for the fall term. College resources do not allow mid-year admission into the first semester of the professional phase.

APPLICATION DEADLINES — Students seeking admission to the preprofessional phase for the fall semester should file an application with the University of Arizona Admissions office by May 15. Students seeking advanced placement or admission to the professional phase must apply by May 15 and must also correspond directly with the College for additional deadlines, information and applications.

GRADUATE STANDING — Prospective graduate students must apply directly to the Graduate College. For graduate standing admission requirements refer to the Graduate College.

Advancement

For advancement in any particular course sequence in the professional phase, individual course prerequisites must have been satisfied, and a cumulative grade-point average of 2.0000 or better must have been maintained for the preceding academic year. For advancement to the final year, the student must have completed all requirements in the lower years.

REQUIRED CURRICULUM
PREPROFESSIONAL PHASE
(Recommended Sequence)

FIRST YEAR

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl. 101 or 103</td>
<td>3</td>
<td>Engl. 102 or 104</td>
<td>3</td>
</tr>
<tr>
<td>Hist. 101 or 103</td>
<td>3</td>
<td>Hist. 102 or 104</td>
<td>3</td>
</tr>
<tr>
<td>Math. 117e</td>
<td>3</td>
<td>Arch. 118 or 112†</td>
<td>3 or 2</td>
</tr>
<tr>
<td>Math. 118</td>
<td>2</td>
<td>Arch. 114</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 112 or Arch. 118†</td>
<td>2 or 3</td>
<td>Elective or Physics 106**</td>
<td>3</td>
</tr>
<tr>
<td>Elective†</td>
<td>3</td>
<td>Elective†</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16 or 17</td>
<td><strong>Total</strong></td>
<td>16 or 17</td>
</tr>
</tbody>
</table>

REQUIRED CURRICULUM
PROFESSIONAL PHASE
(Recommended Sequence)

SECOND YEAR

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Arch. 201</td>
<td>6</td>
<td>Arch. 202</td>
<td>6</td>
</tr>
<tr>
<td>Arch. 222a</td>
<td>3</td>
<td>Arch. 222b</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 228a*</td>
<td>3</td>
<td>Arch. 228b*</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 235*</td>
<td>3</td>
<td>Arch. 236*</td>
<td>3</td>
</tr>
<tr>
<td>Elective†</td>
<td>3</td>
<td>Elective†</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
<td><strong>Total</strong></td>
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## THIRD YEAR

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<thead>
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<tbody>
<tr>
<td>Arch. 301</td>
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<td>Arch. 302</td>
<td>6</td>
</tr>
<tr>
<td>Arch. 324a*</td>
<td>3</td>
<td>Arch. 324b*</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 336*</td>
<td>3</td>
<td>Arch. 335*</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 338a</td>
<td>3</td>
<td>Arch. 338b</td>
<td>3</td>
</tr>
<tr>
<td>Elective††</td>
<td>3</td>
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<td>18</td>
<td>Total</td>
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## FOURTH YEAR

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<thead>
<tr>
<th>Subject</th>
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</thead>
<tbody>
<tr>
<td>Arch. 401</td>
<td>6</td>
<td>Arch. 402</td>
<td>6</td>
</tr>
<tr>
<td>Arch. 424a*</td>
<td>3</td>
<td>Arch. 424b*</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 429*</td>
<td>3</td>
<td>Arch. 439</td>
<td>3</td>
</tr>
<tr>
<td>Elective††</td>
<td>3</td>
<td>Elective††</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>Total</td>
<td>17</td>
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</table>

## FIFTH YEAR

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<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arch. 451</td>
<td>6</td>
<td>Arch. 452</td>
<td>6</td>
</tr>
<tr>
<td>Arch. 459</td>
<td>3</td>
<td>Elective††</td>
<td>3</td>
</tr>
<tr>
<td>Arch. 474</td>
<td>2</td>
<td>Elective††</td>
<td>3</td>
</tr>
<tr>
<td>Elective††</td>
<td>3</td>
<td>Elective††</td>
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</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>Total</td>
<td>15</td>
</tr>
</tbody>
</table>

*Course may be taken in another year but must be completed prior to entrance into the fifth year.

**Physics taken to fulfill a high school deficiency may not be used as elective credit. Students without high school or college physics must complete physics in the first year and should take Math. 117e and Math. 118 first semester.

†Arch. 112 and 118 may be taken either semester.

††Arch. 270 must be taken in lieu of one elective prior to the fourth year. Electives are to be selected from five general areas of knowledge. Consult elective group list available in the College of Architecture.

### RESOURCES AND ACTIVITIES

**FACILITIES** — The activities of the college are housed in the Architecture Building, which was constructed in 1966 and expanded in 1970. It is a three-story facility that houses the majority of the design studios, classrooms and seminar rooms, a large and completely equipped audio-visual lecture hall, model shop, photographic darkroom, faculty offices, exhibition areas, archives and the college library. The library has an extensive collection of books and magazines about architecture and related environmental design fields. An important and active part of this resource is the outstanding 35mm slide collection covering the historical and contemporary architecture of the world. In 1978, a second expansion provided studio and exhibition space as well as an experimental facility for ongoing solar-energy research.

**ACCREDITATION AND AFFILIATIONS** — The program is fully accredited by the National Architectural Accrediting Board. The degree of Bachelor of Architecture is recognized and accepted by licensing agencies as the first professional degree leading to architectural
licensing as recommended by the National Council of Architectural Registration Boards. The College of Architecture is affiliated with the Association of Collegiate Schools of Architecture and recognizes a student chapter of the American Institute of Architects. There is a regular liaison with the Southern Arizona Chapter of the American Institute of Architects and the Arizona Society of Architects, both of which lend support to the College in a variety of ways.

**PLACEMENT SERVICES** — Fifth-year students and former students are eligible to register with the University Placement Service, which is in communication with organizations seeking graduates. College of Architecture graduating students are urged to register with the Placement Service no later than the beginning of their last semester of studies to avail themselves of the benefit of this service. Further information may be obtained by contacting the Director of the Placement Service or visiting the office on campus.

**SCHOLARSHIPS AND FINANCIAL AIDS** — All architecture majors are eligible to apply for University scholarships and aid. In addition, for students in the professional phase of the program there are special College of Architecture scholarships, as well as a short-term loan fund. For further information, refer to the section on Scholarships and Financial Aids in this catalog.

**AWARDS AND HONORS** — Outstanding student accomplishments are recognized each year through the presentation of a number of awards, including the Outstanding Graduating Senior Award, the National School Medal of the American Institute of Architects, the Henry Adams Fund Award, the National School Medal of Alpha Rho Chi and Faculty Commendation Awards. The Dean's List citation goes to all students who attain a grade average of 3.5 or better for a semester while carrying no fewer than fifteen units of work.

**STUDENT GUIDANCE** — Each entering student is assigned a faculty adviser who is available for guidance and counseling throughout the academic year. The faculty advisers maintain regular office hours and students are encouraged to review their progress and problems with their advisers.
College of Arts and Sciences

The College of Arts and Sciences is organized into four Faculties — the Faculty of Fine Arts, the Faculty of Humanities, the Faculty of Science and the Faculty of Social and Behavioral Sciences. Each Faculty is comprised of schools, departments, and committees offering programs at the undergraduate and graduate levels. The college is administered through a dean of each Faculty.

Study within the college is designed to assist students in developing a critical and open mind. Administrative, curricular and degree structures have been developed to support educational objectives which may range from a broad general education to a highly specialized professional program.

ACADEMIC DIVISIONS AND DEGREE PROGRAMS

Faculty of Fine Arts: School of Music; Departments of Art, Drama, Radio-Television, Speech Communication, and Speech and Hearing Sciences; Committee on Dance.

The following degree programs are offered through the Faculty of Fine Arts: Bachelor of Fine Arts with majors in art education, dance, drama education, drama production, general fine arts studies (includes options in general fine arts, cinema, and musical theatre) and studio arts; Bachelor of Music with majors in jazz studies, music education, performance, and theory and composition; Bachelor of Arts in Art with major in art history; Bachelor of Arts in Drama with major in dramatic theory; Bachelor of Arts in Music; Bachelor of Arts in Radio Television; and Bachelor of Arts in Speech Communication; and Bachelor of Science in Speech and Hearing Science.

Faculty of Humanities: Departments of Classics, English, French and Italian, German, Russian and Slavic Languages, Spanish and Portuguese. Committee on Religious Studies.

The following degree programs are offered through the Faculty of Humanities: Bachelor of Arts with majors in classics, creative writing, English, French, Greek, Italian, Latin, Portuguese, religious studies, Russian and Spanish.

Faculty of Science: Departments of Astronomy, Atmospheric Sciences, Chemistry, Ecology and Evolutionary Biology, Geosciences, Mathematics, and Physics; University Departments of Biochemistry, Microbiology and Immunology, and Molecular and Cellular Biology.

The following degree programs are offered through the Faculty of Science: Bachelor of Arts with majors in astronomy, biochemistry, chemistry, ecology and evolutionary biology, geosciences, and mathematics; Bachelor of Science with majors in astronomy, atmospheric sciences, biochemistry, cellular and developmental biology, chemistry, ecology and evolutionary biology, general biology, mathematics, microbiology, and physics; and Bachelor of Science in Geosciences.

Faculty of Social and Behavioral Sciences: Departments of Anthropology, Geography, History, Journalism, Linguistics, Oriental Studies, Philosophy, Political Science, Psychology and Sociology. Committees on American Indian Studies, Black Studies, Latin American Studies, Mexican American Studies, and Women's Studies.

The following degree programs are offered through the Faculty of Social and Behavioral Sciences: Bachelor of Arts with majors in anthropology, economics, geography, history, journalism, Latin American studies, linguistics, Mexican American studies, Oriental studies, philosophy, political science, psychology, sociology, and women's studies; and Bachelor of Science with major in psychology.

The Faculties of Humanities, Science, and Social and Behavioral Sciences combine to offer the Bachelor of Arts degree with a major in general studies.
ADMISSION

Entering freshmen are urged to present a strong academic high school program. (See "Classification of Acceptable Secondary School Subjects" under the Admission to the University section of this catalog.) Entrance deficiencies must be removed within one calendar year of initial enrollment. Special departmental entrance requirements, if any, will be listed in the departmental section of this catalog.

Transfer students should take the initiative in securing an evaluation of transfer course work. The Transcript Evaluation Office, Administration Building, Room 316, will review transcripts to determine course transfer credits and equivalencies. Entering transfer students who have not received an official evaluation may review transcripts for general education course equivalencies with an adviser in the office of the dean of the appropriate Faculty.

Transfer from Arizona Community Colleges — The College of Arts and Sciences has a cooperative outreach program with Arizona community colleges to provide academic and student services information. Joint community college-College of Arts and Sciences advising is designed to assist the student in developing an academic plan for both associate and baccalaureate degree programs. Assistance in evaluating basic academic skills, in strengthening background in English composition, mathematics, reading and study skills, and in removing possible academic deficiencies is provided through the dual advising of the cooperating institutions. Students are able to select and to initiate studies in general education requirements and in major and minor areas of study. Ultimately, transfer to the college is facilitated greatly because of the previously planned and partially completed degree program and the early receipt of information about University of Arizona student services such as financial aids and scholarships, admissions, and housing. Students wishing to utilize this program should familiarize themselves with the general education requirements of the College of Arts and Sciences and the requirements of the students' desired major and minor. A current transcript must be submitted with the application for admission to the University of Arizona.

Change of College within the University — Students wishing to change colleges may consult an adviser in the dean's office. Students should bring their University transcript or an official evaluation of transfer courses in order to facilitate an adviser's review of the application of previously taken courses to the college's general education requirements. Students who have selected a major will be directed to a new departmental adviser for guidance regarding major and minor requirements and options. General studies majors will complete degree program planning with an adviser in the appropriate dean's office. Actual change of colleges becomes effective the semester following the semester in which application for entrance into the College of Arts and Sciences is made.

ACADEMIC ADVISING

The faculty and advisers of the College of Arts and Sciences are committed to the supportive advising of students. The adviser-student relationship supports strengthening competencies, broadening knowledge, focusing on career goals, and experiencing increased responsibility.

Within the Faculty of Fine Arts, advising is carried out in departments, except for the general fine arts studies major which is advised in the Office of the Dean of Fine Arts, Music Building, Room 111. For students majoring within the Faculties of Humanities, Science, or Social and Behavioral Sciences, advising is available in each department within the Faculties and in the Office of Academic Services, Modern Languages Building, Room 347. In the latter office, advisers are available throughout the year for general consultation, to assist the student who has not yet chosen a major, and to advise the general studies major.

Upon selecting a major, students are assigned a faculty adviser from the major department. Faculty advisers assist the student in selecting a program of study and serve as a source of information about general academic rules, regulations, and options. In order to facilitate
orderly progress toward a degree, it is wise to meet with departmental advisers during the first year to obtain information about the major and to develop a sequential study plan. It is always the student's responsibility to know and to meet degree requirements.

REQUIREMENTS FOR DEGREES

In order to graduate, a student within the College of Arts and Sciences must attain a grade-point average of 2.0000 or better for all University of Arizona work in the major, as well as an overall University of Arizona grade-point average of 2.0000. (See "Graduation Average" in the Graduation Requirements section of this catalog.) A minimum of 30 upper-division units is required in all degrees. Degree requirements must be met as specified in the catalog under which the student chooses to graduate. (See "Choice of Catalog Under Which Students May Be Graduated" in the Graduation Requirements section of this catalog.)

Bachelor of Arts and Bachelor of Science

For graduation with these degrees, a student must complete the general education requirements, a major, a minor (except the Bachelor of Science in Geosciences) and appropriate elective courses — all selected in consultation with a departmental or dean's office adviser. No more than 48 units within the major may be applied toward these degrees. A general studies major or a double major (except English and creative writing combinations) may not require a minor. A minimum of 90 units of course work must be taken from programs or departments within the College of Arts and Sciences. Up to 30 units of economics may be counted toward the 90 units. A minimum of 125 units is required for graduation.

Bachelor of Fine Arts and Bachelor of Music

For graduation with these degrees, a student must complete the general education requirements, a major and appropriate electives. At least 44 general academic units must be taken outside the major department. The general education requirements are counted toward these 44 units. Students pursuing a BFA degree with a major in general fine arts studies must take at least 44 units outside of the Faculty of Fine Arts. For information regarding the total number of units required for these degrees, see "The Unit System" in the Graduation Requirements section of this catalog.

GENERAL EDUCATION REQUIREMENTS

Although the general education courses are degree-specific by Faculty, the requirements share the common aim of extending the boundaries of a student's education to embrace exploration and learning in other disciplines. To be able to listen and read critically; to think, speak and write clearly; to appreciate the application of the sciences and social sciences and the power of the humanities and the arts; to understand the definitions and processes of various fields of knowledge—these are the goals of this part of an Arts and Sciences education. General education course work is selected from subject-related groups of courses designated by each Faculty. These course groups are listed on subsequent pages according to Faculty and degree. Normally, the general education portion of the degree requirements is completed during the freshman and sophomore years of study.

Individual studies (courses with numbers ending in 91, 93, 94, 99) or courses completed with pass/fail grades do not satisfy general education requirements. (Exception: For the Faculties of Humanities, Science, and Social and Behavioral Sciences, the course that establishes proficiency for the foreign language requirement must be taken for a letter grade, but the previous courses in the language sequence may be taken pass/fail.)

Faculties of Humanities, Science, and Social and Behavioral Sciences

Within these three Faculties, a major or single discipline minor automatically satisfies the group requirement with which it is identified. No course may be used to satisfy more than one requirement within the major, minor, or general education requirements, except that suitable
mathematics courses which are required as part of a major or minor in some other discipline may be used to satisfy the mathematics requirement. Students majoring in Oriental studies, Latin American studies, Mexican American studies, women's studies or philosophy should consult an adviser in the Office of Academic Services regarding applicability of these majors to the general education requirement groups. Also, at least one course from within the humanities or the social sciences requirements must include a course with a non-Western content. A list of such courses is available from departmental or college advisers.

GROUP             UNITS

I. FRESHMAN COMPOSITION .................................................. 6-9
   All freshmen must enroll in Freshman Composition
   Completion of one of the following sequences:
   A. Engl. 100, 101, and 102
   B. Engl. 101 and 102
   C. Engl. 103 and 104 (Honors)

II. HUMANITIES ...................................................................... 8-9
    All students in the Faculties of Humanities, Science, and Social and Behavioral Sciences are required to complete either:
    A. Two semesters of Hum. 250a-250b (8 units); or
    B. No fewer than 9 units from at least two of the following groups:
       2. Art 117, 118, Hist. 103-104, Mus. 107, 108, Or.s. 140a-140b, Reli. 120, 300.
    The Humanities survey (250a-250b) constitutes a single, 8-unit sequence, but the student may elect only part of the sequence. In such a case, however, a total of 9 units of work in humanities courses must be completed.

III. FOREIGN LANGUAGE ......................................................... up to 16
    The basic requirement for the bachelor's degree is demonstration of proficiency in a foreign language at the fourth-semester level. Fourth-semester proficiency may be demonstrated through a proficiency examination administered by a foreign language department (no credit given); credit by examination (credit awarded); CLEP (see Academic Guidelines section of this catalog); advanced placement (credit awarded); completion of a fourth-semester course taught in the foreign language; the "b" half of an intensive foreign language course; or a special course for the native speaker at the intermediate year level. If proficiency is demonstrated through course work, the course that establishes proficiency must be taken for a letter grade, not pass/fail.
    For students continuing the study of foreign languages already taken in high school, placement will be based upon the results of an examination given by the department concerned.
    For students whose native language is a language other than English, the language requirement may be satisfied by completing successfully English 101 and 102, or 107 and 108. Credit by transfer from other institutions for courses taken in the student’s native language is allowed only for those courses taken during the years equivalent to the United States college years. (For information regarding credit by examination, please refer to “Special Examination for Credit or Grade” in the Academic Guidelines section of this catalog.)
    Some departments require certain languages to meet their major requirements. Please consult the department sections of this catalog for additional information.

IV. SOCIAL SCIENCE .............................................................. 8-9
    Completion of nine units selected from anth., Blk. stds., econ., geog. (except 103a-103b, 104a-104b), hist. (except 103-104), jour. 151, 470, ling. (except 203a-203b, 260, 420, 423a-423b, 461), Mex. Amer. studies (except language and literature courses), Or.s. (except language and literature, religion, and humanities courses), phil. (except 111, 112, 113, 260, 261, 262, 263, 309, 328, 425, 426), pol., psyc., soc., w.s. (except 200, 317, 341, 417, 418, 439, 480). Six units must be in one department or program and three in another.

V. MATHEMATICS ................................................................. 3
    A course selected from Math. 101, 117e, or any 3-unit mathematics course numbered above 117e.
VI. SCIENCE .......................................................... 8-9
Completion of A or B:
A. Laboratory option. Eight units in a single department: astr., atmo., chem., ecol., Geog.
103a-103b and 104a-104b, geos., Hydr. 101a-101b, micr., m.c.b., phys., pty.s. At least two of
these units must be devoted to providing a "laboratory experience" (which can take the form of
traditional laboratories, field trips, or data analysis/discussion sessions) designed to expose
students to the data used in the discipline.
B. Combination option. A minimum of nine units selected from at least two different departments.
At least three units must be in biological sciences (ecol., micr., m.c.b.) and at least three units
must be in the physical sciences (astr., atmo., chem., Geog. 103a-103b, geos., Hydr. 101a-101b,
phys., pty.s.).

Faculty of Fine Arts

General education requirements vary among the several degree programs of the Faculty of
Fine Arts. No course may be used to satisfy more than one requirement in any degree program.

HUMANITIES GROUP REQUIREMENT (HGR) COURSE LIST — The following courses satisfy
the humanities group requirement in the various degree programs offered by the Faculty of
260, 261, 265, 267a-267b, 370a-370b, Clas. 126, 250a-250b, 301, Fren. 300a-300b-300c,
382a-382b, Ger. 270a-270b, 302a-302b, 345, 371, Ital. 400a-400b, 401a-401b, W.S. 200.

Students wishing to use courses other than those listed should consult an adviser and
then submit a College Recommendation Form (obtainable in the dean's office) to the dean
prior to enrollment in the course. Course work within the major field(s) may not be used to
satisfy the humanities group requirements.

BACHELOR OF FINE ARTS
(Majors in studio art, art education, dance, drama production and drama education)

& BACHELOR OF MUSIC
(Majors in performance, music education, theory and composition, and jazz studies)

GROUP           UNITS
I. FRESHMAN COMPOSITION ........................................... 6-9
Completion of one of the following sequences:
A. Engl. 100, 101 and 102
B. Engl. 101 and 102
C. Engl. 103 and 104

II. HUMANITIES ......................................................... 6-8
Specific courses are identified in HGR course list above.
Completion of one of the following sequences:
A. Hum. 250a-250b-250c (any two)
B. No fewer than two 3-unit survey courses from the following:
   1. Art hist., dance hist., drama hist., music hist. or speech hist.
   2. Literature (or survey literature in a foreign language department).
   3. Philosophy (except logic and world religions).
C. Either Hum. 250a or 250b or 250c and one 3-unit course from 1, 2, or 3 above.

III. SCIENCE/MATHEMATICS ............................................ 8-10
Completion of one of the following sequences:
A. Laboratory sciences (identified in the catalog as 4 units: often 3R, 3L) selected from astr.,
atmo., chem., ecol., ento., Geog. 103a or 103b with 104a or 104b, geos., Hydr. 101a or 101b,
micr., m.c.b., phys., pty.s., sp.h. Crosslisted courses (from other home departments) will be
accepted only if approval is granted by the dean prior to enrollment (8 units).
B. Mathematics selected from 116, 117e, 118, 119, 123, 125a-125b, 160 (9 units).
C. Combination of "A" and "B" above (10 units).
IV. SOCIAL SCIENCE ................................................................. 6
Courses to be selected from anth., econ., geog. (except 103a-103b and 104a-104b), hist., phil., pol.,
soc., A.In.s, Bl.s., Or.s., reli., w.s. Experimental, individual studies, special topics courses and courses
crosslisted from other home departments will be accepted only if approval is granted by the dean
prior to enrollment.

Note: Art education, drama education and music education majors must take twelve units: Pol. 110 (or credit by
examination), Psyc. 101, Hist. 130a or 130b, and three additional units of social sciences.

BACHELOR OF ARTS
(Majors in art history, dramatic theory,
music, radio-television, and speech communication)

GROUP

UNITS

I. FRESHMAN COMPOSITION .................................................. 6-9
Completion of one of the following sequences:
A. Engl. 100, 101, 102
B. Engl. 101 and 102
C. Engl. 103 and 104 (Honors)

II. HUMANITIES ................................................................. 8-10
Specific courses are identified in HGR course list.
Completion of one of the following sequences:
A. Hum. 250a-250b-250c (any two).
B. One 3-unit survey course from each of the following:
   1. Art hist., dance hist., drama hist., music hist. or speech hist.
   2. Literature (or survey literature in a foreign language department).
   3. Philosophy (except logic and world religions).
C. Six units in one field and 3 units in another from 1, 2 and 3 above.
D. Combination of Hum. 250a or 250b or 250c and at least 6 units from B.1, 2, or 3 above.

III. FOREIGN LANGUAGE ...................................................... 16
The requirement in foreign language is either completion of 4 semesters in one foreign language or
proficiency at the fourth semester level. Advanced placement for credit in language courses for
students continuing a foreign language taken in high school will be based upon the results of place-
ment examination given by the language department concerned.

IV. SCIENCE/MATHEMATICS ................................................... 7
Students must take a minimum of 4 units in laboratory sciences (identified in the catalog as 4 units;
often 3R, 3L) selected from astr., atmo., chem., ecol., ento., Geog. 103a or 103b with 104a or 104b,
geo.s, Hydr. 101a or 101b, micr., m.c.b., phys., pys.s, sp.h., and 3 units of math selected from Math
116 or any math course above Math 116. Crosslisted courses (from other home departments) will be
accepted only if approval is granted by the dean prior to enrollment (9 units).

V. SOCIAL SCIENCE
Courses to be selected from: anth., econ., geog. (except 103a-103b and 104a-104b), hist., phil., pol.,
psych., soc., A.In.s, Bl.s., Or.s., reli., w.s. Experimental, individual studies, special topics courses and courses
crosslisted from other home departments will be accepted only if approval is granted by the dean prior to enrollment.

BACHELOR OF SCIENCE
(Majors in speech and hearing sciences)

GROUP

UNITS

I. FRESHMAN COMPOSITION .................................................. 6-9
Completion of one of the following sequences:
A. Engl. 100, 101, and 102
B. Engl. 101 and 102
C. Engl. 103 and 104 (Honors)
II. HUMANITIES ................................................................. 8-10
   Completion of one of the following sequences:
   A. Hum. 250a-250b-250c (any two).
   B. One 3-unit survey course from each of the following:
      1. Art. hist., dance hist., drama hist., music hist. or speech hist.
      2. Literature (or survey literature in a foreign language department).
      3. Philosophy (except logic and world religions).
   C. Six units in one field and 3 units in another from 1, 2, and 3 above.
   D. Combination of Hum. 250a or 250b or 250c and at least 6 units from B.1, 2, or 3 above.

III. FOREIGN LANGUAGE OR LINGUISTICS .............................. 6-8
   Eight units in one foreign language or 6 units of linguistics.

IV. SCIENCE/MATHEMATICS .................................................. 22-24
   Completion of plan A or B:*
   A. Math. 117e, 118, and 160,** and sixteen units of general lab. sci. including human anatomy
      and psychology.
   B. Sp.H. 461, Math. 160, and other courses selected in consultation with an adviser to achieve the
      required number of units. Sp.H. 260 and 280 may be used in fulfillment of this group
      requirement.

V. SOCIAL SCIENCE ............................................................ 12
   Completion of plan A or B:*
   A. Psyc. 101 and nine additional units from anth., econ., geog., hist., phil., pol., psyc., or soc.
      (Students who have a psyc. minor or split minor including psyc. may fulfill the social science
      requirement using courses other than Psyc. 101, which may be applied to the minor.)
   B. Six units in psyc. and additional units from anth., soc., or psyc.

*Plan B is for students in the American Indian professional training program.
**Intro. stat. courses may be used for math. 160, except ed.p. 340.

BACHELOR OF FINE ARTS
(Major in general fine arts studies)

All courses used to satisfy the general education requirements, the minor, and the Group VI
requirement for the major in general fine arts studies, must be home department registrations
for any courses that are crosslisted. Home department is the department actually teaching the
course and is designated in the catalog by a complete course description.

GROUP UNITS

I. FRESHMAN COMPOSITION .............................................. 9-12
   Completion of one of the following sequences:
   A. Engl. 100, 101, and 102
   B. Engl. 101 and 102
   C. Engl. 103 and 104 (Honors)
   For the cinema option, in addition to the above requirements, one of the following courses must be
   taken: Engl. 207, 209, 210, or 308.

II. LITERATURE/FOREIGN LANGUAGE/JOURNALISM ....................... 12
   A. Literature (or survey literature in a foreign language department)
   B. Foreign language (8 units minimum in one language)
   C. Journalism
   For the cinema option, Group II must include Engl. 300a-300b and either 6 units of jour. or 8 units in
   one foreign language.

III. SCIENCE/MATHEMATICS .................................................. 8-10
   Completion of one of the following sequences:
   A. Laboratory Sciences (identified in the catalog as 4 units; often 3R, 3L) selected from astr.,
      atmo., chem., ecol., ento., Geog. 103a or 103b with 104a or 104b, geos., Hydr. 101a or 101b,
      micr., m.c.b., phys., phys., sp.h. Crosslisted courses (from other home departments) will be
      accepted only if approval is granted by the dean prior to enrollment (8 units).
   B. Mathematics selected from Math. 116, 117e, 119, 123, 125a-125b, 150, 160 (9 units).
   C. Combination of "A" and "B" above (10 units).
IV. SOCIAL SCIENCE ................................................................. 6

A. Courses selected from: anth., econ., geog. (except 103a-103b and 104a-104b), hist., phil., pol., psy., soc., A.l.n.s., B.l.s., Or.s., reli., w.s. Experimental, individual studies, special topics courses and courses crosslisted from other home departments will be accepted only if approval is granted by the dean prior to enrollment.

Three options are available to meet the major requirements of this degree: the general fine arts option, the cinema option, the musical theatre option. Requirements for Groups V and VI depend upon which option you select. In each option, at least 24 units in Groups V and VI must be taken in residence. Sufficient upper-division units must be taken to meet the total of 30 upper-division units required for graduation. Also, the student must take a writing emphasis course identified in the department in which the major emphasis of course work is taken (Group VI, 24 units.)

**General Fine Arts Option**

V. INTRODUCTORY FINE ARTS

Courses must be selected from four of the following fields: Art 101 and 117 or 118 or 119; Dnc. 259a or 259b and 3 units of dnc. activity courses; Dram. 105 and 149 and 140a or 140b; Mus. 107 or 108 and 3 units of performance courses; R.T.V. 103 and 111 or 213; Sp.C. 136 and 181.

VI. FINE ARTS EMPHASIS COURSE WORK

The candidate for this degree also must complete a minimum of 24 additional units of course work in one of the departments listed in Group V above, and twelve additional units of course work in each of the other listed departments. (Creative Writing, with the approval of the adviser, may be used as one of the 12-unit departments.) At least 24 units must be upper-division courses. At least 24 units in Groups V and VI must be taken in residence.

**Cinema Option**

V. INTRODUCTORY FINE ARTS

Courses must include the following: Art either 101 or 104 and either 117 or 118 or 119; Dram. 101 and either 140a or 140b; Mus. 100 and either 107 or 108; and R.T.V. 111 and 213.

VI. FINE ARTS EMPHASIS COURSE WORK

Courses must include: 24 units of dram., including Dram. 108, 109, 170, 200, 245, 460a or 460b, and 8 units of dram. electives and 24 units in r.t.v. including R.T.V. 141, 215, 302, 315, 375, 415a, 415b, and 3 units of r.t.v. electives.

**Musical Theatre Option**

Students in this option select a concentration in dance, drama, or music.

V and VI FINE ARTS INTRODUCTORY AND EMPHASIS COURSE WORK

Courses must include Dnc. 259b; Dram. 105, 106, 115, 140a-140b, 149, 151, 205, 250, 251; Mus. 110a-110b, 120a-120b, 130a-130b, two units of 201a and one unit of 205, ten units of voice including four units of 285v, plus either A, B, or C as follows:

A. For drama concentration: Dram. 449, 451, 452, 453, two units of Dnc. 152a, and ten units of dram. electives.

B. For music concentration, one unit of Mus. 205, 220a-220b, two units of 405, 330a-330b, four units of voice (additional units of voice may be required if student cannot meet minimum graduation requirements of four units of voice at 285v level), two units of Dnc. 175, one unit of Dnc. 112a, one unit of Dnc. 152a, and three units of music electives.

C. For dance concentration: Dnc. 240a-240b, 241a-241b, 244a-244b, 340a-340b, 343a, 343d, 370 (section for dance majors) and three units of dnc. electives.

All musical theatre students must complete a minimum of four units of the following: Dram. 111, 112, 113, Mus. 205 (production emphasis) or Dnc. 247a-247b.

Students concentrating in drama and music must appear in one major musical theatre role in a University of Arizona production or present a minimum of one-half public solo voice recital, which must include a significant portion of musical theatre repertory. To fulfill two units of electives in the concentration, majors are encouraged to register for one or more musical theatre internships as approved by the musical theatre adviser and the musical theatre committee. Such registration is possible only when suitable internship possibilities are available.
GENERAL STUDIES MAJORS

General studies majors are designed to meet educational needs and interests of students who wish a broad educational approach to a degree program. They provide the flexibility which enables the student to develop an individual program of study of high academic quality. Two general studies majors are offered within the college.

General Fine Arts Studies

The general fine arts studies major, offered by the Faculty of Fine Arts for the Bachelor of Fine Arts degree, combines general education requirements with introductory fine arts course work and concentrated study and participation in selected fine arts fields. For information regarding the specific requirements for this major, please refer to “General Education Requirements, Bachelor of Fine Arts, Major in general fine arts studies” earlier in this section of the catalog.

General Studies

The general studies major, offered through the Faculties of Humanities, Science, and Social and Behavioral Sciences for the Bachelor of Arts degree, provides opportunity for concentration in three subject areas. Individualized programs of study are developed in consultation with an adviser in the Office of Academic Services, Modern Languages, Room 347. Recent programs have combined subject areas such as ecology, urban planning, social sciences, area studies, public or business administration, language and culture, as well as other creative combinations.

Requirements for this degree must be completed as follows:

General Education Requirements

<table>
<thead>
<tr>
<th>Group</th>
<th>Requirement</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>Freshman Composition</td>
<td>6-9</td>
</tr>
<tr>
<td>Group II</td>
<td>Humanities</td>
<td>8-10</td>
</tr>
<tr>
<td>Group III</td>
<td>Foreign Language</td>
<td>up to 16</td>
</tr>
<tr>
<td>Group IV</td>
<td>Social Sciences</td>
<td>9</td>
</tr>
<tr>
<td>Group V</td>
<td>Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Group VI</td>
<td>Science</td>
<td>8-9</td>
</tr>
</tbody>
</table>

Subject Areas

- Subject Area I: 20 units
- Subject Area II: 20 units
- Subject Area III: 20 units

Electives to total 125 units.

At least one writing emphasis course must be taken from those listed in the department chosen for either Subject Area I or II. A subject area is defined as at least twenty units of course work. Subject Areas I and II each must be in a single program or major field of study in which a Bachelor of Arts, or a Bachelor of Science degree is offered, or in the structured program of an academic committee within one of these three Faculties. Subject Area III may be in courses from one of these disciplines or academic committees, from an approved combination of courses united by a common theme, from within the Faculty of Fine Arts, or from another college. Courses in Subject Area III may not be in more than two academic disciplines, divided equally, except for the thematic subject area which may combine various disciplines but which must include at least nine units of upper-division course work.

The following may not be used within the three subject areas: freshman composition, the first year in a foreign language (except for Greek, American Indian languages, languages taught within the Oriental Studies Department, French 302b, Portuguese 202b, and Spanish 202b), military aerospace studies, military science, naval science, and specified courses in physical education.
Thirty upper-division units are required for the general studies major, with at least eighteen upper-division units required in the three subject areas collectively. A minimum of six upper-division units within each subject area must be studies in residence at the University of Arizona. A maximum of nine units of independent study may be included among the subject areas, with no more than six units in a single subject area. A department within the three Faculties may designate up to six units of required course work if the subject area selected is within its discipline. Ninety units in the degree must be taken in courses offered through the College of Arts and Sciences and up to 30 units of economics may be included within this requirement. A graduation average of 2.0000 is required for all university credit courses taken and included collectively or selectively in the subject areas. Degree program planning is crucial within this degree option and a special form is used for this purpose. Past, present, and future courses are incorporated to form the complete general studies major, and approval of the entire program by the Office of Academic Services' Scholastic Committee must be obtained prior to acceptance as a general studies major. An up-to-date transcript must be presented with the degree proposal and the general studies major must be declared through an academic adviser.

An approved copy of the program must be submitted to degree certification personnel at the time of application for degree candidacy.

DEPARTMENTAL MAJORS

The course requirements for majors are specified by individual departments in the Departments and Courses of Instruction section of this catalog. Course work used to satisfy other graduation requirements may not be used to satisfy requirements of the major. For the Bachelor of Arts and Bachelor of Science degrees, no more than 48 units in the major may be counted toward graduation. For unit restrictions applicable to the Bachelor of Fine Arts and the Bachelor of Music degrees, see "Requirements for Degrees" earlier in this section. Students must obtain a grade-point average of 2.0000 or better for all work in the major.

Faculty of Fine Arts

The Faculty of Fine Arts requires the student to select a degree program at the time of application for admission to the University or upon entrance into the Faculty. Students majoring in art education, drama education or music education must complete at least 56 units applicable to the degree with a grade-point average of 2.5000 or better before being admitted to certain professional education courses.

Fine Arts students are encouraged to participate in on-campus or off-campus, nondepartmental productions or performances. Participation cannot conflict, however, with commitments already made to departmental programs and student colleagues within those programs. Where such conflicts are imminent, students are responsible for consulting in advance with the relevant department head or director.

Faculties of Humanities, Science, and Social and Behavioral Sciences

Within these three Faculties, students may indicate a degree program, or select the exploratory, or undeclared, status at the time of admission into the University or college.

Undeclared status is for students who are not prepared to designate a major area of study while still in high school or during the initial year of university studies. With the assistance of a college adviser, such students can plan an academic program in which the courses taken in freshman composition, humanities, science, mathematics, foreign language, and the social sciences during the freshman and sophomore years will apply toward the college's general education and graduation requirements. Exploratory students are encouraged to sample from the University-wide diversity of disciplines and academic offerings. This sampling plus contact with a wide range of faculty members and their disciplines will assist the student to select a major area of study. Late in the sophomore or early in the junior year a major should be declared.
In the Faculties of Humanities, Science, and Social and Behavioral Sciences, the following courses are included within the 48-unit maximum allowable in one department: honors courses in the major and courses crosslisted with an academic committee (American Indian Studies, Black Studies, Mexican American Studies, and Religious Studies). The following are excluded from the 48-unit rule: freshman composition, the first year (elementary) of foreign languages, and courses crosslisted in a second academic department if the latter is the home department. In addition, students who major in English and minor in creative writing (or vice versa) may take 57 units in the English Department. Students with a double major in English and creative writing may take 72 units in that department. At least 15 units of a major must be courses in residence.

Change of Major. Students wishing to change majors within the college should consult an adviser in the dean's office, where a review of the student's standing in the college and progress in the general education program will be made. General studies majors will continue to work with a dean's office adviser; all other majors will be provided with new departmental advisers.

THE MINOR

The minor complements the major and is an essential component of the overall degree program. A twenty-unit minimum minor is required in both the Bachelor of Arts and the Bachelor of Science degree programs (except the Bachelor of Science in Geosciences). The minor normally is done in a department related to the major and must be approved by the student's adviser. Additional information about minors will be found in the departmental listings in this catalog. In general, completion of this requirement may be met in one of the following ways:

Faculty of Fine Arts
A. Twenty units in one department, usually related to the major;
B. A split minor, wherein work is done in two departments with at least eight units in one and twelve units in the other;
C. A fine arts minor, consisting of a broad survey of courses outside of the major department, which must include six to nine units from three of the following departments: arts, dance, drama, music, radio-television, and speech communication;
D. A teaching minor for education majors (specific requirements described in the departmental sections of this catalog);
E. For speech and hearing sciences majors, selection of a minor as outlined above or, with the approval of the major adviser, selection of a twenty-unit, non-traditional set of courses.

Course work used to satisfy other graduation requirements may not be applied to the requirements of the minor.

Faculties of Humanities, Science, and Social and Behavioral Sciences
A. Twenty units in one department, usually related to the major;
B. A split minor, wherein work is done in two departments with at least eight units in one and twelve units in the other;
C. A teaching minor for education majors (specific requirements described in the departmental sections of this catalog);
D. A structured business minor — see an adviser for more information;
E. A thematic minor, which is designed around a specific theme and which may include course work pertinent to the theme from more than one college. If this minor is made up of courses from three or more disciplines, they must be described on a form available from your departmental adviser or the Office of Academic Services. This form must be submitted to the Degree Certification Office at the time the student files for degree certification. At least six units must be in upper-division courses.

The minor may not include freshman composition or first-year courses in a foreign language (except for Greek, American Indian languages, the languages taught in the Oriental Studies Department, French 302b, Port. 202b., and Span. 202b), military aerospace studies,
military science, naval science, or specified courses in physical education. Also, courses selected for the minor must be approved by the Office of Academic Services if the minor is to be used to satisfy a general education requirement other than the humanities requirement.

DOUBLE MAJOR AND SECOND DEGREES

Double Majors. Students may graduate with more than one major by completing all requirements for both majors. Although there are restrictions on the degree and subject combinations (e.g., both majors must apply to the same degree — i.e., B.A., B.S., B.F.A., or B.M.), usually the minor area of study is modified to meet departmental major requirements. Because of the complexity of the double major, close contact with the advisers in both departments is necessary to ensure that all requirements are being met. The minimum units required for graduation remain the same as for a single major, with at least fifteen units of course work in residence required for each major.

Second Degrees. A second degree may be earned through the completion of no fewer than thirty units in addition to those units required for the first degree. The second degree does not have to be of the same title (e.g., it may be a B.A. and B.S.; a B.S. and a B.F.A.; etc.). However, all of the general education and major requirements for the second degree must be met.

The deans' offices have additional information about options and limitations regarding these programs.

INDIVIDUAL STUDIES

A department may provide its majors with the opportunity to combine learning with non-classroom experience through preceptorships, internships, practicums, or independent study. Such experiences should be carefully planned to achieve specific educational objectives. Individual studies may not be used to fulfill the college's general education requirements, and a department may have a limit on the number of units which may be credited toward the major or the degree. However, the college encourages students to consider enrollment in individual studies. Additional details are in the section of this catalog titled "University-wide 'House Numbered' Courses."

CORRESPONDECE STUDY

With advance approval of a dean of the College of Arts and Sciences, students may enroll in correspondence study offered by the University's Division of Continuing Education. Credit earned in correspondence study courses is not considered residence credit at the University of Arizona, and the grades received will not be averaged into the cumulative grade-point average.

A maximum of sixty units toward a bachelor's degree may be earned through correspondence instruction and/or credit by examination.

GRADUATE DEGREE PROGRAMS

Curricula leading to master's and/or doctoral degrees are offered by most of the departments in the College of Arts and Sciences. Consult the Graduate College section of this catalog for admission requirements. Departments with such programs have graduate academic advisers to provide consultation regarding the discipline's advanced level studies and departmental admission requirements.
HONORS, SCHOLARSHIPS, AND PROFESSIONAL AND HONORARY ASSOCIATIONS

DEAN'S HONOR LIST — Each semester the Dean's List honors students who have achieved 3.5000 grade averages while carrying fifteen units or more for letter grade and credit.

HONORABLE MENTION LIST — Each semester this list honors students who have met the 3.5000 grade average standard while completing twelve through fourteen units for letter grade and credit.

These lists are posted by the deans' offices and each fall individual certificates of recognition are awarded in conjunction with the annual Honors Convocation. At that occasion, students who have attained a 4.0000 grade average on a minimum of fifteen graded units of work taken each semester during the two semesters of the regular academic year will receive an engraved silver bowl.

SCHOLARSHIPS — Numerous scholarships and awards are made each year by the departments and college to academically qualified students. Further, the Office of Student Financial Aid has a comprehensive program of scholarships and financial aid.

HONORS PROGRAM — The Faculties and departments of the college participate in and strongly support the University Honors Program. To encourage and recognize academic work of great depth and originality by undergraduates, virtually every department in the College of Arts and Sciences supplements its regular degree program with honors courses. Honors courses are specially designated by a department and carry an "H" after the course number.

HONOR SOCIETIES, PROFESSIONAL AND HONORARY ASSOCIATIONS:

Faculty of Fine Arts
- American Guild of Organists—Student Chapter
- American Musicological Society—Student Chapter
- Dancer's Consortium
- International Society for Music Education—Student Chapter
- Kappa Kappa Psi—Band Fraternity for Men
- Music Educators National Conference—Student Chapter
- Music Teachers National Association—Student Chapter
- National Student Speech-Language-Hearing Association
- Phi Mu Alpha Sinfonia Fraternity of America—Men's National Professional Music Society
- Pi Kappa Delta—National Speech Honorary
- Sigma Alpha Iota—Women's National Music Honorary
- Tau Beta Sigma—Band Fraternity for Women
- Theta Alpha Phi—Honorary Fraternity for Theatre Arts

Faculty of Humanities
- Delta Phi Alpha National Honor—German
- Dobro Slovo—Russian and Slavic Languages
- Phi Beta Kappa—National Honor Society
- Sigma Delta Pi—Spanish and Portuguese

Faculty of Science
- Alpha Phi Sigma—Chemistry
- American Geophysical Union—Atmospheric Sciences
- American Meteorological Society—Atmospheric Sciences
- Phi Beta Kappa—National Honor Society
- Pi Mu Epsilon—Mathematics
- Sigma Gamma Epsilon—Geosciences
- Sigma Xi—Atmospheric Sciences
- Society of Earth Science Students—Geosciences
- Society of Physics Students—Physics
- Society of Women Engineers Student Chapter—Statistics
Faculty of Social and Behavioral Sciences
Alpha Kappa Delta (Alpha Chapter)—Sociology
Gamma Theta Upsilon—Geography and Regional Development
Kappa Tau Alpha—Journalism
Latin American Studies Association—Latin American Area Center
Phi Alpha Theta—History
Phi Beta Kappa—National Honor Society
Phi Sigma Alpha—Political Science
Psi Chi National Honorary—Psychology
Society of Professional Journalists—Student Chapter

ACADEMIC PROCEDURES

MAXIMUM ACADEMIC LOAD — The normal maximum load is eighteen units. Students wishing to exceed this limit must get written permission from a dean prior to registration. Freshmen and students on probation may not exceed the eighteen-unit limit. All courses, including those taken for credit, non-credit, by correspondence, or at another college or university are counted in determining the maximum academic load.

DROP/ADD PROCEDURE — The college adheres closely to the University's change of schedule procedures, which include the addition of a class only through the last day of registration for credit. For additional information about these procedures, see "Registration Adjustments" in the Registration section of this catalog, or consult the deans' offices.

PASS-FAIL OPTION — The purpose of the pass-fail option is to allow students to take course work according to their interests without requiring the assignment of a letter grade. For information regarding restrictions on registration for pass-fail, see "Pass-Fail Option" in the Academic Guidelines section of this catalog.

PROBATION AND DISQUALIFICATION — The deans of the college monitor closely those students who fail to meet the University required grade-point averages for good academic standing. Students failing to maintain those grade-point averages will be placed on academic probation and risk disqualification. Under no circumstances will a student with two disqualifications be considered for readmission for at least a year. For additional information, see "Scholastic Requirements" and "Academic Probation and Disqualification" in the Academic Guidelines section of this catalog.

PREPROFESSIONAL PROGRAMS

Preprofessional programs are not majors in themselves; that is, there are no majors called "premedical," "predental," "prelaw," etc. In each program, the student must select an established major in this college or in one of the other colleges.

Students embarking upon other preprofessional programs which use Arts and Sciences course work (such as education, nursing, medical technology, pharmacy, veterinary medicine) should review relevant sections of this catalog and seek advice from representatives of the schools or colleges in which these programs are offered.

PREHEALTH PROFESSIONS (PHP) APPLICANT INFORMATION FOR PREMEDICAL AND PREDENTAL STUDENTS — The Prehealth Professions Office has been established in the College of Arts and Sciences to assist the student in qualifying for admission to the professional schools of dentistry and medicine. From the outset of study at the University, it is important for students to consult advisers in this office, which is within the Office of Academic Services, Modern Languages, Room 347.

Student File. This file must be organized during September of the student's junior year. To initiate the process, the following information should be submitted to the PHP secretary: (1) Registration form (available from PHP secretary); (2) Essay describing reasons for particu
lar professional career objectives; and (3) Copies of unofficial transcripts including most recently completed semester. Eventually the file will also include a Prehealth Professional Interview Committee report and letters of recommendation.

**The Committee.** Most professional schools request an undergraduate committee interview report as part of the application. The PHP Interview Committee is made up of selected senior faculty from throughout the University. In subcommittees, they interview preprofessional students during the spring semester of the junior year. The committee’s report, the student’s essay, university activities, grades, and letters of recommendation form the professional schools’ impression of the applicant. Formal application to medical schools through the American Medical College Application Service is completed during the summer between the junior and senior years.

**PROFESSIONAL STUDENT EXCHANGE PROGRAM** — This program, sponsored by the Western Interstate Commission for Higher Education and administered by the Arizona Board of Regents, enables Arizona students to enroll in one of five professional programs in other states at essentially the same expense to the student as residents of the state in which the school is located. The five programs are dentistry, occupational therapy, veterinary science, optometry, and osteopathy. The osteopathy program is through a separate (bilateral) contract with an osteopathic college. To qualify for the programs, students must maintain at least average grades in their preprofessional work and must have been legal residents of Arizona for the last five years prior to entrance into the professional school. Students receiving such assistance are required to return to Arizona to practice, or to repay a portion of the funds expended in their behalf, including interest. For further information, the student is referred to the Office of Academic Services, Modern Languages, Room 347.

**Dentistry**

In many of the sixty schools and colleges of dentistry, the stated “formal minimum” predental training is two years and the “generally acceptable minimum” is three or four years. The vast majority of those accepted into dental school, however, have a bachelor’s degree. Basic minimum requirements include one year each of biology, English, inorganic chemistry, organic chemistry, physics, and usually mathematics. Additional suggested or required course work varies considerably from a “broad liberal arts background” (courses in psychology are often mentioned) to art, sculpturing, and a metal machine shop. A student planning to apply for admission to a particular dental school should refer to Admission Requirements of U.S. and Canadian Dental Schools, published annually by the American Association of Dental Schools, to insure that the specific requirements are met.

Evaluation is based upon the entire academic record, the Dental Admission Test (DAT), extracurricular activities, letters of recommendation, and personal interviews. Although no major is preferred, it is important that the student excel in the major. The DAT must be taken no later than the fall of the year preceding that in which the applicant plans to enter dental school.

**Law**

A broad liberal education is considered an excellent preparation for a career in law, and it is generally accepted that there is no preferred major for such preparation. Every good lawyer must be highly skilled in the use of language and have a deep understanding of social, political, and economic institutions.

The two most important law school admission criteria are the student’s undergraduate grade-point average and Law School Admission Test (LSAT) scores. The Prelaw Handbook is an excellent source of information for prelaw students. Students are also encouraged to read the College of Law section of this catalog. Students interested in a prelaw program of studies should seek the guidance of a prelaw adviser no later than their sophomore year.
**Medicine**

Although colleges of medicine differ in their specific entrance requirements, all emphasize a well-balanced cultural education, strong foundations in the natural sciences and mathematics, highly developed communication skills, a solid background in the social sciences and humanities and outstanding personal characteristics. Most of them require a bachelor's degree and all of them specify minimum requirements. A student planning to apply for admission to a particular medical college should refer to *Medical School Admissions Requirements*, published annually by the Association of American Medical Colleges, to insure that the specific requirements are met.

Evaluation is based upon the entire academic record, the Medical College Admission Test (MCAT), extracurricular activities, letters of recommendation, and personal interviews. Although no major is preferred, it is important that the student excel in the major.

The University of Arizona College of Medicine has established the following minimum requirements:

a. Successful completion of ninety semester units (thirty upper division) or 135 quarter units (45 upper division) at an approved college or university;

b. Successful completion of two full semesters (or three quarters) in each of the following areas: general chemistry, organic chemistry, physics, general biology or zoology, and English;

c. Completion of the MCAT no later than the year preceding that in which the applicant plans to enter medical school.

In addition, applicants cannot be considered unless they are residents of Arizona, Alaska, Montana or Wyoming, which participate in the WICHE program.

**Optometry**

Entrance requirements for the thirteen optometric schools and colleges vary slightly, but the minimum preoptometric requirements consist of two years of undergraduate course work (sixty units), including one year each of English, general biology or zoology, inorganic chemistry and physics. Most of the institutions also require one semester each of organic chemistry and calculus and one year of psychology. The science courses should have laboratories and should be of preprofessional caliber. Students considering the study of optometry should contact either the American Optometric Association or the schools they intend to enter regarding specific requirements for admission. All applicants are required to take the Optometric College Admissions Test (OCAT), offered twice a year.

**Podiatry**

There are five colleges of podiatric medicine in the United States. Although all require at least sixty units (ninety quarter units) of undergraduate course work, about 98 percent of the students selected have completed three or more years of prepodiatric education, and about ninety percent have a bachelor's degree. Minimum prepodiatric requirements consist of one year each of English, general biology or zoology, and inorganic chemistry; one semester each of organic chemistry and physics; and a variable number of other courses (including, in some cases, additional chemistry, physics, and mathematics), particularly in the humanities and social sciences. The science courses should have laboratories and be of preprofessional caliber. Students considering the study of podiatry should contact either the American Association of Colleges of Podiatric Medicine or the schools they intend to enter regarding specific requirements for admission. The colleges of podiatric medicine have adopted the new Medical College Admission Test (MCAT) as an entrance requirement for applicants.
SPECIAL PROGRAMS

Cooperative Education

The Cooperative Education Program combines academic course work with one or more periods of closely supervised work experience related directly to the student's academic and career goals. While exploring a possible career, students develop additional interpersonal and teamwork skills, and benefit from job training, a salary, and professional contacts. Cooperative education information is available in the deans' offices or in the Cooperative Education Program Office in the Harvill Building.

Cooperative Program in International Management Careers
College of Arts and Sciences/American Graduate School of International Management

The College of Arts and Sciences and the American Graduate School of International Management (Thunderbird) offer a cooperative program which combines liberal with professional education as preparation for an international career.

The college provides academic advising to undergraduates in preparation for the intensive graduate courses at Thunderbird. A complete preparatory program includes course work in foreign languages, related international and cultural studies, statistics, mathematics, computer science, English business and technical writing, finance, and upper-division courses in a business specialization area. Matriculation in upper-division business courses requires a grade-point average of 2.2500. The major may be selected in consultation with an adviser in the Office of Academic Services.

Business or public service experience makes a valuable contribution to the overall success of the graduate, as does extended overseas experience. Students taking technical degrees can combine those skills with the specific curriculum of AGSIM.

Exceptional opportunities are open to both U.S. and foreign students who demonstrate maturity, leadership capabilities, and preparation in various phases of multinational business or international affairs. At this time, women make up more than 27 percent of the enrollment.

Recommended courses in business have been combined with the Thunderbird preparatory program and the college's requirement of a minor. Consult an adviser in the Office of Academic Services, Modern Languages Building, Room 347, for additional information.

East Asia Study Center and Near Eastern Center

The Centers coordinate teaching and research relating to the Middle East and East Asia in the disciplines of anthropology, art, economics, geography, history, literature, philosophy, political science, and Oriental languages and cultures. Several interdisciplinary programs of study, where Oriental languages and area instruction represent a strong concentration, are found in curricula leading to the Bachelor of Arts degree with a major in Oriental Studies. The Master of Arts and the Doctor of Philosophy degrees are also offered. Descriptions of the major and its various programs of study are included under "Oriental Studies" in the Departments and Courses of Instruction section of this catalog.

STUDY ABROAD — The University is a member of the Center for Arabic Studies Abroad and of the American Research Center in Egypt, both of which offer selected undergraduate and graduate students opportunities for intensive study of Arabic language, literature, and culture in Cairo, Egypt. The University also participates in a graduate exchange program with the National Taiwan and the Cheng Kung Universities in Taiwan. The University is a member of the American School of Oriental Research, which has student programs in ancient Near Eastern studies, Biblical studies, and archaeology at its centers in Nicosia, Jerusalem, and Amman.
Foreign Service Careers

The United States Foreign Service is America's diplomatic, consular, commercial and overseas cultural and information service. Acceptance into the service is based on a written and oral examination. The written examination consists of seven areas: English usage, economics, administration, political science, consular information, cultural affairs and commerce. Students pursuing a foreign service career should obtain as broad an educational background as possible. Course work should include, but not be limited to: (1) English language skills with stress placed on an ability to speak and write persuasively, and to analyze and defend policies and proposals; (2) Foreign language competency in at least one language; and (3) Knowledge in economics, political science (particularly international relations), area studies in geography and history of a chosen area, and U.S. government and history.

Students interested in more information should consult with the foreign service adviser in the Political Science Department or an academic adviser in the Office of Academic Services.

Social Services

Students interested in professional careers in social work should plan on study through the master's degree. Because each graduate school of social work has its own statement of requirements, students should consult an academic adviser in the Office of Academic Services, examine catalogs from the graduate schools of social work, and contact those schools. Although the college has no degree program in social work, it does offer specific curricula oriented toward the common educational goals of the profession. In addition, ongoing volunteer work within the various social services provides valuable experience with agencies, organizational structures, social policies and programs, the client, and the community.

Study Abroad

The college encourages students toward variety and diversity in pursuing degree programs. Foreign study is one way to gain such diversity through experiencing the language, culture, and history of another country. Study abroad is available through specific University of Arizona programs in France, England, Mexico, Italy, Brazil, the Middle East, China, Japan, and Taiwan, plus programs from major academic institutions in many other countries.

Prior to study at a foreign institution, a student must follow four steps to insure that the study experience, course work, and credits earned are meritorious and applicable within a University of Arizona degree program: (1) Consult with the director of the International Studies Office in the Nugent Building for information about academic institutions or study plans abroad; (2) Consult with an academic adviser to review academic progress and to ascertain how the planned foreign study will contribute to it; (3) Consult with the Foreign Evaluation Office, Administration, Room 302, to confirm that the planned foreign course work will be accepted in transfer by the University; and then (4) Consult again with the academic adviser to determine how course options will be applied to the degree sought.

Written confirmation of the application of foreign studies to the student's degree program must be placed with the student's college records in the dean's office; a special form is available for this record. The University will award credit only if an official transcript from the foreign university is received by the University of Arizona following the student's return.

3/2 Program: College of Arts and Sciences and College of Business and Public Administration

The 3/2 Program is based upon a cooperative academic plan developed by the College of Arts and Sciences and the College of Business and Public Administration and approved by the Graduate College.

The 3/2 Program offers highly qualified students in the College of Arts and Sciences the opportunity to earn both an undergraduate and the Master's of Business Administration degrees in five years. The student must first complete three years of course work, meeting
general education requirements, selected prerequisite courses and the majority of the requirements of the major. The GMAT is taken, and application to the 3/2 Program is made during the second semester of the junior year. Qualified students are accepted for the senior year with continued study within the major and in 30 units of designated MBA courses. The 30 MBA units are used within the undergraduate degree program as the minor, as elective units, or as excess units. Upon completion of all degree requirements, the baccalaureate degree is awarded. Admission to the Graduate College to complete the M.B.A. is based upon compliance with Graduate College requirements and procedures, and a grade-point average of 3.0000 in the 30 units of completed M.B.A. classes.

Additional information is available through advisers in the Office of Academic Services of the College of Arts and Sciences and in the Graduate Professional Programs Office, College of Business and Public Administration.
The college offers professional education in business and public administration. Its purpose is to prepare men and women for managerial and professional positions in the public and private sectors. The college also provides continuing educational opportunities for those seeking to improve their positions. Faculty of the college are actively engaged in research on a wide range of economic and administrative topics.

The college has been a member of the American Assembly of Collegiate Schools of Business since 1948, and its undergraduate and graduate curricula in business are accredited by the Assembly. The graduate program in planning is recognized by the American Planning Association. Also, the college's graduate program in public administration is recognized by the National Association of Schools of Public Affairs and Administration.

The college faculty offers a rich combination of experience in professional management problems and practices, scholarship, teaching and research. Many members serve as consultants in industry, government, health care, education and transportation. The faculty averages $1 million annually in research grants and contributions. Several faculty members have authored texts which are widely used in management education throughout the U.S. In addition, the faculty is well represented on the editorial boards of major professional publications.

The college includes the following departments: Accounting; Economics; Finance and Real Estate; Management and Policy; Management Information Systems; and Marketing.

DEGREE PROGRAMS

UNDERGRADUATE DEGREES — Two undergraduate degrees are offered by the college: the Bachelor of Science in Business Administration (B.S.B.A.), and the Bachelor of Science in Public Administration (B.S.P.A.). The structure and purposes of the two degrees are similar. Both provide a strong foundation in the arts and sciences in the freshman and sophomore years. Under both programs, the common body of knowledge necessary for effective management is thoroughly explored. Through the major, a comprehensive exposure to a particular field is obtained. Finally, there is the opportunity to enroll throughout the undergraduate years in courses outside the field of administration.

UNDERGRADUATE MAJORS — Within the B.S.B.A. degree program, students may select a major in accounting, business economics, finance, general business administration, management information systems, marketing, operations management, personnel management, and real estate.

Within the B.S.P.A. degree program, students may select a major in criminal justice administration, health services administration, human services administration, public management, or public recreation administration.

Students may elect to take a second major from among those offered in their degree program. The general business administration major, however, may not be combined with another major. Students selecting a second major must complete all the stipulated requirements for each.

The majors offered in the college are more fully described below. Minor fields are not available in the college.

Students interested in the Cooperative Program in International Management Careers should see “Special Programs” in the College of Arts and Sciences section of this catalog.

GRADUATE DEGREES — The Graduate College, through the College of Business and Public Administration, offers a number of graduate degrees for qualified students. These include the Master of Business Administration; Master of Public Administration; Master of Accounting;
Master of Arts degree with major in economics; and Master of Science degree with majors in finance, management and policy, management information systems and marketing. Also, the Graduate College, through the Graduate Committee on Planning, offers the Master of Science degree with a major in planning.

The Doctor of Philosophy degree is offered with majors in business administration and economics.

Detailed information on these programs is contained in the Graduate Catalog.

STUDENT ADVISEMENT

Students new to the college, who either are just entering the University or are transferring into the BPA College, should come to the Undergraduate Programs Office, BPA 108, for information and academic advising. Students with prior college-level work should bring transcripts of that work.

Freshmen, sophomores and all general business administration majors are counseled by college advisers in the Undergraduate Programs Office.

Juniors and seniors in all majors except general business administration are advised through the department offering the major. Students should contact the department office to obtain a major adviser.

Information on all college degree programs, policies and requirements can be obtained at the Undergraduate Programs Office.

SPECIAL ADMISSION REQUIREMENTS

Incoming freshmen should present credit in mathematics as follows: one unit of elementary algebra, ½ unit of intermediate algebra, and ½ unit of advanced algebra.

Transfer students from community colleges must meet all freshman and sophomore requirements as shown below for the degree they wish to pursue, either by acceptable transfer credit or course work for university credit.

TRANSFER CREDITS

GENERAL STATEMENT — Undergraduate programs in business administration in universities normally concentrate the professional courses in the last two years of a four-year program. Only a limited amount of work in business courses is offered below the junior year. The objective of this policy is to permit the student to acquire a foundation of work in the basic arts and sciences as a prerequisite for professional courses in business.

All business programs accredited by the American Assembly of Collegiate Schools of Business require the students to take a minimum of 40% of the four years' work in the arts and sciences, including work in mathematics, social science, humanities and the natural sciences. Students desiring a four-year degree are advised to take a majority of their work during the first two years in the arts and sciences, including a strong background in mathematics.

Students planning to take their first two years of work at a junior college or at another four-year institution should take only those courses in business that are offered as freshman- or sophomore-level courses at any of the three state universities. These lower-division courses are numbered 1 through 299. A maximum of thirty hours of business and economics courses from community colleges will be accepted toward a bachelor's degree in business administration.

Professional business courses taught at the junior or senior year in the three state universities may not be completed at a two-year college for transfer credit in the business core or major (the introductory course in business law will be accepted as an exception to this policy). Such courses may be utilized in the free elective category subject to the thirty-hour limitation. Courses taught as vocational or career classes at the community colleges which are
not taught in the colleges of business at any of the three state universities will not be accepted for credit toward a bachelor's degree. Courses taught in the upper-division business core at the three state universities must be completed at the degree-granting institution unless transferred from an accredited four-year school.

Only seventy-two units from a community college may be applied toward a BPA College degree program.

**SUGGESTED COURSES** — The following general pattern of courses is recommended for students completing their first two years' work in a junior college and planning to transfer to one of Arizona's universities without loss of credit:

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<td>Accounting 6</td>
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<td>Economics 6</td>
<td>Mathematics 2</td>
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<td>Quantitative Analysis &amp; Statistics 3</td>
<td>Science 1</td>
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<td>Business Law 3</td>
<td>Humanities 1</td>
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<td>Lower-Division Business Electives 12</td>
<td>Social Science 1</td>
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<td>Electives</td>
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**UPPER-DIVISION BUSINESS COURSES** — Normally, the college accepts transfer credit in upper-division courses only from schools or colleges whose programs are accredited by the American Assembly of Collegiate Schools of Business.

Policies regarding transferable units vary among universities. For further information, see “Transfer Students” in the Admission to the University section of this catalog.

**ADVANCED STANDING**

Upper-division (300 and 400 level) courses offered by the departments in the BPA College during the fall and spring terms are open only to those students who either have been admitted to Advanced Standing in the college or qualify for a catalog exemption or the exempt programs clause. Any ineligible students who have inadvertently enrolled in such restricted courses will have their enrollments cancelled. Students will be provided written evidence of their eligibility which will need to be presented in order to register for these classes.

Any undergraduate students who intend to preregister or register for 300-and/or 400-level courses offered by the departments in the BPA College must make application and have their eligibility established. Information and application forms are available in the Undergraduate Programs Office, BPA 108. Students must provide transcripts for each college or university attended as part of their application.

Students having attained Advanced Standing or catalog exemption status, who are absent from the University for a regular semester or longer, regardless of reason, must reapply to have their eligibility revalidated upon readmission to the University.

**ADVANCED STANDING REQUIREMENTS** — Eligibility requirements for Advanced Standing are as follows.

**BPA Students:** Applicants must complete (a) at least 56 units; (b) all lower-division requirements (only pre-major requirements are excepted); and (c) attain an overall grade-point average of 2.25 or better for all coursework undertaken at the college and university level. Lack of Advanced Standing only restricts students from the 300- and 400-level courses offered by the departments in the BPA College.

Students who are currently enrolled in coursework that will complete all requirements for Advanced Standing and who wish to preregister for upper-division BPA courses in the following semester may apply for conditional Advanced Standing on a one-time basis. Conversion to regular Advanced Standing will be made upon successful completion of the in-process coursework. However, if all requirements have not been met prior to the beginning of the subsequent term, the conditional admittance will be revoked and any registrations in 300-and 400-level BPA courses cancelled.
Non-BPA Students: Those students in other colleges and divisions of the University who wish to register for 300- and 400-level BPA courses, either as electives or as part of a program minor, can attain Advanced Standing status in the college if they have (a) at least junior standing in their own colleges, and (b) a cumulative grade-point average of 2.25 or higher in all college and university level work undertaken. These students must also meet stated prerequisites or be otherwise eligible for the specific courses selected.

CATALOG EXEMPTION — To qualify for a catalog exemption, a student must be eligible for and planning to graduate under the 1979-81 or earlier General Catalog.

EXEMPT PROGRAMS CLAUSE — To qualify for the exempt programs clause, students must be in a degree program outside the BPA College which has specific catalog-designated and approved upper-division BPA course requirements in the major. Such students will be given permission to enroll on a course-by-course basis each semester upon joint agreement of the dean of each student’s college and the College of Business and Public Administration. Students must apply and be approved each semester.

To be eligible under this clause, students must (a) have a university grade-point average of at least 2.0000 but less than 2.250, (b) have at least junior standing in their own colleges, and (c) have been enrolled in their major program for at least one semester prior to submission of the request to enroll in upper-division BPA classes. Such students also must meet stated prerequisites or be otherwise eligible for the designated courses.

PRESCRIBED CURRICULUM FOR BACHELOR OF SCIENCE IN BUSINESS ADMINISTRATION

A student is required to earn 125 units for the B.S.B.A. degree. These include (1) at least 56 units of the specified lower-division requirements; (2) an additional 15 units, of which nine must be upper-division, in non-business subjects beyond those taken to fulfill the lower-division requirements; (3) 21 units of required professional courses; (4) a major of at least 15 units in one of the major fields of business administration; (5) six units of international dimension coursework selected from the approved options list; and (6) sufficient free electives to meet the minimum 125 total unit requirement for graduation. The number of units of free electives required varies because of pre-major requirements and other options selected. Free electives may include any university course or acceptable college-level credit.

Lower-Division Requirements

These courses are required during the freshman and sophomore years. Students must adhere to course prerequisites as indicated in the catalog.

<table>
<thead>
<tr>
<th>Courses</th>
<th>Units</th>
<th>Yr. Normally Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl. 101 or 103</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Engl. 102 or 104</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Pol. 102</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Math. 119</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Math. 123</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>M.I.S. 111</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Social Science</td>
<td>6</td>
<td>Fr.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selected from anth., psyc., soc., geog. (102a, 102b, 151, 207 and 275 only).</td>
</tr>
<tr>
<td>Natural Science</td>
<td>6-8</td>
<td>Fr. or So.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phil. 112 and one semester of natural sci. or two semesters of natural sci. selected from astr., atmo., chem., ecol., geog. (103a, 103b, 104a, and 104b only), geos., hydr., m.c.b., micr., phys.</td>
</tr>
<tr>
<td>Humanities or Foreign Language</td>
<td>8-10</td>
<td>Fr. or So.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fulfilled by two semesters of the same foreign language or by humanities course options selected from list available in BPA 106.</td>
</tr>
<tr>
<td>Acct. 200</td>
<td>3</td>
<td>So.</td>
</tr>
<tr>
<td>Acct. 210</td>
<td>3</td>
<td>So.</td>
</tr>
<tr>
<td>Econ. 201a and 201b, or</td>
<td>6</td>
<td>So.</td>
</tr>
<tr>
<td>Econ. 210 and Econ. 300 (in junior year).</td>
<td></td>
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</tr>
</tbody>
</table>
Non-Business Requirements

All candidates for the degree must complete 15 units in non-business courses beyond those taken to fulfill the lower-division requirements above. At least nine of the units must be in courses numbered 300 or above.

These units may be chosen from any University offering, but not from the Departments of Accounting, Finance and Real Estate, Economics, Management and Policy, Management Information Systems, and Marketing. Courses in the college crosslisted with departments in other colleges may be included as non-business courses if not specified as part of the student's major.

No more than six units of military science, naval science, and military aerospace studies may be used to meet this requirement.

International Dimension Requirement

All candidates for the degree must complete six units in courses from the international dimension options list available in the Undergraduate Programs Office, BPA 108. The units selected may be used simultaneously to fulfill such other degree program requirements as social science, non-business electives, the major field, and free electives.

Required Professional Courses

All candidates for the degree must complete the professional courses listed below. These courses should be completed in the junior year, with the exception of the course in business policy which should be taken in the senior year. Advanced Standing is required for admission to these courses.

Econ 330.
Fin. 311.
M.A.P. 305, 320, and 373.
Mktg. 361.
Business policy. [option varies; see description of major fields]

MAJOR FIELDS AVAILABLE

Students declare one of the major fields of business administration upon enrollment. Any subsequent change in major is accomplished by completing a change-of-major form available in BPA 108.

The major consists of 15 units with additional units optional to the student. The grade-point average earned in the major must be 2.0000 or better to meet graduation requirements and includes all courses undertaken in the major, but does not include courses taken for the business policy option. Transfer students must offer at least six University of Arizona credit units toward the major with no more than nine units being transferred from other institutions.

The requirements for each major field in business administration are given below. BPA students will not be allowed credit for more than one policy course in their degree program. Advanced Standing is required for enrollment in all 300- and 400-level BPA courses.
Accounting

This major prepares students for diversified careers in the independent practice of public accounting, in controllership for business and government, and in general accounting management. All students planning to major in accounting must complete M.I.S. 121 before beginning the major. Accounting majors must take Acct. 310 and M.A.P. 471 or M.I.S. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete: Acct. 300a-300b.
(b) An additional nine units (three courses) must be selected from the following: Acct. 320, 401, 410, 422, 431, 461, 472.

Additional upper-division accounting courses may be taken by students who want further undergraduate education for career fields or for the Uniform C.P.A. Examination. Some states now require a five-year program to sit for the examination; for this and other career reasons, a five-year program leading to the Master of Accounting degree (see Graduate Catalog) may be necessary to achieve a student's objectives. Information concerning the legal requirements for taking the Uniform C.P.A. Examination may be obtained by writing the state board of accountancy in the capital city of the appropriate state. In Arizona the address is 3110 N. 19th Ave., 140, Phoenix, Arizona 85015.

Business Economics

This major is designed for those who wish to concentrate in economic analysis and to prepare themselves for such professional work in business firms, governmental agencies, private research, or consulting firms; or to enter college teaching following graduate study. Business economics majors must take Econ. 361 and M.A.P. 375 prior to beginning major courses, and Geog. 471, M.A.P. 471, M.I.S. 471, or Mktg. 471 to fulfill the business-policy requirement.

The major consists of fifteen units of economics, including Econ. 332, to be selected from the 300- and 400-level courses offered by the Department of Economics.

Finance

This major offers undergraduate preparation for careers or graduate work in corporate financial management, investment analysis, security brokerage, and investment or commercial banking. Finance majors must take Acct. 320 and M.A.P. 375 prior to beginning major courses, and Fin. 471 or M.A.P. 471 to fulfill the business policy requirement.

(a) All students in this major will complete: Fin. 412, 421, and 431
(b) Six additional units (two courses) will also be chosen from the following: Acct. 300b, 401; Econ. 332, 422, 442; Fin. 361, 362, 422; A.Ec. 313; M.A.P. 426.

General Business Administration

This major gives the student a broad knowledge of the principal areas of business administration. It prepares the graduate for a variety of careers (including intensive graduate study in business), and aims to educate generalists rather than specialists. General business administration majors must take M.A.P. 471 to fulfill the business-policy requirement.

The major consists of fifteen units. Students will select one three-unit 300- or 400-level course from each of five of the following seven areas: (1) accounting; (2) economics; (3) finance and real estate; (4) geography and regional development (305, 371, 379, 453, 456 or 461 only); (5) management and policy; (6) management information systems; and (7) marketing (364 and 366 may not be selected).

Management Information Systems

This major is designed for students with interest in establishing careers in the analysis, design, implementation, use and management of computerized information systems in an organizational environment.
All students planning to major in management information systems must complete M.I.S. 121 before beginning the major. M.I.S. majors must take M.I.S. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete M.I.S. 301, 307, 341, and 441.
(b) An additional three units (one course) must be selected from the following: M.I.S. 331, 421, 422, 451, and 461.

Materials describing career paths, recommended major courses, and suggested options for upper-division non-business electives are available in the M.I.S. office.

Marketing

The major offers undergraduate preparation for careers both in business and in non-profit organizations. Attention is given to understanding the changing wants of customers and the public; the development of products and services; pricing; distribution; promotion; planning, execution and control of marketing programs; and maintenance of satisfactory relationships with customers and the public. Marketing majors must complete M.A.P. 375 prior to beginning major courses, and Mktg. 471 to fulfill the business-policy requirement.

(a) All students in the major will complete Mktg. 440 and 450. (Mktg. 361, 440, and 450 should be taken as soon as one becomes eligible in order to ensure flexibility in selecting major courses.)
(b) Nine additional units (three courses) are to be selected from 400-level courses.

Operations Management

This major offers preparation for management careers in manufacturing and service operations. Emphasis is placed on operation and control of inventory systems, materials management, plant and project scheduling, and service design. Both quantitative and computer based techniques are used for specific applications in these areas.

The major is also useful for those who wish to understand more about the functioning of the production system of any organization. All students planning to major in operations management must complete M.I.S. 121 or 122 before beginning the major. Operations management major must take M.A.P. 471 to fulfill the business-policy requirement.

(a) All students in the major will complete M.A.P. 473a-473b.
(b) Nine additional units (three courses) will be completed from the following: M.A.P. 474, 476, 477; M.I.S. 301, 331, 421; S.I.E. 405, 462.

Personnel Management

This major is concerned with the recruiting, development, compensation, and utilization of human resources, and with the creation of constructive human relationships within modern organizations. Prospective majors are strongly urged to choose elective courses in psychology and sociology. Psyc. 101 should be elected in the freshman or sophomore years. Personnel management majors must complete M.A.P. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete M.A.P. 330 and 430.
(b) Nine additional units (three courses) must be selected from the following: Coun. 401; Econ. 382, 383, 386; Psyc. 450; Sp.C. 412a or 412b; M.A.P. 411, 413, 444, 479, 480.

Real Estate

This major, by providing a broad basic understanding of the legal, economic, social, and civic aspects of real property, prepares the student for a career in both the real estate profession and related industries. Real estate majors must take Acct. 320 and Fin. 261 before beginning major courses, and Geog. 471, M.A.P. 471 or Fin. 471 to fulfill the business-policy requirement.

(a) All students in this major will complete Fin. 361, 362, 461.
(b) Six additional units (two courses) must be selected from the following: Econ. 435, 436; Fin. 251, 463, 465; Geog. 379; M.A.P. 426; Ping. 465.
Regional Development

This major is designed for those interested in careers in the field of regional development, i.e., conducting research in problems of local and regional growth and development and in devising and supervising public or private programs for regional development. The regional development major is also appropriate for those who anticipate graduate study in urban and regional planning and development. Regional development majors must complete Geog. 471 to fulfill the business-policy requirement.

(a) All students in this major must complete Geog. 371, 379 or 456, and 453.
(b) Six additional units (two courses) must be selected from the following: Econ. 484; Geog. 257, 305, 457, 461, 481, 485; Ping. 300.

At the time of catalog printing, this major was undergoing modification. For current information, contact the Department of Geography and Regional Development.

PRESCRIBED CURRICULUM FOR BACHELOR OF SCIENCE IN PUBLIC ADMINISTRATION

A student is required to earn 125 units for the B.S.P.A. degree. These include (1) at least 62 units of the specified lower-division requirements; (2) nine units of upper-division courses offered outside the College of Business and Public Administration; (3) 18 units of required professional courses; (4) a major totaling 21 units that consists of 12 units of restricted options in a major field, and nine units of required courses and restricted options in a management emphasis area; and (5) sufficient free electives to meet the minimum 125 total unit requirements for graduation. The number of units of free electives required varies depending upon options selected. Free electives may include any university credit course or acceptable college-level credit.

Lower-Division Requirements

These courses are required during the freshman and sophomore years. Students must adhere to course prerequisites as indicated in this catalog.

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<td>Fr.</td>
</tr>
<tr>
<td>Engl. 101 or 103</td>
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<td>Fr.</td>
</tr>
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<tr>
<td>Pol. 102</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Pol. 103</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Math. 119*</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Math. 123*</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>M.I.S. 111</td>
<td>3</td>
<td>Fr.</td>
</tr>
<tr>
<td>Social Science</td>
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<tr>
<td>Natural Science</td>
<td>6-8</td>
<td>Fr. or So.</td>
</tr>
<tr>
<td>Phil. 112 and one semester of natural science, or two semesters of natural science selected from astr., atmo., chem., ecol., geog. (103a, 103b, 104a and 104b only), geos., hydr., m.c.b., micr., phys.</td>
<td></td>
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<tr>
<td>Humanities and Foreign Language</td>
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<td>Fr. or So.</td>
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<tr>
<td>Fulfilled by two semesters of the same foreign language or by humanities course options selected from list available in BPA 108.</td>
<td></td>
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<tr>
<td>M.A.P. 204**</td>
<td>3</td>
<td>So.</td>
</tr>
<tr>
<td>Acct. 200</td>
<td>3</td>
<td>So.</td>
</tr>
<tr>
<td>Acct. 272</td>
<td>3</td>
<td>So.</td>
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<tr>
<td>Econ. 201a and 210b</td>
<td>6</td>
<td>So.</td>
</tr>
<tr>
<td>or Econ. 210, and either Econ. 217 or Econ. 300 (in junior year).</td>
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<tr>
<td>Sp.C. 112</td>
<td>3</td>
<td>So.</td>
</tr>
<tr>
<td>M.A.P. 275</td>
<td>3</td>
<td>So.</td>
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</tbody>
</table>

*The math. readiness test, given prior to registration periods, is used to determine math. placement and the student's readiness for Math. 119 or 123. College algebra or two entrance units of high school algebra are prerequisites for Math. 119 and 123.

**To be taken prior to M.A.P. 275.
Non-Business Upper-Division Requirement

The student must complete nine units at the upper-division level in courses offered outside the Collège of Business and Public Administration.

Required Professional Courses

All candidates for the degree must complete the professional courses listed below. These courses generally should be completed in the junior year with exception of M.A.P. 472, which should be taken in the senior year. Advanced Standing is required for admission to the 300- and 400-level BPA courses.

M.A.P. 305
M.A.P. 373
M.A.P. 410a
Econ. 435
Pol. 474
M.A.P. 472

MAJOR FIELDS AVAILABLE

Students declare one of the major fields of public administration upon enrollment. Any subsequent change in major is accomplished by completing a change-of-major form available in BPA 108.

The major consists of 12 units of restricted options in a major field plus 9 units of required courses and restricted options in a management emphasis area. The grade-point average earned in the major must be 2.0000 or better to meet graduation requirements and includes all courses undertaken in the major. Transfer students must offer at least 12 University of Arizona credit units toward the major with no more than 9 units being transferred from other institutions.

The requirements for each major field in public administration are given below. Advanced Standing is required for enrollment in all 300- and 400-level BPA courses.

Public Management

This major, which should be selected by all B.S.P.A. students except those with firm preferences for other specific fields, prepares students for administrative positions in government and quasi-public agencies. Graduates of the program may choose to enter policy areas of government, defense, manpower, transportation, housing, environment, energy, education, and other fields through entry-level positions in a variety of areas including program analysis, research and evaluation, budgeting and finance, personnel, and public information. The public management major also prepares students for graduate study in law, in specialized planning and administrative fields, or in public policy and administration.

(a) All students in this major will complete 12 units from M.A.P. 330, 401, 413, 475, 478.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below. Some public management major required courses overlap with courses in the management emphasis areas. If this occurs, students selecting these courses cannot use them to fulfill the management emphasis area requirement. Substitutions must be approved by the student's major advisor.

Criminal Justice Administration

This major prepares students for operational and administrative responsibilities in courts, corrections and police work, as well as for graduate study in law or in the administration of justice.

(a) All students in this major will complete M.A.P. 331, 332 and two of the following: M.A.P. 337, 431, 436.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.
Health Services Administration

This major is appropriate for students desiring careers in the planning and implementation of national, state, or local health policies, programs and services. Positions may involve hospital administration, as well as the management of public or volunteer health agencies and medical care services. Long-term care administration, with special reference to the aged, is offered as part of this major. Students in health services administration may also prepare for graduate study in health and allied professions.

(a) All students in this major will complete 12 units from M.A.P. 354, 454, 455, 456; Econ. 487.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.

Human Services Administration

This major prepares students to exercise operational skills and administrative responsibility in human service agencies, institutions, and organizations. In developing management skills in the human service policy area, this major is effective preparation for entry-level positions and for graduate study in such fields as social work, social planning, and human services administration.

(a) All students in this major will complete 12 units from M.A.P. 348, 360, 454, 463, 466.
(b) Nine additional units (three courses) must be selected from the required courses of one of the management emphasis areas listed below.

Public Recreation Administration

At the time of catalog printing this major was undergoing modification. For current information, contact the Undergraduate Programs Office, BPA 108.

Management Emphasis Areas

To complete any of the majors identified above, except public recreation administration, the student must also complete the requirements of one of the management emphasis areas described below. Options available in the management emphasis areas are operations management, human resources management, and policy analysis and strategic planning.

OPERATIONS MANAGEMENT — All students choosing this management emphasis area will complete:

(a) M.A.P 476, 478.
(b) Three units of course work selected from M.A.P. 474, 479. Three units of other course work may be substituted with approval of the student's major advisor.

HUMAN RESOURCES MANAGEMENT — All students choosing this management emphasis area will complete:

(a) M.A.P. 330, 430.
(b) Three units of course work selected from M.A.P. 411, 413, 444, 479, 480; Econ. 382, 383, 386; Coun. 401; Psyc. 450.

POLICY ANALYSIS AND STRATEGIC PLANNING — All students choosing this management emphasis area will complete:

(a) M.A.P. 401, 405.
(b) Three units of course work selected from M.A.P. 410b; Econ. 436; Pol. 406, 407, 480; Mktg. 470.

ENTREPRENEURIAL STUDIES PROGRAM

Sponsored by the Karl Eller Center for the Study of the Private Market Economy, the entrepreneurial studies program is for seniors in the College of Business and Public Administration and M.B.A. students. The program prepares students for careers as leaders in venture capital and investment banking activities, as managers of innovative corporate endeavors, and as independent entrepreneurs.
The program will provide students with the conceptual and analytical framework for conceiving, planning and initiating innovative business ventures. In particular, the program aims to impart an understanding of the nature of entrepreneurship, as well as the conditions necessary for its success.

OTHER COLLEGE PROGRAMS

The Board of Advisors — A group of leading executives from Arizona and other states serves as the Board of Advisors to the College of Business and Public Administration, assisting in the development of resources, providing a communication link between the college and management community, reviewing the goals and objectives of the college, and advising and assisting the dean in the resolution of important policy issues. An important dimension of the board's activities centers around member interaction with the students and faculty of the college.

The Business Partners — Believing that it exists within the total context of the private and public organizational sectors, the college maintains a Business Partners Program in which the institution and the business community provide one another with resources. Among the services supplied to business and industry is assistance in the recruitment of graduates.

The College Alumni Council — The College of Business and Public Administration is one of several within the University which has organized its own Alumni Council. The council assists in obtaining wide recognition of its accomplishments by sponsoring public events at which faculty expertise is made available to the larger community.

The Division of Economic and Business Research (DEBR) — One of the major public services of the college, the division specializes in applied research (as differentiated from scholarly research undertaken by departmental faculty) into economic matters affecting the state of Arizona. The division publishes statistical material as well as the Arizona Review and Arizona's Economy, which contain articles of general interest about the state's changing economy.

The Department of Executive Programs — The Department of Executive Programs utilizes college faculty, as well as experts from across the country, in the presentation of conferences, programs and seminars for executives. The Executive Development Conference, a semi-annual, nine-day program, attracts top executives from throughout the U.S. and several foreign countries.

Distinguished Lectures — Throughout the academic year, leaders in American business and public management are brought to the college to speak to students and faculty. The MBA Student Association sponsors an Executive Lecture Series. Other lectures are presented periodically when exceptional executive talent is available.

Career Guidance — In addition to the services offered by the University of Arizona Placement Office, the College of Business and Public Administration provides career assistance to its students. At career forums throughout the year, students learn more about the kinds of career opportunities available in a variety of business and public fields. Career development programs that include a series of self-marketing seminars and mock interview sessions also are held during the year. Executives also serve as guest speakers in classes and at special programs sponsored by BPA student organizations.

STUDENT INVOLVEMENT

The college encourages student participation in the numerous professional clubs, organizations and honorary societies associated within the various fields with business and public administration.

The BPA student council is a college-wide service organization which serves as a liason between students, faculty, administration and other student organizations. The council sponsors and participates in a variety of college activities and programs.

The honoraries and professional organizations affiliated with the college include Alpha Kappa Psi, a professional business fraternity; Alpha Mu Alpha, a national marketing honorary; American Marketing Association, a professional marketing organization student chapter; Beta Alpha Psi, a national accounting honorary; Beta Gamma Sigma, a national scholastic honor
society; Delta Sigma Pi, an international business fraternity; Management Information Systems Association, a professional information systems organization; Phi Chi Theta, a college professional fraternity; Pi Alpha Alpha, the National Honor Society for Public Affairs and Administration; Public Administration Student's Association; University of Arizona Personnel Administration Association, a student chapter of the American Society for Personnel Administration; Economics Club; and Finance Club.

Outstanding student accomplishments are recognized each year through the presentation of a number of awards and honors.
The College of Education is committed to the preparation of qualified individuals in the fields of instruction in elementary, secondary, special and postsecondary education, bilingual education, student personnel services, instructional media and library services, and rehabilitation, and in the supervision and administration of elementary and secondary schools, special education schools and facilities, community colleges, four-year colleges, and universities. The college is composed of the Departments of Business and Career Education, Counseling and Guidance, Educational Foundations and Administration, Educational Psychology, Elementary Education, Reading, Rehabilitation, Secondary Education, Special Education, the Graduate Library School, the Center for the Study of Higher Education, and the Arizona Center for Educational Research and Development.

At the time the catalog was being edited, the College of Education was undergoing review. Because of this it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

DEGREES AND MAJORS

The College of Education offers academic programs leading to the Bachelor of Arts in Education, Bachelor of Science in Education, Master of Arts, Master of Science, Master of Education, Master of Library Science, Master of Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees. All departments within the College of Education offer programs leading to master's degrees. Majors may also be selected from any one of over 24 other departments within the University. Educational Specialist degrees are offered with majors in educational administration, educational media, educational psychology, elementary education, reading, secondary education, and special education. Doctor of Philosophy and Doctor of Education degrees are available with majors in counseling and guidance, educational administration, educational psychology, elementary education, foundations of education, higher education, reading, rehabilitation, secondary education, and special education.

Course work is offered in the college leading to the undergraduate degrees of Bachelor of Science in Education with majors in business education, physical education, rehabilitation, and secondary education (with a teaching major in mathematics or any one of the natural sciences); and Bachelor of Arts in Education with majors in early childhood education, elementary education, and secondary education (all teaching majors other than those listed under the B.S.Ed.).

Major and minor subjects should be selected as early in the undergraduate program as possible, and no later than the junior year. Major subjects may be changed at the beginning of any semester. However, if a change of major or minor fields is made late in the program, an additional semester or semesters may be necessary to complete the established requirements.

A major is defined as the principal subject which the student intends to teach, except in the cases of rehabilitation and elementary education. (Students majoring in secondary teaching will pursue a secondary teaching major and should refer to "Majors in Secondary Education" in this section.) Students will select majors in consultation with advisers in the College of Education. Specific requirements for given majors are described in the Departments and Courses of Instruction section of this catalog.

A teaching minor is a secondary field of specialization in which the student plans to teach. It too should be selected in cooperation with a College of Education adviser. The specific requirements for minors may also be found in the Departments and Courses of Instruction section of this catalog.

A subject matter minor is required of all elementary majors. The minor should be selected and planned with the assistance of a College of Education adviser. Specific requirements for the minors are available in the department office.
The College of Education also offers an instructional program designed to prepare individuals to work in educational services positions as training officers or directors in organized educational activities outside of the formal classroom setting. The program provides sufficient flexibility in the developing of an individualized program of high academic quality to meet the needs and interests of the students in preparing for specific career goals.

The available secondary education teaching majors and minors are:

**Majors Requiring No Minor**

<table>
<thead>
<tr>
<th><strong>Business Education</strong></th>
<th><strong>Language Arts-Social Studies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended English</td>
<td>Physical Education (K-12 emphasis)</td>
</tr>
</tbody>
</table>

*The language arts-social studies program is a 50-unit special combination of language arts and social studies for junior high/middle school teachers. The social studies major consists of 50 units. The language arts-social studies or social studies major is to be designed in cooperation with a secondary education adviser and with the approval of the department head.**

**A specialization in office or distributive education is available for the major.**

### Regular Majors and Minors

<table>
<thead>
<tr>
<th><em>Business Education</em></th>
<th>French</th>
<th>Journalism</th>
<th>Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>General Biology</td>
<td>Latin</td>
<td>Political Science</td>
</tr>
<tr>
<td>Earth Science</td>
<td>Geography</td>
<td>Mathematics</td>
<td>Russian</td>
</tr>
<tr>
<td>English</td>
<td>German</td>
<td>Physical</td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>History</td>
<td>Education</td>
<td>Speech Communication</td>
</tr>
</tbody>
</table>

*A specialization in office or distributive education is available for the major.*

<table>
<thead>
<tr>
<th>Majors Requiring No Minor</th>
<th>French</th>
<th>Journalism</th>
<th>Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Education</td>
<td></td>
<td></td>
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<tr>
<td>Chemistry</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>History</td>
<td>Education</td>
<td>Speech Communication</td>
</tr>
</tbody>
</table>

### Minors Only

<table>
<thead>
<tr>
<th>Anthropology</th>
<th>Chemistry-Physics</th>
<th>Oriental Studies</th>
<th>Safety Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athletic Coaching</td>
<td>Computer Science</td>
<td>Portuguese</td>
<td>Sociology</td>
</tr>
<tr>
<td>Bilingual/Bicultural Education</td>
<td>Economics</td>
<td>Psychology</td>
<td>Special Education</td>
</tr>
<tr>
<td></td>
<td>Italian</td>
<td>Radio-Television</td>
<td></td>
</tr>
</tbody>
</table>

### Teaching Majors in Other Colleges

<table>
<thead>
<tr>
<th>†Agricultural Education</th>
<th>†Early Childhood Education</th>
<th>†Home Economics Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Art Education</em></td>
<td><strong>Health Education</strong></td>
<td>Education</td>
</tr>
<tr>
<td><em>Drama Education</em></td>
<td>†Home Economics Education</td>
<td><em>Music Education</em></td>
</tr>
</tbody>
</table>

*Offered through the College of Arts and Sciences.*

†Offered through the College of Agriculture.

**Offered through the School of Health-Related Professions.*

### ADMISSION AND DEGREE REQUIREMENTS

Candidates for admission to the College of Education must have completed 56 semester units of credit applicable to a baccalaureate degree with a grade-point average of 2.5000 or better. Transfer students, whose cumulative grade-point averages (including work taken at other institutions) must meet the 2.5000 standard at the time of admission to the college, must also have grade-point averages above that for probation (2.0000) for all work taken at the University of Arizona. Provisions are made for the admission of those students who may not meet the minimum entrance requirements, but who demonstrate special skills deemed desirable in the field of professional education. The College of Education Admissions Committee, composed of five voting members of the college faculty, meets to hear and recommend to the dean all petitions for special admission.

Additionally, students admitted to teacher education programs in the College of Education, including teacher education students in other schools and colleges, must successfully pass a proficiency examination in each of the areas of English grammar, reading, and mathematics before they may enroll in student teaching. This examination should be undertaken so that students may have ample time for remediation, where necessary, before enrollment in student teaching. Dates and times for the examinations can be obtained in the dean's office, College of Education.

### PROGRAM REQUIREMENTS

For prospective elementary teachers, education is regarded as the major field; however, another field of specialization may be developed in an area of the student's choice. For prospective junior or senior high school teachers, emphasis is placed
upon special topics to be considered in the major field and, ordinarily, in one or more teaching minors. Teaching major and minor subjects which are generally included in high school curricula in most states are listed under "Degrees and Majors" in this section. All teacher education majors are required to complete course work in the areas of state and federal constitutional government. This requirement may be fulfilled by passing Pol. 110, or 102 and either 103 or 214a or 214b; or by special examination.

All teacher education majors must complete two courses in the humanities and arts and one course in U.S. history as required for Arizona teacher certification.

The following courses may be used to meet the humanities and arts requirement (the literature courses listed are literature in translation): Art 117, 118, 124; Clas. 250a, 250b; Dnc. 259a, 259b; Dram. 140a, 140b; Engl. 260, 261, 265, 267a, 267b, 370a, 370b; Fren. 300a, 300b, 382a, 382b; Ger. 270a, 270b, 282a, 282b, 345, 371; Hist. 103, 104 (no other hist. courses are acceptable); Ital. 282a, 282b, 400a, 400b, 400c; M.A.S. 443, 477b; Mus. 107, 108; Or.s. 140a, 140b, 340a, 340b, 449, 444a, 444b, 447a, 447b; Phil. 111, 113, 238, 260, 261, 262 (Phil. 112 is not acceptable); Port. 383; Russ. 300a, 300b, 300c; Span 331, 332, 400a, 400b; Sp.C. 181; Women's Studies 200.

The following courses may be used to meet the U.S. history requirement: Hist. 130a, 130b, 230, 245, 252, 253a-253b, 431, 432, 433, 435, 436, 437, 440, 449a, 449b.

Transfer courses and other courses proposed to meet the above requirements must be approved by the department head and the dean.

Students in the College of Education who do not intend to meet classroom teacher certification requirements upon completion of their degree programs may pursue a noncertification program through the major in secondary education. This instructional program prepares graduates for educational services positions in business, government, military, social services, adult education, and industry.

SPECIFIC LIMITATIONS — All candidates for graduation from the College of Education are subject to the following restrictions: no more than 48 units may be taken for credit in any one department. (Activity courses are excluded in the computation of the 48-unit maximum in the physical education major.) Candidates for a secondary teaching certificate must include at least forty units of upper-division course work among the total number of units offered to meet degree requirements, while candidates for the elementary teaching certificate must offer 48 such units.

GRADES IN STUDENT TEACHING — Pass (P) or fail (F) are the only grades issued upon completion of Elem. 493a or S.Ed. 493a. Enrollment in these courses will not reduce the amount of course work for which a student may enroll under the regular pass-fail option as described in the section on Academic Guidelines in this catalog.

OPEN COURSES — Courses in the College of Education are generally restricted to those students who have been admitted to the college or the Graduate College, except for the following which are open to any student with junior standing, assuming that all of the necessary prerequisites have been met: B.C.Ed. 373, 379, 389, 471, 472, 473, 474, Coun. 401, 403, Ed.F.A. 325, 350, 399, 401, 408, 437, 465, 476, 487, 489, Ed.P. 301, 302, 310, 340, 400, Li.S. 400, 417, 480, 485, 486, Rdnng. 304, 435, 494a, 494b, 494c, 494d, Rhab. 300, 320a, 320b, 325, 405, 410, 419, 420, 430, 455, 480, 485, S.Ed. 329, 414, 417, 418, 449, 494, Spec. 403, 407, 408, 410, 413, 419, 423, 456, 470, 471, 473, 495. The following special courses are open to lower-division students: B.C.Ed. 106, 108, 174, 175, 177, 274, 276, Ed.F.A. 226, Elem. 193, 194, Rhab. 200a-200b, 215, S.Ed. 194, 199, 225, 294, 299.

FACULTY ADVISING — An adviser from the faculty of the College of Education will, upon request, be assigned to any student enrolled in the University who is interested in pursuing a career in education. Upon admission to the College of Education, students without an adviser will be assigned one by the major department or the office of the dean. The adviser will assist the student in selecting a field of specialization and in arranging an appropriate schedule of studies.

PRE-EDUCATION ADVISING — Students who have not yet acquired 56 semester units of credit applicable to a baccalaureate degree are generally enrolled in the College of Arts and Sciences rather than in the College of Education. The first two years of academic preparation
for admission to education programs are very important. The College of Education provides a pre-education adviser to assist students in completing the course work required for admission to education programs.

DEAN'S HONOR LISTS — The Dean's Honor List is reserved for students who carry at least fifteen units of work in a semester, exclusive of pass-fail courses, and who attain a grade average of 3.5000 or better. Students who complete at least twelve units of work in a semester, of which part are pass-fail courses, and who attain a grade average of 3.5000 or better, are given honorable mention. The honors lists are posted on the College bulletin board at the close of each semester. All honors students will receive a certificate of recognition.

COLLEGE PROGRAMS

The faculty and administration of the College of Education are dedicated to the continuing development and improvement of programs in preprofessional and in-service teacher education. In addition, experimentation is carried on in some areas through the extension and implementation of various kinds of programs, innovative arrangements of course sequences, and contemporary content structures within courses. Students are regularly invited to participate in these experimental programs. Students are selected on the basis of those criteria which have been established for a given experiment and can enroll by special permission only.

The following programs are currently being offered through the Departments of Business and Career Education, Elementary Education, Rehabilitation, Secondary Education, Special Education, and the Graduate Library School.

Major in Business Education

Early childhood education is the major for students in the College of Education or the School of Family and Consumer Resources who intend to pursue teaching careers at the preschool, kindergarten, or primary-grade levels.

These students follow the program for the freshman and sophomore years as described under "Major in Elementary Education." The upper-division program includes those courses, with the exception that Elem. 376, 377, and 379 are substituted for Elem. 322 and 327.

Major in Elementary Education

(For Teachers of Grades Kindergarten Through Eight)

For students preparing to become elementary teachers, the freshman and sophomore years should be completed in the College of Arts and Sciences. Regardless of the college from which the student transfers, each study program must include at least 45 units of general education to include six units of freshman composition, one introduction to linguistics course, twelve units of social science, twelve units of natural science, six units of mathematics, two courses in the humanities and arts (as listed under "Admission and Degree Requirements" in this section), Pol. 110 or 102 and 103, and two units in health education. In addition, the program must include a subject matter minor of at least twenty units. All of these courses must be selected with the approval of an adviser from the Department of Elementary Education.

The basic major in elementary education includes the following courses, unless the student selects one of the two program options described under "Early Childhood Education" or "Bilingual and Elementary Education": Art 430; Ed.F.A. 350; Ed.P. 301, 310; Elem. 322, 323, 324, 326, 327, 493a; Li.S. 480; Mus. 360 and 361; Ex.S.S. 351a, 351b, or 351c; and Rdnq. 304 and 494.
DUAL PROGRAM IN BILINGUAL AND ELEMENTARY EDUCATION (English and Spanish)—This course of study is intended for students who desire to teach in classrooms operating bilingual curricula in English and Spanish. Students should follow the program for the freshman and sophomore years as described above. Electives should be taken in Mexican American studies. Proficiency in the Spanish language must be demonstrated by passing a proficiency examination. Course work must include Elem. 394 (6 units — 3 units of creative arts and 3 units of music); Span. 441, 473; Ex.S.S. 351a, 351b, or 351c; Ed.P. 301, 310; Ed.F.A. 325, 350, 427; Elem. 322, 323, 324, 326, 327, 493a; Engl. 408; and Rdng. 406, 494a.

Major in Rehabilitation

The undergraduate major in rehabilitation will prepare students for selected positions in various service areas, including rehabilitation, social, and education programs. All course requirements for admission to the College of Education must be completed before the student may be accepted as a major in rehabilitation.

Students will enroll in colleges other than the College of Education during their freshman and sophomore years. Regardless of the college from which the student transfers, the following general education requirements must be met: freshman composition, six units; social sciences, twelve units (including Psyc. 101, plus three additional courses from anth., soc., or psyc.); Ecol. 159a-159b, eight units; and humanities, eight to nine units (as listed under "Admission and Degree Requirements" in this section). Course work used to satisfy lower-division requirements cannot be included as electives for the upper-division program.

Course work for the major in rehabilitation includes Ed.P. 340, 400, 458; Rhab. 300, 320a-320b, 325, 450, 460; and nine additional units of rhab. course work approved by an adviser. Course work for the major in rehabilitation with a specialization in interpreting for the deaf includes Rhab. 300, 320a-320b, 325, 405, 410, 420, 430, 450, 460, and six additional units of rhab. course work approved by an adviser. An 18-unit minor is required and can be met by taking (1) Psych. 416, 418, and twelve additional units of course work from one of the following areas of concentration: anthropology, educational psychology, psychology, sociology, or special education, or (2) Psych. 416, 418, one additional three-unit psych. course, and nine units from one of the concentration areas listed under option one.

Minor in Rehabilitation

Rehabilitation is concerned with the knowledge and methods necessary to assist physically, mentally, or socially disabled adults to a more productive life. An 18-unit, non-teaching minor is offered at the undergraduate level. (See departmental headnotes.)

Major in Secondary Education

College of Education students enrolled in a teacher preparation program in the Department of Secondary Education must complete a teaching major or a teaching major and minor from among the subjects and fields listed under "Degrees and Majors" in this section.

Though secondary education majors do not transfer to the College of Education until their junior years, they take S.Ed. 225 in their freshman or sophomore years. Students are encouraged to contact an adviser in the Department of Secondary Education during their lower-division years concerning the election of appropriate teaching majors and minors.

Major and minor requirements and descriptions of all courses are found in the Departments and Courses of Instruction section of this catalog.

Students pursuing degrees in secondary education will complete 45 units in arts and sciences in the humanities, mathematics, natural sciences, foreign languages, social sciences, literature and/or fine arts. Course work from any one of these areas completed in fulfillment of the requirements for a teaching major and minor may be incorporated into the 45 units of arts and sciences credit. Students will complete six units of freshman composition (including Engl. 101 and 102, or 103 and 104), one course in Arizona and U.S. constitutional government (or satisfactorily pass an examination on the provisions and principles of the constitutions of Arizona and the U.S.), one course in U.S. history, one additional course in social and
behavioral sciences, one course in general psychology, two courses in the humanities and the arts (as listed under “Admission and Degree Requirements” in this section), one course in natural science, and one course in mathematics.

The required professional sequence includes S.Ed. 225, Ed.P. 311, S.Ed. 329, 330, 338 or equivalent, 417, Rdng. 435, S.Ed. 493a, 494b. S.Ed. 330 is to be taken the semester immediately preceding student teaching or concurrently with student teaching in the professional semester program.

**NONCERTIFICATION TRACK** — Students not wanting certification as classroom teachers upon completion of their degree programs may enroll in the noncertification track of the secondary education major. Students will complete six units of freshman composition (including Engl. 101 and 102, or 103 and 104) and Engl. 207, Sp.C. 102, Hum. (6-8 units), Math. 116, lab. science (8 units), and social science (12 units with 6 in one area). Students will complete one of the listed secondary education teaching majors. Additionally, the noncertification track consists of a minimum of 30 units including the following sequence of courses: B.C.Ed. 373, Ed.P. 311, 465, 487, S.Ed. 417, 449, 493n, 499 and three units of education electives. Students interested in pursuing this program may obtain information in the office of the dean.

**Majors for Community College Personnel**

The College of Education cooperates with departments in other colleges of the University in the preparation of students who are candidates for community-college teaching certificates. The Arizona Board of Directors for Community Colleges has established the following standards for academic certification.

The minimum requirements for an Arizona Community College Regular Certificate, valid for six years shall be:

a. a master's or higher earned degree with at least twenty-four semester hours of upper-division and/or graduate credit in the field to be taught, or
b. a bachelor's degree in a specific area with at least three years of directly related occupational experience and skill in the field to be taught, or
c. an associate's degree or at least sixty-four semester hours and, in addition, at least five years of directly related occupational experience in the field to be taught.

Additionally, applicants must have completed an approved course on the community college offered at one of the Arizona universities or by a college district.

Provisional, special, and honorary Arizona community college certificates are available with varying requirements and periods of validity. The College of Education will assist individuals seeking application information on these certificates or on community college certification in other states. The above standards are subject to modification by the Arizona State Board of Directors of Community Colleges.

**Minor in Special Education**

Special education is concerned with children who deviate markedly in physical, mental, or emotional characteristics. An eighteen-unit, nonteaching minor in special education is offered at the undergraduate level (see departmental headnotes). Students interested in this program should consult a departmental adviser. In addition, special education is available as a graduate major.

**CENTERS FOR RESEARCH AND SERVICE**

Research and service centers operating within the College of Education greatly enhance the academic programs and research capabilities of the college. Basic and applied research is conducted in all contexts and at all levels of professional education. Professional services are available to clientele ranging from individuals to such institutions as school districts; public and private postsecondary institutions; local, state, and federal agencies; health-service-related agencies; correctional institutions; Indian tribal governments; and business and industry. A description of the nature and function of each of these centers is provided under the headings below.
Arizona Center for Educational Evaluation and Measurement

The Arizona Center for Educational Evaluation and Measurement initiates and conducts multidisciplinary research on such topics as nondiscriminatory psychological assessment; assessment of developmental competencies, sequencing of instruction, cognitive skills in children; and evaluation of school effectiveness. The center maintains state-of-the-art research technology, prepares graduate students in research methodology; and provides technical assistance to public and private agencies regarding testing, student services, curriculum development and systems for program evaluation.

Arizona Center for Educational Research and Development

The Arizona Center for Educational Research and Development initiates and conducts research and development programs in such areas as early childhood education, teaching and learning, language and literacy, cultural diversity and learning, and education of exceptional children. The center provides faculty and graduate students with the following support services: grant proposal development; weekly notices of funding sources; computer allocations for research and instruction; funding for small projects; and budget review and negotiation assistance.

Center for the Study of Higher Education

The major objectives of the Center for the Study of Higher Education are the development and dissemination of knowledge about higher-education policy and operation; instruction at the graduate level leading to graduate degrees; facilitation of research by faculty members and students; and research studies and service activities for state and institutional needs and national, international, and regional governmental units and organizations.

University Rehabilitation Services

Degrees are offered in several areas, including undergraduate and graduate majors in rehabilitation, a two-year master's program, and doctoral programs. As a member of the National Interpreter Training Consortium, the department offers undergraduate course work to prepare students to become interpreters for deaf persons. The department is used as a clinical and laboratory facility by many campus and community groups. Workshop and seminar programs provide opportunities for in-service training for professional workers in health and rehabilitation agencies. The staff of the department is trained in the practical application of rehabilitation techniques and provides statewide consultative services to rehabilitation agencies.

The department provides an excellent setting for interdisciplinary research and demonstration programs. Projects are directed by faculty members for various university departments. Research is encouraged in all aspects of rehabilitation.

A variety of services is available in the department, including comprehensive vocational and psychological evaluation. Vocational and psychological evaluations provide disabled and handicapped individuals with realistic vocational goals.

Instructional Materials Collection

The Instructional Materials Collection (IMC), operated by the University Library and located in the Media Center of the Main Library, was created to disseminate materials used by elementary and secondary school students. The collection is comprised of tradebooks, textbooks, and audiovisual materials, including teaching devices and instructional games. Samples are provided of various forms of informational packages. Courses of study for many subject fields are provided from various school districts and institutions of teacher education throughout the nation. An audiotutorial facility and audiovisual equipment center are available for student use.
Engineering education is preparation for a professional career. While most graduates embark on careers in engineering practice, men and women with engineering majors find the baccalaureate program excellent preparation for other fields as diverse as law, medicine, business and government. An engineering education develops analytical and quantitative thinking, a critical but optimistic approach to problems, and the habit of self-directed future learning. Graduates make a transition successfully to a wide variety of different careers. The graduate has a thorough understanding of how materials, energy, and information can be adapted to humanity's needs and desires. This is developed through the study of physical science, mathematics, engineering science, humanities, social science, economics and practice.

MAJOR PROFESSIONAL FIELDS OF STUDY

The college offers four-year curricula leading to the degrees of Bachelor of Science in:

- Aerospace Engineering
- Agricultural Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Energy Engineering
- Engineering Mathematics
- Engineering Physics
- Hydrology
- Industrial Engineering
- Mechanical Engineering
- Nuclear Engineering
- Systems Engineering

Each of these curricula is described in the following pages. In addition, the degrees of Bachelor of Science in Chemical Engineering, Geological Engineering, Materials Science and Engineering, and Mining Engineering are available through the College of Mines. The latter curricula are described in the College of Mines section of this catalog.

The entering student is asked to designate a field of interest from among those listed above. Since a high degree of commonality exists among the various fields in the first year, it is often possible for a student to transfer from one field to another after the first year with only minor realignment of the study program.

GRADUATE STUDY TOWARD THE M.S. AND PH.D.

The Master of Science (M.S.) degree is offered with majors in aerospace engineering, agricultural engineering, civil engineering, electrical engineering, engineering mechanics, hydrology, industrial engineering, mechanical engineering, nuclear engineering, systems engineering and water resources administration. The Doctor of Philosophy (Ph.D.) degree is offered with majors in aerospace engineering, civil engineering, electrical engineering, engineering mechanics, hydrology, mechanical engineering, nuclear engineering, systems engineering and water resources administration. Complete details of both graduate programs are set forth in the Graduate Catalog.

OPTIONS

**BIOMEDICAL ENGINEERING OPTION** — Biomedical engineering can be defined as a multi-discipline in which physical scientists and engineers interact with life scientists and physicians to solve problems ranging from basic investigations to applications in clinics and the health care delivery system. The Departments of Aerospace and Mechanical, Electrical and Computer,
and Nuclear and Energy Engineering offer biomedical options available as undergraduate technical electives, graduate minor programs and research. A University committee coordinates the option. See Biomedical Engineering for further details.

**CLINICAL ENGINEERING OPTION** — This option is offered in conjunction with the Master of Science degree through the Department of Electrical and Computer Engineering. For information regarding the option, please see the *Graduate Catalog*. At the undergraduate level, students can select several of the medically-oriented courses such as those concerning medical instrumentation, clinical engineering, physiology, and health care management in order to obtain an understanding of engineering in medicine and biology while earning a Bachelor of Science degree.

**COMPUTER SOFTWARE ENGINEERING OPTION** — This option deals with the analysis and design of systems in which computer programs play an important role. The computer software engineer performs the systems analysis which determines the computer programs to be developed, participates in the structured design of the programs, manages the programming effort and oversees the testing, debugging, installation and documentation of the programs. The Department of Systems and Industrial Engineering offers this option through the undergraduate degree program in systems engineering by structuring the choice of technical electives. Contact the department for further details.

**MANUFACTURING SYSTEMS ENGINEERING OPTION** — The modern manufacturing systems engineer designs, installs, implements, improves and manages computer integrated manufacturing systems. This option prepares students in the areas of organizing, scheduling, and managing the total manufacturing system from product design through fabrication, distribution and consumer services. The Department of Systems and Industrial Engineering offers this option through the undergraduate degree program in industrial engineering by structuring the choice of technical electives. Contact the department for further details.

**PREMEDICAL OPTION** — An engineering degree can provide a valuable background for physicians who will utilize modern technological advances being implemented in the practice of medicine or who will participate in medical research. All departments in the college offer a premedical option. Electives which satisfy admission requirements for medical school are selected by the student and departmental adviser.

**ACCREDITATION**

The Accreditation Board for Engineering and Technology (ABET) is the official agency for accrediting undergraduate engineering curricula. Schools are visited periodically by teams of outstanding engineers selected by ABET. A complete evaluation is made of curricula, faculty qualifications, laboratory and library facilities, grading standards, and many other considerations. Thus, when the major undergraduate curricula of an engineering college are accredited by the ABET, the student is assured that high standards are maintained.

**COLLEGE ENTRANCE REQUIREMENTS**

Entering freshmen will meet those requirements outlined in the *Admission to the University* section of this catalog. Students transferring from other colleges or universities are required to present a cumulative grade-point average of 2.500 or better for all previous college work and meet the specific admissions requirements outlined in the "Admission to Particular Colleges and Schools" section of this catalog.

**ADVANCED STANDING**

Students must have been granted advanced standing to enroll in 300- and 400-level courses in the College of Engineering. To qualify for permanent advanced standing, students must meet the following criteria:
1. Completion of a minimum of 56 credit hours, including all required courses listed in the freshman and sophomore years of the curriculum of the student's major department. At least 15 units of required courses must have been completed at the University of Arizona. In addition, all admission deficiencies must have been removed.

2. A University of Arizona cumulative grade-point average of not less than the minimum set by the major department, but in no case below 2.0000.

Students otherwise qualified and lacking no more than three required lower-division courses may be granted provisional advanced standing. If these courses are not completed during the next semester they are offered, advanced standing will be revoked until such time as they are completed.

Transfer students who do not meet the 15-unit requirement set forth above, but meet all other requirements, will be granted provisional advanced standing until such time as they have completed a minimum of 15 units of required courses at the University of Arizona. At that time advanced standing will become permanent if the student's grade-point average at the University of Arizona meets the departmental requirement; if it does not, advanced standing will be revoked.

Application forms are available at the office of the dean of the College of Engineering (Room 100, Civil Engineering Building) and at all departmental offices in the college. Applications should be filed by May 1 or September 15 to qualify for preregistration, or one month prior to walk-through registration.

Students wishing to enroll in 300- and 400-level engineering courses, who are registered in colleges other than the College of Engineering, will normally be expected to have completed all course prerequisites and have fulfilled the above criteria relative to their own majors. Such students will be allowed to register for one advanced-standing course each semester without special permission. Those wishing to register for more than one advanced-standing course must apply at the dean's office for special permission.

**HUMANITIES AND SOCIAL SCIENCE ELECTIVES**

Throughout the four-year programs in engineering are requirements for humanities and social-science electives, recognized as important in the education of engineers by the Accreditation Board for Engineering and Technology (ABET). The goals of these electives are to help the students acquire:

1. An understanding of the evolution of the social organization within which we live and of the influence of science and engineering on its development.
2. The ability to recognize and make a critical analysis of a problem involving social and economic elements, to arrive at an intelligent opinion about it, and to read with discrimination and purpose toward these ends.
3. The ability to organize thoughts logically and to express them lucidly and convincingly in oral and written English.
4. An acquaintance with some of the great masterpieces of literature and an understanding of their setting in and influence on civilization.
5. The development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude.

The courses to be submitted as humanities and social-science electives are selected from a college-approved list by the student in consultation with a faculty adviser. Courses selected should preferably include at least six units in the humanities (art, humanities, music, philosophy, and literature) and at least six units in the social sciences (anthropology, economics, history, political science, psychology and sociology), with the remainder from either category.

**DEPARTMENTAL PROGRAMS**

Brief discussions of each subject area as well as the particular curriculum for each will be found under the section headings which follow.
Aerospace engineering is concerned primarily with solving the problems of flight, and places special emphasis on the design and operation of all types of aircraft, rockets, satellites, and spacecraft. In recent years, aerospace engineers have become involved in the design of deep-submergence vehicles, modern surface ships, air cushion vehicles, and ground transportation systems.

Equipment supporting aerospace engineering studies includes digital computers with interactive graphics; internal combustion engines and a gas turbine; microcomputers and microprocessors; nonlinear control systems; production and tooling shop; low and high-speed wind tunnels; refrigeration and heat transfer loops; and instrumentation of a wide variety.

### Required Curriculum

#### FRESHMAN YEAR

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<th>Units</th>
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*The nine units of technical electives are selected, in consultation with an adviser, from upper-division offerings in engineering or other scientific or technical fields.
BACHELOR OF SCIENCE IN AGRICULTURAL ENGINEERING

Agricultural engineers work directly in the design, construction, application, and management of power units, machines, water distribution and disposal systems, buildings, and processing equipment for production of plants and animals. They develop systems for production, processing, packaging, transportation, and distribution of food and other agricultural products.

The agricultural engineering curriculum is administered by the College of Engineering. The agricultural engineering curriculum is based upon those fundamentals common to all types of engineering. It also develops the student's background in the biological sciences. Specific courses in agricultural engineering are included to offer the student experience in the application of engineering to food and fiber production. Agricultural engineering courses are listed under the subheading, Agricultural Engineering, in the Soils, Water and Engineering departmental section of this catalog.

Required Curriculum

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BACHELOR OF SCIENCE IN CIVIL ENGINEERING  
(ABET Accredited)

Civil engineering is primarily concerned with the larger elements of both the natural and man-made environment. The civil engineer designs, constructs, and operates the physical facilities necessary for such tasks as reducing air and water pollution, planning and building new communities, and providing water, power, and transportation systems. Students may elect to take a concentrated series of courses in structural engineering, geotechnical engineering, transportation engineering, hydraulic engineering, or environmental engineering. Fully equipped laboratories for instruction and research are available.

**Required Curriculum***

**FRESHMAN YEAR**

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**SOPHOMORE YEAR**

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* A.En 120a-120b and 121a-121b are offered alternate years. Thus, some students will take 121a-121b in their freshman year and 120a-120b in the sophomore year. A.En. 410, 412, 415, and 423 are offered alternate years also. Thus, some students will take 410 and 412 in their junior year and 415 and 423 in their senior year. Others will reverse this sequence.

**Technical electives are twelve units of technical courses chosen to form a coherent program of study in relation to an area of special interest such as water resource development, irrigation, livestock housing, feed or food processing, energy or agricultural machinery. Courses will be selected to meet engineering science and design accreditation requirements. At least four units of design must be included in the technical electives. Students selecting the soil and water option are required to take A.En. 456.

***Agricultural science electives will include one course each from the plant, soil, and animal science areas. Suggested courses include Pl.S. 100, An.S. 102, S.W. 200, 470, Ecol. 105.

****Writing-emphasis class.
The computer engineering program prepares students to work in the dynamic and rapidly expanding field of digital technology. Computer engineers design computers and computer systems, apply computers as components in larger systems, and apply digital techniques to solving a broad range of engineering problems. The curriculum includes a strong electrical engineering component, made up of almost all the required courses in the electrical engineering curriculum. To this base it adds extensive course work in both the hardware and software aspects of computers and digital systems. The program is strengthened by the availability of extensive laboratory and computing facilities.

### Required Curriculum

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*B*Modification of this program may be permitted, but requires the approval of the student's adviser and department head.

**Elective courses are grouped as follows: humanistic and social science (12 units from the approved list of the College of Engineering) and technical (21 units). To meet the technical elective requirement, students must fulfill one of the following 12 or 15 unit option sequences. Required courses in the given sequence are indicated by *. Environmental engineering: C.E. 371*, 423*, 424, 477, 479*, N.E.E. 467; geotechnical engineering: C.E. 423*, 440*, (C.E. 402 or G.En. 427)*, 441*; hydraulics/water resources: C.E. 371*, 422*, 423*, 424*; structural engineering: C.E. 336*, 429*, 426*, (402 or 440)*; transportation and highway engineering: C.E. 361*, 452*, 462*, (C.E. 463 or 468)*; general civil engineering: C.E. 336*, 361*, 371*, 423*, 440*. Listings of all acceptable technical electives are available from advisers. Selection of all electives should be made with adviser's approval.
### Junior Year

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*The 12 units of technical electives will normally be 400-level courses in the Department of Electrical and Computer Engineering, and must be approved by the student's faculty adviser.

### Bachelor of Science in Electrical Engineering

(ABET Accredited)

Due to the rapid pace of modern technology, the goal of the electrical engineering undergraduate curriculum is to educate immediately productive electrical engineers who are also qualified to pursue further educational opportunities. Consequently, the program emphasizes basic scientific knowledge, modern design techniques, and laboratory experiences that pinpoint design limitations.

The presence in the department of the Computer Science Research Laboratory, the Thin Films and Field Emission Laboratory, and the Microelectronics Laboratory, as well as research in fields, physical and plasma electronics, lightning processes, pattern recognition, modern control theory, and other specialities, maintains a modern viewpoint in the undergraduate program.

### Required Curriculum

### Freshman Year

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
<th>Subject</th>
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<tr>
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<td>Math. 125b</td>
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<tr>
<td>Engl. 101</td>
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<td>Engl. 102</td>
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<tr>
<td>Chem. 103a</td>
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<td>Phys. 110</td>
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COLLEGE OF ENGINEERING 141

SOPHOMORE YEAR

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<td>Phys. 121</td>
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JUNIOR YEAR

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<td>E.C.E. 321b</td>
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SENIOR YEAR

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**The 24 units of technical electives are to be chosen by the student in consultation with a faculty adviser, from a list of approved technical electives that may be obtained at the departmental office. Not less than 15 credits must be in E.C.E.

BACHELOR OF SCIENCE IN ENERGY ENGINEERING

The Energy Engineering program at the University of Arizona is intended to bring a broad perspective to the problems of energy generation and usage. The need exists for engineers familiar with many facets of energy related engineering to participate in decisions involving considerations of economics, environmental impact, available resources, conservation, and the options for generation and distribution of electricity. The program of study is intended to prepare the student to make decisions or advise those who do in these areas. Such individuals must have a strong background characteristic of all engineering graduates, including basic mathematics, physics, and chemistry. A basic preparation in conventional economic principles and applied engineering economics is also required.

Required Curriculum

FRESHMAN YEAR

<table>
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<tr>
<th>Subject</th>
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## Sophomore Year

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## Senior Year

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**Econ. 210 plus 13 elective units.
**Tech. electives include 18 or 19 units to be selected from areas of specialization for a total of 131 units for graduation.
***Offered both semesters.
****Alternate sequence: Ch. E. 201, 203, 204; or M.S.E. 224R, E.C.E. 321a, A.M.E. 331a.

## Bachelor of Science in Engineering Mathematics

The engineering mathematics curriculum is designed to give the student a deep understanding of mathematics to complement specific interests in engineering. Graduates of this curriculum working in industry may use their proficiency in analysis, statistics, computer science or numerical analysis to develop techniques needed to obtain meaningful solutions to engineering problems for which there is no standard solution. The program can be tailored to give each individual the desired concentration in particular areas of mathematics and engineering, the goal being breadth with selective depth. The engineering mathematics curriculum gives an excellent background for graduate work in applied mathematics and computer science as well as various areas in engineering.

### Required Curriculum**

## Freshman Year

<table>
<thead>
<tr>
<th>Subject</th>
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<th>Units</th>
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<td>Math. 125b</td>
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<td>Engl. 101</td>
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<tr>
<td>Chem. 103a</td>
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<td>Chem. 103b</td>
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<td>Chem. 104b</td>
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BACHELOR OF SCIENCE IN ENGINEERING PHYSICS

The engineering physics curriculum stresses basic scientific and engineering principles in order to prepare the student to solve engineering problems which involve either several areas of knowledge or basic new scientific developments. Modern complex devices and systems often involve several fields such as optics, mechanics, electronics, solid state, and nuclear radiation.

This curriculum helps bridge the gap between science and engineering. To reduce a scientific development to a practical application requires both physical understanding and engineering skill. The engineering physics curriculum prepares the student for graduate work in physics and engineering.

Technical electives should be upper-division units carefully chosen in conference with the adviser.

Required Curriculum

FRESHMAN YEAR

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*Humanities and social science electives: 17 units to be chosen from a list approved by the college. Technical electives: 23 units to be chosen in consultation with an adviser.

**Those students interested in using technical electives to emphasize computer science should include C.Sc. 115, 227 and 237 their first three semesters.
### SOPHOMORE YEAR

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### JUNIOR YEAR

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### SENIOR YEAR

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### BACHELOR OF SCIENCE IN HYDROLOGY

Hydrology, the science of water, deals with the origin, distribution, and the physical, chemical, and biological properties of the waters of the Earth. It has application to flood control, water supply, recreation, structure (bridges, dams, etc.) design, pollution control, and other water management concerns. The hydrology curriculum is designed to give the student a basic knowledge of hydrology and allied subjects. Flexibility is offered through the selection of electives so that a program of study can be developed which best fits the student's needs.

Graduates with the degree of Bachelor of Science in Hydrology obtain professional positions in the fields of hydrology and water resources. Because hydrology is an applied science, instruction is augmented at all levels with field trips in Arizona, a state which contains a great diversity of natural features and climatic zones, making it a superb outdoor laboratory. The five-week summer field course provides direct experience with hydrologic measurements, testing, and data gathering at a number of locations in Arizona. The field course ends with students applying these techniques, on location, to solve a local water resource problem.

### FRESHMAN YEAR

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<tr>
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### SOPHOMORE YEAR

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**Total** 17

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### JUNIOR YEAR

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**Total** 15

*Electives to be chosen in humanities, social science, language, and fine arts.

**Technical and other electives (may not be prerequisite or equivalent to required courses).

### BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING

(ABET Accredited)

Industrial engineering focuses on productivity and quality improvement. Industrial engineers design, analyze, and implement systems integrating people, materials, information and equipment. They are concerned with solving problems through the application of science and practical knowledge. Industrial engineers differ from other engineers in that they use knowledge in a wider variety of applications and in almost every kind of organization imaginable. Professional industrial engineers practice in virtually every facet of our economy, including manufacturing, health-care delivery, computing, defense, transportation, construction, electronics and agriculture. The importance of manufacturing is reflected in the form of a manufacturing engineering option.
Required Curriculum

FRESHMAN YEAR

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SOPHOMORE YEAR

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SENIOR YEAR

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*Hum. and soc. sci. electives must be chosen from a list approved by the College of Engineering. Science electives must be chosen from a list available in the department office. Selection of these electives is made in consultation with the student's faculty adviser.

**Technical electives and math. electives must be chosen from lists of 300- or 400-level courses available in the department office and must be approved by the student's faculty adviser.

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING
(ABET Accredited)

Mechanical engineering is a broad discipline which covers the fields of solid and fluid mechanics, thermodynamics, and engineering design. Basic studies are devoted to machine dynamics, fluid flow, energy and heat power, mechanical properties of materials, and instrumentation. Students can specialize in a wide variety of topics, which include power systems, thermal sciences, automatic controls, reliability and quality assurance, and mechanical design.

Equipment supporting mechanical engineering studies includes digital computers with interactive graphics; internal combustion engines and a gas turbine; microcomputers and microprocessors; nonlinear control systems; production and tooling shop; low- and high-speed wind tunnels; refrigeration and heat transfer loops; and instrumentation of a wide variety.
## Required Curriculum
### FRESHMAN YEAR

#### First Semester
- **Subject**: Math. 125a
  - **Units**: 3
- **Subject**: Engl. 101
  - **Units**: 3
- **Subject**: Hum. & Soc.Sci. Elective*
  - **Units**: 3
- **Subject**: C.E. 110
  - **Units**: 3
- **Total**: 15

#### Second Semester
- **Subject**: Math. 125b
  - **Units**: 3
- **Subject**: Engl. 102
  - **Units**: 3
- **Subject**: Phys. 103a
  - **Units**: 3
- **Subject**: Phys. 180a
  - **Units**: 1
- **Subject**: Hum. & Soc.Sci. Electives*
  - **Units**: 3
- **Subject**: A.M.E. 133
  - **Units**: 3
- **Total**: 16

### SOPHOMORE YEAR

#### First Semester
- **Subject**: Math. 223
  - **Units**: 4
- **Subject**: Chem. 103a
  - **Units**: 3
- **Subject**: Phys. 103b
  - **Units**: 3
- **Subject**: Phys. 180b
  - **Units**: 1
- **Subject**: Hum. & Soc.Sci. Elective*
  - **Units**: 3
- **Subject**: C.E. 214
  - **Units**: 3
- **Total**: 18

#### Second Semester
- **Subject**: Math 254
  - **Units**: 3
- **Subject**: Chem. 103b
  - **Units**: 3
- **Subject**: E.C.E. 207
  - **Units**: 3
- **Subject**: A.M.E. 232
  - **Units**: 3
- **Total**: 15

### JUNIOR YEAR

#### First Semester
- **Subject**: A.M.E. 331a
  - **Units**: 3
- **Subject**: A.M.E. 334
  - **Units**: 3
- **Subject**: A.M.E. 340a
  - **Units**: 3
- **Subject**: E.C.E. 208
  - **Units**: 3
- **Subject**: C.E. 217
  - **Units**: 3
- **Subject**: Hum. & Soc.Sci. Electives*
  - **Units**: 3
- **Total**: 18

#### Second Semester
- **Subject**: A.M.E. 310
  - **Units**: 4
- **Subject**: A.M.E. 331b
  - **Units**: 3
- **Subject**: A.M.E. 333
  - **Units**: 3
- **Subject**: A.M.E. 340b
  - **Units**: 3
- **Subject**: M.S.E. 331R
  - **Units**: 3
- **Subject**: M.S.E. 331L
  - **Units**: 1
- **Total**: 17

### SENIOR YEAR

#### First Semester
- **Subject**: A.M.E. 312
  - **Units**: 3
- **Subject**: A.M.E. 409a
  - **Units**: 3
- **Subject**: A.M.E. 415
  - **Units**: 3
- **Subject**: A.M.E. 455
  - **Units**: 2
- **Subject**: Tech. Electives*
  - **Units**: 6
- **Total**: 17

#### Second Semester
- **Subject**: A.M.E. 416
  - **Units**: 3
- **Subject**: A.M.E. 495s
  - **Units**: 1
- **Subject**: Hum. & Soc.Sci. Electives*
  - **Units**: 3
- **Subject**: Tech. Electives*
  - **Units**: 9
- **Total**: 16

*Elective courses are chosen by the student in consultation with a faculty adviser. The thirty units of electives must contain fifteen in the humanities and social sciences. The remaining fifteen units are technical electives, which are to be selected from engineering and science courses. At least 9 units must be at the 400 level, with 6 of these in A.M.E. (exclusive of independent study, which can at most total 3 units). Moreover, 3 of these units must be taken from a selected list of courses having a design emphasis. There can be no more than 3 units at the 100- or 200-level.

## BACHELOR OF SCIENCE IN NUCLEAR ENGINEERING

(ABET Accredited)

Nuclear engineering is concerned with the release, control, and utilization of all forms of energy resulting from nuclear reactions. This branch of engineering is deeply rooted in the physical sciences and mathematics and requires a broad-based interdisciplinary education.

The applications of nuclear energy are many, ranging from commercial nuclear power systems to the use of radiotopes in science, industry and medicine.

The four-year curriculum gives the student a broad base in engineering science and mathematics. The first two years are similar to those for other engineering disciplines. The remaining two years are devoted to areas of particular interest to the nuclear engineer. With an understanding of fundamental concepts, the student is prepared to cope with future advancements in the field.
Facilities available for laboratory experiments and research include: TRIGA nuclear reactor for operating the steady state or pulsed mode; 2 MeV Position Ion Van de Graaff Accelerator operating in steady state, pulsed, or modulated source mode to produce charged particles and neutrons; 1.25 MeV Radiation Dynamics Electron Accelerator operating as a source of electrons or bremsstrahlung; 500 curie Gamma Ray Irradiator serving as a source for materials and biological specimen irradiations. Also available is a wide variety of laboratories including those needed for radioactive material counting, radiochemical processing, nuclear materials and related equipment for evaluating performance and modification of materials in radiation fields.

Required Curriculum

**FRESHMAN YEAR**

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*Elective courses are chosen by the student in consultation with a faculty adviser. 
**Offered both semesters.
BACHELOR OF SCIENCE IN SYSTEMS ENGINEERING  
(ABET Accredited)

Systems engineering is concerned with effective and efficient decision making in a wide variety of fields such as manufacturing, communication, water resources, etc. It is an interdisciplinary activity which utilizes tools from the classical engineering disciplines as well as from the mathematical, behavioral and physical sciences. Most engineers develop and build components which are parts of larger systems. The systems engineer, on the other hand, is concerned with the design and analysis of large scale complex systems. Systems problems are often too complex to solve without the use of a digital computer. Thus computer applications are stressed throughout the program and especially emphasized in the computer software engineering option.

Required Curriculum

FRESHMAN YEAR

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<th>Subject</th>
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*Hum. and soc. sci. electives must be chosen from a list approved by the College of Engineering. Science electives must be chosen from a list available in the department office. Selection of these electives is made in consultation with the student's faculty adviser.

**Technical electives and math. electives must be chosen from lists of 300- or 400-level courses available in the department office and must be approved by the student's faculty adviser.
COOPERATIVE EDUCATION PROGRAM

The Cooperative Education Program is one which provides undergraduate and graduate students with an opportunity to gain valuable income and career-related work experience in industry, business and government service on a national basis.

Students must have finished their freshman year and have completed, or be in the process of completing, one full-time semester at the University of Arizona. Grade-point average requirements range from 2.0 to 3.3, depending upon the specific employer.

Those students who carefully plan their academic schedules will be able to participate in the co-op program and still graduate in the same time frame of 4½ to 5 years, which is typical for engineering students in general.

Complete information regarding the co-op program is available in Harvill 235.

SUMMER TECHNICAL PROGRAM

The Placement and Career Services Office in the Nugent Building provides students seeking summer employment with the opportunity to interview with companies for the Summer Technical Program.

STUDENT PROFESSIONAL AND HONORARY SOCIETIES

The following student organizations are active in the various professional fields in the College of Engineering:

Scholastic Honorary Society
  Tau Beta Pi

Professional Organizations
  American Nuclear Society
  American Society of Agricultural Engineers
  American Society of Civil Engineers
  American Society of Mechanical Engineers
  American Institute of Aeronautics and Astronautics
  American Water Resources Association
  Association For Computing Machinery
  Institute of Electrical and Electronic Engineers
  Institute of Industrial Engineers
  Society of Automotive Engineers
  Society of Reliability Engineers
  Student Energy Society

Other Engineering Student Organizations
  Engineers' Council
  Society of Women Engineers
 Theta Tau
College of Law

The University of Arizona College of Law is a member of the Association of American Law Schools and an approved law school of the American Bar Association. A rigorous course of professional education prepares students for service to the community in the private and public practice of law. To qualify for membership in the legal profession, a student must possess a broad educational experience and significant intellectual capacity, and must successfully negotiate a difficult course of study during which he or she is expected to master the principles of the law and of the legal system and to acquire professional techniques of lawyers.

Application forms and additional information pertaining to the program, as well as a College of Law Catalog, may be obtained from the College of Law.

ADMISSION REQUIREMENTS — Applicants for admission to the College of Law must have earned a bachelor's degree from an accredited college or university and have achieved a cumulative grade-point average which, when considered with the score on the Law School Admission Test (LSAT) and other relevant data, indicates a reasonable probability of success in the study of law.

Applicants are initially evaluated according to a formula which combines the student's undergraduate academic record and score on the LSAT. It is not possible to fix any particular combination of grade average and LSAT score as the breaking point between admission and rejection. As a generalization, however, students with grade-point averages no higher than "B" will find difficulty in gaining admission, unless they receive a high score on the LSAT. Even those with a higher academic record will experience some difficulty if they have done poorly on the LSAT.

The admissions formula is not inflexibly applied, and careful consideration is given to any relevant factors which indicate that the applicant has considerable potential for law study.

APPLICATION PROCEDURE — First-year students are admitted only in the fall semester. All items necessary to complete the student's application must be sent to the College of Law and postmarked no later than March 1 for admission in late August. The following materials should be sent to the Admissions Office, College of Law, University of Arizona, Tucson, Arizona 85721, prior to March 1:

1. A completed application form.
2. Domicile Affidavit.
3. LSDAS Report.
4. $10.00 check or money order payable to the University of Arizona (not required of Arizona residents or students who attended an Arizona college or university).

LAW SCHOOL ADMISSION TEST — All applicants must take the Law School Admission Test. The test is given by Law School Admission Services (LSAS) several times a year at the University of Arizona and at other centers throughout the state and nation. Arrangements to take the test should be made as early as possible in the academic year prior to enrollment in the College of Law. In order to meet the March 1 deadline, the test must be taken no later than December. An application for the test may be obtained from any law school admissions office or university prelaw adviser, or by writing to Law School Admission Services, Box 2000, Newtown, Pennsylvania 18940, and requesting a Law School Admissions Bulletin. Please check the Bulletin for dates on which to apply for the test.

Scoring of the LSAT takes a minimum of six weeks and the score is sent to the student and law school at approximately the same time. A student may take the LSAT more than once; however, the scores are averaged for use in the initial evaluation formula. LSAT scores obtained prior to October, 1983, will not be accepted.
LAW SCHOOL DATA ASSEMBLY SERVICE (LSDAS) — All applicants must apply for the Law School Data Assembly Service Report no later than February 1. An application for this service is included in the Law School Admissions Bulletin. Official transcripts from each undergraduate institution attended must be sent directly to LSAS by the institution. It is wise to keep receipts for transcripts and LSDAS services as evidence of compliance with deadlines. Students planning to graduate in May should submit to LSAS transcripts of their first six semesters' studies, including summer school but not fall semester work. Applicants who graduated prior to the fall semester should submit their entire transcripts to LSAS. Applicants graduating in December should submit transcripts for the first seven semesters' work. Transcripts of graduate work should also be sent to LSAS. They will not appear on the report as part of the index, but will be attached to the back of all LSDAS reports sent to law schools. LSDAS reports are issued to the law school and applicant about six weeks after LSAS receives all transcripts and an applicant has taken the LSAT.

TRANSFER STUDENTS — Students who have done well at other law schools may be permitted to transfer to the University of Arizona in either the fall or the spring semester of their second year of law school. A transfer applicant must send the following items to the Admissions Office, University of Arizona College of Law, Tucson, Arizona 85721, prior to December 1 for application to the spring semester, and prior to July 15 for application to the fall semester.

1. Completed application for transfer admission.
2. Domicile Affidavit.
3. An LSDAS report showing entire undergraduate career and the LSAT score.
4. A letter from the dean of the law school currently being attended stating that the candidate is presently in good standing and eligible to continue studies at that institution.
5. Transcripts of at least one full year (three quarters or two semesters) of law work. First-year students may not transfer in midyear.

If these minimum requirements are met, applicants will be judged as to whether a transfer would be in the best interest of the student and of the college. Third-year students will not be considered for transfer but may apply as transient or visiting students. No student who has been disqualified or placed on probation at another law school, or who has failed to maintain at least a "C" average for all law work attempted, will be allowed to transfer to the College of Law. Transfer students will not receive credit for work done at a law school which is not a member of the Association of American Law Schools or approved by the American Bar Association.

PART-TIME STUDENTS

Special Students. A limited number of students without the qualifications required of candidates for the law degree may, at the discretion of the faculty, be allowed to audit a course or courses as special students. Applicants must have experience and educational background which indicate a strong probability that they will be successful in law study. They must also demonstrate some special need for legal training.

Students From Other Colleges. With the written approval of their advisers, graduate students may register for courses in the College of Law. Students desiring to do so will be required to obtain the prior approval of the instructor and of the Executive Committee of the College of Law.

Part-time students in the College of Law are not degree candidates, nor are they eligible for the Arizona bar examination. Law courses may not be used by part-time students as credit toward a law degree in the event that such students are subsequently admitted as degree candidates.
College of Medicine

The College of Medicine offers a professional program leading to the M.D. degree and graduate programs leading to the Ph.D. degree in certain of the medical sciences. A combined M.D./Ph.D. program in which the two degrees are awarded concurrently is also available. Candidates for the Ph.D. degree are enrolled in the Graduate College of the University. For information beyond that summarized below, one should request a catalog from the Admissions Office, College of Medicine, University of Arizona, Tucson, Arizona 85724.

PREMEDICAL REQUIREMENTS — Applicants must meet the minimum requirement of ninety semester hours, including thirty hours at the upper-division level, in an accredited college or university. Successful completion of the following specific course work is required: two semesters or three quarters each of inorganic chemistry, organic chemistry, physics, general biology or zoology and English. Students should demonstrate the ability to handle scientific material effectively, irrespective of their majors.

MEDICAL COLLEGE ADMISSION TEST — All applicants must take the new Medical College Admission Test and arrange to have scores forwarded to this College. The test should be taken in the year preceding that in which the student hopes to enter medical school, or at the latest, within two years of application. For applications write: MCAT—The American College Testing Program, P.O. Box 414, Iowa City, Iowa 52243.

APPLICATION TO THE FIRST-YEAR CLASS — The College of Medicine is a participating member in the American Medical College Application Service (AMCAS). Each student need submit only one application if applying just to AMCAS schools. Requests for application material may be obtained from the Admissions Office of the College of Medicine. The application period is June 1 to November 1 of the year preceding that in which the applicant hopes to enter medical school. Those to be considered are requested to appear for a personal interview. Applicants will be notified of their status shortly after the close of the application period. Further details of the application procedure may be found in the College of Medicine Catalog.

SELECTION FACTORS — The College of Medicine follows the recommended acceptance procedures of the Association of American Medical Colleges. Acceptance is based upon an assessment of the applicant’s intellectual and personal traits. In evaluating candidates, the Admissions Committee considers ability and scholarship as indicated by the candidate’s entire academic record, the results of various aptitude and achievement tests; letters of recommendation, and the personal interview. Consideration is given only to residents of Arizona and to highly qualified residents of Alaska, Montana, and Wyoming who are certified and funded by the Western Interstate Commission for Higher Education (WICHE). Applicants from states other than these cannot be considered.

ADMISSION OF TRANSFER STUDENTS — Applications are accepted for transfer into the clinical years of the College of Medicine curriculum only from Arizona residents and WICHE certified and funded residents from Alaska, Montana and Wyoming. Please see the College of Medicine Catalog for further information.

ACADEMIC POLICY AND CURRICULUM — All medical students are graded on an Honors-Pass-Fail basis. Students who are enrolled in other colleges of the University and who are taking College of Medicine courses will be graded by the same system as the rest of the University.

The curriculum of the College of Medicine is based upon a four-year program. For information concerning the pace of academic work, please consult the College of Medicine Catalog.
**College of Mines**

The College of Mines carries out its teaching, research, and public service functions in the areas of knowledge relating to the arts and sciences required to recover the earth's mineral and fuel resources and convert them to the use of humankind. Minerals and fuels are the nonrenewable resources which supply the materials and energy society has used to build its world. They are the basis of civilization and are essential to our economic well-being. As such, these minerals and fuels must be developed and used as wisely, safely, economically, and unobtrusively as possible. It is the purpose of the College of Mines to teach and to augment the technology required for the proper development of these nonrenewable resources. At the center of an extraordinary mineral-producing region, the college is ideally located to carry out its purpose.

The college is composed of the following academic departments: Department of Chemical Engineering, Department of Materials Science and Engineering, and Department of Mining and Geological Engineering. In addition, the Bureau of Geology and Mineral Technology is attached to the College of Mines. The Bureau is a service organization charged with developing, maintaining, and disseminating information to the people of the state of Arizona relating to mining, metallurgy, and the earth sciences generally. Its scientific investigations and public service activities are comparable to those conducted by geological surveys and mineral experiment stations in other states.

**DEGREES**

The following degrees are offered through the departments in the college: Bachelor of Science in Chemical Engineering, Bachelor of Science in Geological Engineering, Bachelor of Science in Materials Science and Engineering, Bachelor of Science in Mining Engineering, Master of Science, and Doctor of Philosophy. In addition, the college offers the following professional degrees: Chemical Engineer, Geological Engineer, Metallurgical Engineer, and Mining Engineer.

**MAJORS**

The undergraduate majors available in the College of Mines are chemical engineering, geological engineering, materials science and engineering, and mining engineering. For the Master of Science and Doctor of Philosophy degrees, students may major in chemical engineering, geological engineering, materials science and engineering, mineral economics, and mining engineering.

**COLLEGE REQUIREMENTS**

**ADMISSION** — In addition to the general requirements for admission to the University, the College of Mines requires the following specific subjects: plane geometry, one unit; intermediate algebra, ½ unit; advanced algebra, ½ unit; trigonometry, ½ unit; chemistry, one unit; and physics, one unit.

A deficiency in chemistry or physics will be waived upon satisfactory completion of Chem. 103b or Phys. 103b. A deficiency in intermediate algebra, advanced algebra, or trigonometry will be eliminated by taking Math. 116, 117e, or 118, respectively. (Completion of Math. 117d will also eliminate a trigonometry deficiency.)
GRADE AVERAGE IN THE MAJOR FIELD — For graduation, a grade average of 2.0000 is required for all courses taken in the major field at the University of Arizona.

MAXIMUM UNITS PER SEMESTER — Students in the College of Mines may take no more than nineteen units per semester, except by special permission of the dean of the college. Permission to take more than nineteen units will be granted only to students showing unusual capacity for such a heavy academic load.

TOTAL UNITS REQUIRED — The minimum units required for a bachelor's degree in the College of Mines is 133-138, depending upon the major field. Of these units, at least 25 percent must be university credit, with at least eighteen units of university credit in the major department. Each undergraduate curriculum is designed so that degree requirements can be completed in four years if the student earns sixteen to eighteen units per semester plus the necessary summer units where required. However, the curricula are flexible enough to permit the student to take only fifteen to sixteen units each semester if he or she wishes to extend the time required for graduation to 4½ years. A student earning credit at a rate to ensure completion of requirements in 4½ years and maintaining a satisfactory grade record will be considered by the college to be making normal progress toward a degree.

HUMANITIES-SOCIAL SCIENCE REQUIREMENTS — All candidates for bachelor's degrees in the College of Mines must complete the equivalent of one semester's worth of credit, as specified in each department's required curriculum, in the humanities and social sciences. In general, at least six units should be in the humanities area and at least six should be in the social sciences, with the remainder from either category. Credit for a certain number of these courses may be established by examination, upon approval of the student's adviser.

The purpose of such requirements is to provide breadth to the aspiring engineer both in humankind's cultural development (the humanities) and social development (the social sciences). Inasmuch as engineering is practiced under public scrutiny and for the public good, it is appropriate that the engineering student's education include intellectual exposure to and exchange with nonengineering faculty, students, and subject matter by taking humanities and social science courses.

Humanities courses include certain selections from art and music (history and appreciation), history, languages (at least one full year), literature, humanities, Oriental studies, and philosophy.

Social science courses may be selected from certain offerings in anthropology, economics, geography, history, political science, psychology, sociology, and speech communication.

The courses to be submitted for the humanities—social sciences electives are selected from a college-approved list by the student in consultation with an adviser. A copy of the currently approved list is available in college and departmental offices.

ACCREDITATION

The Accreditation Board for Engineering and Technology (ABET) is the official agency for accrediting undergraduate engineering curricula. Schools are visited periodically by teams of outstanding engineers selected by ABET. A complete evaluation is made of curricula, faculty qualifications, laboratory and library facilities, grading standards, and many other considerations. Thus, when the major undergraduate curricula of an engineering college are accredited by the ABET, the student is assured that high standards are maintained.
**REQUIRED CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING (ABET Accredited)**

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* *Humanities, social sciences, technical electives and technical requirements. A total of 15 units of humanities and social science electives is to be taken with a minimum of six in each category to be selected from the fields listed under "Humanities-Social Science Requirements" in this section. Fifteen units of technical electives are to be selected from appropriate fields of engineering, science or business to meet the individual student's needs or interests as approved by a departmental adviser. The technical requirements include three units of civil engineering, three units of material science and six units of electrical engineering as specified by the department.

**A field trip is made in mid-January and is a required part of Ch. E. 304."*
REQUIRED CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN GEOLOGICAL ENGINEERING (ABET Accredited)

FRESHMAN YEAR

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SUMMER SESSION

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SENIOR YEAR

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REQUIRED CURRICULUM LEADING TO THE DEGREE OF
BACHELOR OF SCIENCE IN MATERIALS SCIENCE AND ENGINEERING

FRESHMAN YEAR

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SOPHOMORE YEAR

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JUNIOR YEAR

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SENIOR YEAR

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†Technical electives must be chosen in consultation with the student's adviser. Half of the technical electives must be taken in the department.

# REQUIRED CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN MINING ENGINEERING (ABET Accredited)

## FRESHMAN YEAR

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## PROFESSIONAL DEGREES

The requirements for the professional degree of Chemical Engineer (E. Chem), Geological Engineer (E. Geol), Metallurgical Engineer (E. Met), or Mining Engineer (E. Min) are:

1. The candidate must have earned a degree from the University of Arizona and must hold a bachelor's or master's degree in engineering.
2. The degree may be granted no fewer than ten years after graduation in recognition of outstanding professional accomplishments and is not conferred merely to mark the termination of a prescribed period of industrial practice.

3. The faculty of the College of Mines shall be responsible for recommending candidates for the degree on the basis of professional achievement.

4. Award of a professional degree requires that a candidate be recommended by the College of Mines faculty to the Faculty Senate of the University. The name of a candidate approved by the Faculty Senate will then be included in the list of those candidates for degrees certified by the Registrar to the college faculties and the University faculty for final approval.

SPECIAL COLLEGE PROGRAMS

COOPERATIVE EDUCATION PROGRAM — Many industrial and governmental organizations which employ engineers and scientists in Arizona and other states cooperate with the College of Mines in a five-year, work-study program which supplements formal classroom education. The general plan requires the student to finish all freshman courses with a satisfactory grade-point average, after which he or she will alternate work with study in semester and summer periods.

Among the many advantages to the student are: acquiring as much as two years of work experience — both practical and professional — in the area of the major field, and earning enough money to finance a large portion of the college education.

Each student in the program must register for the work periods as well as for the semesters of regular course work. The registration fee for each work period is $5.00. This registration gives official student status, permitting the student to retain such University residence as would be assigned if the student remained in Tucson. In addition, the student may purchase activity and Artist Series tickets on the same basis as could any student enrolled for fewer than seven units.

Further information may be obtained by contacting the Cooperative Education office.

SCHOLARSHIP PROGRAM — Besides the general financial assistance available through the University Office of Student Financial Aid, a large number of scholarships are available specifically to students enrolled in the College of Mines.

College of Mines scholarships, in general, are awarded primarily on the basis of scholastic achievement, character, and engineering promise, with financial need usually of secondary consideration. Some of these scholarships are open only to continuing students in the college, but many are available to those just entering. Stipends range from $150 to $4500 for one year. Inquiries concerning these scholarships should be addressed to the dean, College of Mines.

MINERAL ENGINEERING STUDENT EXCHANGE PROGRAM — The University of Arizona has a compact with seven other western schools to support undergraduate studies in mineral engineering through the Western Interstate Commission for Higher Education (WICHE). Thus, if a student who is a resident of the states of Alaska, Idaho, Montana, New Mexico, Nevada, Utah, or Wyoming desires to pursue studies in mining engineering, materials science and engineering, or geological engineering at the University of Arizona, and the desired curriculum is not offered in the home state, then that student is eligible to attend the University of Arizona without paying non-resident tuition, which otherwise would normally be assessed. Write to the dean of the College of Mines for more information.
The following professional organizations have active student chapters sponsored by the college. The college encourages students to participate in these organizations through all four years of enrollment.

- American Institute of Mining, Metallurgical and Petroleum Engineers
  - Society of Mining Engineers
  - The Metallurgical Society
- American Institute of Chemical Engineers
- American Society for Metals
- Association of Engineering Geologists
College of Nursing

Professional nursing is a service which helps people achieve and maintain optimum health. It is demanding but rewarding. Rapid social changes require professional nurses to have a body of knowledge in pace with scientific advances which they apply to effective nursing care. They must possess problem-solving ability and discriminative judgment in recognizing the health needs of patients, their families, and the community, and in utilizing appropriate nursing intervention. The practice of nursing changes as continuously as the practice of medicine and related disciplines. Clinical nursing is based upon the natural and behavioral sciences, and students are encouraged to draw upon scientific principles from related courses to include psychological and social as well as physical care in their applied nursing courses.

The college is accredited by the National League for Nursing and approved by the Arizona State Board of Nursing. Upon recommendation of the faculty, the graduates will be admitted to the licensing examination administered by the state board. Information regarding licensure may be obtained from the office of the associate dean of the baccalaureate program.

DEGREES

The degrees offered are the Bachelor of Science in Nursing, the Master of Science, the Nursing Specialist, and the Doctor of Philosophy. For information regarding graduate study, please see the Graduate Catalog.

The program which leads to the B.S. in Nursing prepares the graduate to begin practice as a professional nurse, and to undertake graduate study in nursing. The curriculum is composed of two years of preclinical courses, which are taken in the College of Arts and Sciences, followed by the clinical major. After having completed the preclinical phase of the program, students are admitted selectively to the College of Nursing to begin the nursing major in fall or spring. A minimum of 33 units of the nursing major must be university-credit course work.

Nursing students are preparing for a profession which is exacting and in which they must take responsibility for the lives and well-being of others. Applicants must be in good physical and mental health; otherwise, they may be denied admission or, once admitted, recommended for withdrawal.

REQUIREMENTS

Any entering freshman who meets University admission requirements as described in the Admission to the University section of this catalog may be admitted to the College of Arts and Sciences for the prenursing portion of the program.

Transfer students must meet the same University admission requirements. They may complete all freshman and sophomore courses as listed in the nursing program at another college or university, or may present a combination of transfer and University of Arizona courses for consideration for admission to the nursing major.

There is a selection process before any student can be accepted into the College of Nursing for the upper-division, nursing courses. For acceptance into the nursing major, students must have completed the prescribed freshman and sophomore courses, attained a grade-point average of 2.5000 on all courses taken in the freshman and sophomore years, and have removed any high school deficiencies. All transfer students must have a minimum 2.5000 average on all freshman and sophomore courses on both University of Arizona and transfer credits for consideration for admission to the college.
Students are required to take the University of Arizona Writing-Proficiency Examination before starting their classes in the College of Nursing. Students who have an unsatisfactory rating on the examination will be required to complete remedial work acceptable to the College of Nursing.

Effective fall semester 1986, all students entering the College of Nursing will be required to have basic computer knowledge, obtained in high school, computer store, university courses, or self-taught.

Since enrollment in the college is limited, completion of freshman and sophomore courses by entering freshmen or transfer students with the required grade-point average does not assure the student of admission to the major. Once admitted to the major, the student must be full time, attending five consecutive semesters. During these semesters the student must be enrolled for all required courses.

Students seeking acceptance to the College of Nursing for fall semester need to file the special application form, to be obtained directly from the college, by February 1 of the sophomore year and can expect to hear of their status by April 1. Students planning to enter the college in a spring semester must file this application by August 1 of the previous year and can expect to hear by October 1 regarding acceptance.

In addition to these requirements, registered nurses from diploma or associate degree schools of nursing must hold a current, valid license to practice nursing. For these applicants acceptance of transfer credits and the establishment of credit by examination will be considered on an individual basis. (See also Special Examination for Credit section of this catalog.)

Since clinical laboratories are in a variety of community settings, all students in the clinical nursing courses are required to provide their own cars for transportation to the areas where they are assigned for patient-care experience.

A candidate for the degree of B.S. in Nursing must fulfill the requirements both in number and kind of units as outlined in the catalog under which the student has chosen to graduate. The graduation average must be 2.0000 or better, with an average of 2.0000 or better for all work undertaken in the major field at the University of Arizona (See also Graduation Requirements section of this catalog.)

HONORS

The college participates in the Honors Program.

REQUIRED CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN NURSING

FRESHMAN YEAR

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### SOPHOMORE YEAR

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*All students must complete Psyc. 101 (3 units) and at least one other psyc. course (3 units). At least nine units of the fifteen units in anth., psyc. or soc. must be in the same department.

**Humanities (6 units): All students in prenursing are required to complete either: (A) two semesters of Hum. 250a-250b (8 units); or (B) no fewer than 6 units of course work from the following groups: courses in literature, courses in history, courses in philosophy. A list of courses acceptable under option B is available in the College of Nursing. The humanities survey (250a-250b) constitutes a single, 8-unit sequence, but a student may elect only part of the sequence.

***There may be an additional prerequisite for Ecol. 159aR, 159bR.

### JUNIOR-SENIOR YEARS

Five consecutive semesters beginning either fall or spring.

**FIRST SEMESTER** — N.F.S. 310 (3); Nurs. 353 (6), 354 (3), 359 (3)
Total units — 15

**SECOND SEMESTER** — Pcol. 472 (3); Nurs. 363 (11); Nurs. Elective (3)
Total units — 17

**THIRD SEMESTER** — Nurs. 373a (6), 373b (5), 375 (3), 379 (2)
Total units — 16

**FOURTH SEMESTER** — Nurs. 381 (6), 382 (6), 388 (2), 389 (2)
Total units — 16

**FIFTH SEMESTER** — Nurs. 387a (8), 387b (8)
Total units — 16

Total Minimum Units Required for Graduation — 140-143
**College of Pharmacy**

The primary objective of the College of Pharmacy is to educate selected, highly-motivated students to become competent pharmacists capable of delivering pharmaceutical and other health-related services necessary for modern health care. These services, whether performed in a community, institutional, or other setting, require the expertise of a drug specialist who is concerned with providing high-quality patient care, particularly as it relates to safe and rational drug therapy. These responsibilities provide unusual opportunities for humanitarian service and impose high standards of moral and professional integrity on the practitioner.

The curricula in pharmacy provide the basic science and professional courses, as well as social and behavioral science and humanistic courses, which are essential to patient care in a variety of health-care settings. The programs provide flexibility for the student interested in research, industrial practice of pharmacy, or preparation for graduate study. The College of Pharmacy is accredited by the American Council on Pharmaceutical Education.

**DEGREES**

The college offers the degree of Bachelor of Science in Pharmacy based upon five years of college work (two years of prepharmacy and three years in the College of Pharmacy) as outlined below. The Doctor of Pharmacy degree, a six-year program is also offered as an optional first professional degree for a selected number of students. The person who completes this degree is an advanced practitioner who can find opportunities for employment as a clinical practitioner in facilities such as hospitals, ambulatory care clinics, extended care institutions, progressive community pharmacies, drug and poison information centers, private group medical practices and as a pharmacy faculty member. The curricula for both degrees are outlined below. Through the Graduate College, the Master of Science is available for majors in pharmacology, toxicology, and pharmacy; the Doctor of Philosophy, with majors in pharmaceutical chemistry, pharmacology and toxicology, and pharmacy is also available. In conjunction with the University of Arizona Health Sciences Center, the Southern Arizona Mental Health Center, and the Veterans' Administration Medical Center in Phoenix and Tucson, the college provides training applicable to Pharmacy Residency Certification. For the specific programs available in the departments of Pharmaceutical Sciences, Pharmacology and Toxicology, and Pharmacy Practice, consult the respective department headings elsewhere in this catalog.

**REQUIREMENTS**

**ADMISSION** — In addition to the general requirements for admission to the University, all applicants should have completed one unit of elementary algebra, one unit of plane geometry, ½ unit of trigonometry, and ½ unit of advanced algebra. A deficiency in advanced algebra or trigonometry can be removed by taking Math. 117e or 118.

Admission to the College of Pharmacy requires completion of courses as specified in the prepharmacy curriculum below. Students in the Prepharmacy Program at the University of Arizona are enrolled in the College of Arts and Sciences. However, equivalent courses completed at other colleges or universities are accepted in fulfillment of the prepharmacy curriculum.

Applications for admission to the University are available from the Office of Admissions, University of Arizona, Tucson, AZ 85721. Completed applications and transcripts of all college work should be submitted to the Office of Admissions. All other application materials (listed below) should be sent directly to the College of Pharmacy. Applicants must take the Pharmacy College Admission Test (PCAT) and arrange to have scores forwarded to the College of Pharmacy. The PCAT is given in November, February, and April during each admission cycle,
and it is recommended that it be taken in November, but no later than February. Application forms for the PCAT may be obtained from Psychological Corporation, 7500 Old Oak Blvd., Cleveland, OH 44130.

Candidates are admitted to the first year of the professional pharmacy program only in the fall semester. Evaluation for admission is based upon consideration of the following application items: (1) completed application form, (2) academic record, (3) a listing of courses that are in progress, (4) a listing of courses which the student will enroll in and complete before the beginning of the fall semester, (5) a completed Student Profile Questionnaire, (6) three completed Recommendation forms, (7) report of PCAT results, and (8) interviews.

Students who seek acceptance to the College of Pharmacy are urged to initiate the application process in October of the year preceding admissions and have all application materials submitted as soon as possible, but no later than by the end of February. It is expected that most students will be informed of their admission status shortly after the academic results of the fall semester (i.e., the third prepharmacy semester) have been reviewed by the College Admissions Committee.

Candidates for admission to the Doctor of Pharmacy program are selected from those students completing the second professional year in the college. Students interested in pursuing the Doctor of Pharmacy degree should apply for admission to the program at the end of the second professional year. Admission is based upon the candidate's academic record, motivation, communicative skills and potential for leadership in professional service and/or education. Letters of recommendation, academic records and structured interviews will be used to assess the qualifications of each applicant.

SCHOLASTIC REQUIREMENTS — Two types of grade-point average are considered for the determination of scholastic standing in the College of Pharmacy: the cumulative University grade-point average and the cumulative professional grade-point average. A student shall be placed on probation if either grade-point average falls below 2.0000 at the end of a semester or summer session. A student who is on probation may be disqualified at the end of the next semester if either grade-point average is still below 2.000. A student who has been disqualified for at least a semester and who wishes to be readmitted to the pharmacy program, must petition the College of Pharmacy. A readmitted student is automatically on scholastic probation and is subject to any additional conditions that may be imposed by the faculty. It should be noted under "Academic Probation and Disqualification" in this catalog that, "Any later disqualification will be considered permanent disqualification from the University."

INTERNERSHIP REQUIREMENTS — After enrolling in the College of Pharmacy, a student may register as an intern with the Arizona State Board of Pharmacy, 5060 N. 19th Ave., Suite 101, Phoenix, Arizona 85015. Inquiries concerning registration as a pharmacy intern and internship regulations should be addressed to the Secretary of the Board of Pharmacy.

FINANCIAL ASSISTANCE — Both undergraduate and graduate students in the College of Pharmacy are eligible for financial assistance through the scholarship and loan funds described in the Scholarships and Financial Aids section of this catalog.

REQUIRED CURRICULUM LEADING TO THE DEGREES OF BACHELOR OF SCIENCE IN PHARMACY AND DOCTOR OF PHARMACY

FIRST PREPHARMACY YEAR

<table>
<thead>
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<th>Subject</th>
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<tr>
<td>Engl. 101</td>
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<tr>
<td>Chem. 103a</td>
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<td>Soc.Sci. Elective*</td>
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### SECOND PREPHARMACY YEAR

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*Lower-division social science elective — six units of introductory courses from any of the following areas: anth., psyc., soc., pol., speech, hist.

**The equivalent of College Algebra (one-half unit advanced algebra and one-half unit trigonometry in high school) must be satisfactorily completed as a prerequisite.

***Humanities 250a or six units from College of Arts and Sciences accepted list or equivalent.

### FIRST PROFESSIONAL YEAR

(Bachelor of Science and Doctor of Pharmacy)

<table>
<thead>
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### SECOND PROFESSIONAL YEAR

(Bachelor of Science and Doctor of Pharmacy)

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### THIRD PROFESSIONAL YEAR

(Bachelor of Science)

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THIRD PROFESSIONAL YEAR
(Doctor of Pharmacy)

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SUMMER SESSION
(Doctor of Pharmacy)

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<tbody>
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FOURTH PROFESSIONAL YEAR
(Doctor of Pharmacy)

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</table>

*Five units of general electives required for B.S. and Pharm.D. programs.
**Six units of professional electives required for Pharm.D. program.

ELECTIVES — In addition to the lower-division social science electives and the humanities option required of all students during their prepharmacy curriculum, students in the College of Pharmacy are required to complete electives during their professional curriculum.

Five units of upper-division general electives are required for the Bachelor of Science program and for the Doctor of Pharmacy program. These electives may be chosen from upper-division (300 and 400 level) courses in the following departments:

Accounting  Marketing
Anthropology  Molecular and Cellular Biology
Biochemistry  Nutrition and Food Science
Chemistry  Pharmaceutical Sciences
Computer Science  Pharmacology and Toxicology
Ecology & Evolutionary Biology  Pharmacy Practice
Economics  Psychology
Finance  Sociology
Health Related Professions  Speech Communication
Management and Policy  Statistics
Management Information Systems

In addition to five units of general electives required for the Doctor of Pharmacy program, six units of professional electives are required and may be chosen from upper-division (300-600 level) courses in the following departments:

Pharmaceutical Sciences  Multidisciplinary courses offered
Pharmacy Practice  by the College of Medicine
Pharmacology and Toxicology  (with approval)
THE ARIZONA POISON AND DRUG INFORMATION CENTER, 
THE RUTH E. GOLING CLINICAL PHARMACOKINETICS LABORATORY, 
AND THE JEFFREY M. GOLING CLINICAL RESEARCH UNIT

The Arizona Poison and Drug Information Center, the Ruth E. Golding Clinical Pharmacokinetics Laboratory, and the Jeffrey M. Golding Clinical Research Unit are operated by the College of Pharmacy. For a description of their unique, invaluable service and teaching functions, consult the general information section of this catalog.
THE NATURE OF GRADUATE WORK — The status of graduate students is different from that of undergraduates. Satisfying degree requirements should not be the primary aim of graduate students. Graduate education provides an opportunity to increase knowledge, to broaden understanding and to develop research capabilities. Consequently, the student's academic achievements should reflect a personal commitment to the discipline and to scholarly standards.

ADMISSION — Admission to the Graduate College is open to qualified applicants who hold the bachelor's degree from the University of Arizona or from a college or university which grants degrees recognized by the University of Arizona. Applicants who apply for admission to the Graduate College are evaluated on the individual merits of their academic achievements and individual scholarly potential to complete graduate-level course work and curriculum requirements. Admission is granted only after approval of the candidate's previous academic record by the Dean of the Graduate College and the head of the department in which the candidate proposes to do the greater portion of major academic work. Each applicant with an undergraduate academic record containing “pass,” “satisfactory,” “credit,” or similar entries for courses which have a substantial bearing on the field of specialization must also submit (i) a written evaluation by the instructor of each such course, or a letter grade, and (ii) scores on the aptitude test of the Graduate Record Examinations. An additional number of undergraduate courses may be required when previous work has not approximated the general requirements for the corresponding bachelor's degree at the University of Arizona or the special requirements for the field in which the candidate proposes to specialize. With departmental approval, a limited number of deficiencies may be satisfied after admission to a graduate degree program, but without graduate credit. Students whose preparation is such that they are temporarily unable to elect any work for graduate credit must register in the appropriate undergraduate college.

Regular Graduate Status. Students who meet the admission requirements outlined above may be admitted to Regular Graduate Status to undertake work leading to an advanced degree.

Unclassified Graduate Status. University of Arizona graduates or qualified Arizona residents who are not admitted to graduate degree programs may apply for admission to Unclassified Graduate Status for the purpose of undertaking work to suit their needs. Except for submission of Graduate Record Examination scores and approval of the heads of departments in which a prospective student plans to study, such applicants must meet the admission requirements outlined above. Graduate students who complete an advanced degree and, subsequently, register for additional course work without being admitted to another advanced degree program will be placed in Unclassified Graduate Status. Unclassified Graduate students may earn graduate credit as their qualifications and performance warrant; but no student may later apply toward an advanced degree more than six units earned as an Unclassified Graduate student.

Admission of Foreign Students. Nonimmigrants should request graduate application forms from the Graduate Student Admissions Office and departmental requirements and materials from the major department.

All foreign student applications, with the required credentials, should reach the Graduate Student Admissions Office-F before May 15 for the fall term; September 15 for the spring term; and April 1 for the summer sessions. It is frequently very difficult to evaluate properly a foreign student's preparation in terms of University requirements for advanced degree programs. Many graduates of foreign institutions are therefore admitted routinely as International Special Students with the understanding that they may be required to undertake certain work without graduate credit in order to make up deficiencies in preparation, and that no commitment can be made in any case regarding the time required to complete a course of
study. The decision as to whether an international special student can qualify for graduate
credit will be made after the student has established a satisfactory record of performance in
graduate course work.

Foreign students must demonstrate proficiency in English as one of the conditions for
admission. The University requires all foreign applicants whose native language is other than
English and who have not completed at least two academic years of full-time study in the
United States, English-speaking Canada, the United Kingdom, Australia, or New Zealand,
unless that study has resulted in a bachelor's or higher degree, to take the Test of English as a
Foreign Language (TOEFL). Results of the TOEFL are valid for two years, and scores will be
sent to the University of Arizona, when requested by the applicant, from TOEFL; Box 899-TR,
Princeton, New Jersey 08540, U.S.A. The scores for this examination must be received before
the student's application is complete. New foreign students whose native language is not
English may also be required to take a locally administered English test and to enroll for any
further English courses which may be recommended.

Foreign students on nonimmigrant visas must certify that they possess adequate
financial resources to support themselves while in residence at the University of Arizona. If
sponsorship is through an organization or government agency, the sponsor must inform the
Graduate Student Admissions Office-F, in advance, what the terms of support will be. If the
University is to bill for tuition and fees, billing must be through an embassy or an agent in the
United States. In addition, foreign students on nonimmigrant visas are required by the
University to have student accident and sickness insurance coverage for each term of
enrollment. The cost of this insurance is included in the amount of financial guarantee
required. Students may be exempted from the University of Arizona insurance plan only when
their government or sponsoring agency has submitted accident and sickness insurance plans
acceptable to the University of Arizona. Additional information and costs of this coverage will
be sent to those foreign students who are accepted for admission.

APPLICATION FOR ADMISSION — Application for admission to the Graduate College must
be made on forms furnished by the Graduate College. Completed application forms must
arrive before supporting transcripts come or processing will be seriously delayed. An applicant
from another institution should request that two sets of complete official transcripts of all
undergraduate and graduate work done and degrees received be sent directly by the institution
at which the work was done to the Dean of the Graduate College of the University of Arizona.
Both the application and the transcripts should be on file at least three months prior to
registration. Applicants should also contact the department of their intended major to obtain
departmental application materials and requirements. Students who have been admitted to the
Graduate College, but who were not enrolled during the previous regular semester, must apply
for readmission.

GRADUATE RECORD EXAMINATIONS — To supplement other evidence of preparation for
graduate work, the Graduate Council has authorized the use of the Graduate Record
Examinations. These examinations will not replace other records of achievement as a basis for
admission to the Graduate College, but they will offer additional evidence concerning the
qualifications of students desiring to undertake graduate work.

A number of departments have specific requirements with regard to the Graduate
Record Examinations, the Graduate Management Admissions Test, and other examinations.
Departmental headnotes in the Graduate Catalog and academic departments should be
consulted for further information.

It is strongly recommended that, in addition to providing transcripts of records of all
previous academic work, each applicant for admission to the Graduate College take the
Graduate Record Examinations and submit a transcript of the scores. Applications for the
examinations, which are administered locally as well as in other centers, should be sent,
together with the examination fee, to Graduate Record Examinations; Educational Testing
Service; Box 1502; Berkeley, California 94701; or Box 955; Princeton, New Jersey 08541.
Application materials are available in the office of the Graduate College and from the
Educational Testing Service.
CANDIDACY FOR AN ADVANCED DEGREE — Admission to graduate study does not imply admission to candidacy for an advanced degree and gives no right or claim to be so admitted. Such candidacy is determined after the student has demonstrated, by work done at the University of Arizona, the ability to do work of graduate character with originality and independence. Until admitted to candidacy a student should not rely upon taking the final examination for a degree at any set time.

GRADUATE CREDIT FOR SENIORS AND UNCLASSIFIED (NOT GRADUATE) STUDENTS — A University of Arizona student of senior standing who is within 15 units of completing all requirements for graduation may register for graduate work if recommended by the head of the department and approved by the Dean of the Graduate College. For such registration a petition for graduate credit in excess of senior requirements must be filed with the dean at the time of registration. This petition must be endorsed by the professor in charge of the course and the student's adviser. The dean will not approve a petition unless the senior has a grade point average of 3.0000 or better on all work already completed at the University, is proceeding toward graduation as directly as possible, and does not propose a total load to exceed sixteen units. The maximum number of units of graduate credit that may be earned by a senior in any semester is equal to the difference between sixteen and the number necessary to complete requirements for graduation.

An unclassified (not graduate) student at the University who holds the bachelor's degree may petition for permission to take courses for graduate credit. The petition must be filed at registration time, must be recommended by the instructor of the course and the head of the department concerned, and must be approved by the Dean of the Graduate College.

GENERAL PREREQUISITES FOR MAJOR GRADUATE CREDIT — The undergraduate major, or its equivalent, in any field of study is prerequisite to major graduate work in that field. In some cases, a field of concentration in undergraduate work different from but suitably related to the graduate major may be acceptable. The minimum requirement in education is fifteen units, of which three may be general psychology, anthropology, or sociology.

Deficiencies in undergraduate preparation must be satisfied by the completion of prescribed courses, for undergraduate credit.

REGULAR GRADUATE CREDIT COURSES — Regular courses numbered 500 and above are intended for graduate students, while approved 400-level courses, indicated by a GC in the course listing, may be taken for graduate credit by graduate students, and by undergraduates who have received prior, written permission of the Dean of the Graduate College. (See the Departments and Courses of Instruction section for classification of regular courses by number.) With prior written permission of the Dean of the Graduate College, exceptionally well-qualified seniors may enroll in 500-level courses. Courses numbered 600 and above are not open to undergraduates.

OTHER COURSES FOR GRADUATE CREDIT — In addition to the regularly scheduled campus offerings, the University also offers a variety of special courses. Such courses are designated by numbers of four digits. The first digit, 4 or 5, indicates the type of course instruction. The last three digits are the same as the number of the regular campus offering unless there is no such counterpart.

All courses given by television for credit are designated by four-digit numbers beginning with 5. As many as eighteen units of credit in 5000 series courses may be applied to meeting the requirements for the master's degree, except that this limit is reduced by the number of units of transfer work offered. No course in the 5000 series may be applied toward meeting the requirements for the doctoral degree. Correspondence courses are designated by four-digit numbers beginning with 4. No courses in the 4000 series may be used toward a graduate degree.

TRANSFER OF GRADUATE CREDIT — The University of Arizona accepts graduate credit by transfer from other accredited institutions; however, the whole number of transferred units offered toward a master's degree may not exceed twenty percent of the minimum number of units required for the degree in question. Such transfer of credit may be applied toward an advanced degree only upon satisfactory completion of such additional courses as may be
prescribed by the head of the corresponding department in the University. Furthermore, the
application of transfer work toward meeting requirements for a master's degree will reduce the
number of units of work in the 5000 series acceptable for the same program (see "Other
Courses for Graduate Credit" above).

In any case, transfer of credit toward an advanced degree will not be made unless
approved by the head of the major department, unless the grade earned was "A" or "B," and
unless the credit was accepted or would be acceptable toward an advanced degree at the
institution where the work was completed. Furthermore, transfer will be made of credit only;
no account will be taken of the grades of transfer work in computing the student's grade-point
average. Such transfer, which must be arranged by the student through the Graduate Degree
Check Office, may be initiated at any time but will not become effective until the student has
completed satisfactorily at least twelve units of graduate work at the University of Arizona.

Credit for extension work from other institutions will not be accepted.

CORRESPONDENCE COURSES — Correspondence courses will not be accepted for
graduate credit.

SCHOLARSHIP REQUIREMENTS — A high level of performance is expected of students
enrolled for graduate credit. A student who does not appear to be making satisfactory progress
in graduate work may be required to withdraw from the University. No student will be
recommended for the award of an advanced degree unless he or she has achieved a grade-
point average of 3.0000 or better (a) on all work taken for graduate credit and (b) on all work
included specifically in the graduate study program. To meet condition (a) the grade-point
average will be computed on all University of Arizona course work for which the student has
enrolled for graduate credit, whether or not it is offered in satisfaction of requirements for an
advanced degree, except for courses in which grades of "P" or "S" have been awarded. To meet
condition (b) the grade-point average is computed in a like manner, but only on courses in-
cluded in the approved graduate study program set up by the major department. Students who
do not meet condition (b) may take additional work. Such additional work may be included with
the major work in the computation of the grade-point average to meet condition (b), but only
with the approval of the major department secured prior to taking the work in question.

PASS-FAIL OPTION — This option is not available to graduate students except for; (a)
admission deficiencies which the student has specific, prior, written approval to take on a "P-F"
basis. (Only the department head or the departmental graduate adviser may give such
approval, which must be on file in the Graduate College office before registration.); and (b) any
undergraduate, nondeficiency course available for "P-F" grading; and (c) any course offered by
the college of Law.

FULL-TIME STUDENT STATUS — Full-time status for graduate students is widely variable,
depending upon assistantship and associateship duties and the constitution of the individual
student's program. Students in doubt about their standing should check with the Graduate
College.

MAXIMUM ENROLLMENT — The maximum enrollment allowed per semester for students
registered in the Graduate College is sixteen units. Students are asked not to request
permission to take more than this maximum.

SUPPLEMENTARY REGISTRATION — Each student who, during any academic term, is
associated with the University in any capacity that makes use of University facilities or faculty
time must register. During the fall and spring semesters a minimum of three units of course
work will be required; during any summer term one unit of course work will be required. The
minimum course-work-registration requirement may be met by registering officially for any
single course or combination of courses for which the total number of units meets or exceeds
the specific minimum.
Each student completing requirements for an advanced degree must be registered
during the semester or summer term during which requirements are completed, or the
previous semester or term if requirements are completed during an intersession. Students
who have previously enrolled for all the regular courses required for their degrees and who
still must register should enroll for supplementary registration (course number 930). Supple-
mentary registration may be used concurrently with other enrollments to meet the unit
registration requirement.

**THESIS AND DISSERTATION WORK IN ABSENTIA** — Under conditions approved by the head
of the major department, a portion of the student's thesis or dissertation work may be done in
absentia. Approval to do work in absentia must be sought prior to undertaking the work.

**AUDITING OF COURSES BY GRADUATE STUDENTS** — With the consent of the Dean of the
Graduate College and the instructors concerned, students enrolled in the Graduate College
may unofficially audit courses not included in their regular programs. It is not necessary to
register for such courses, but an auditor's permit must be obtained from the dean. If courses
are audited officially by registering as an auditor, the units are included in the student's unit
load and the fees are the same as a registration for credit. For the purpose of reporting full- or
part-time student status to outside agencies, however, only those courses taken for credit are
counted. After the fourth week of classes, a change from credit to audit will be permitted only
if the student is doing passing work in that course and receives the approval of the course
instructor and the Dean of the Graduate College.

**MAJOR FIELDS FOR MASTER'S DEGREES**

Major work leading to a master's degree is offered in each of the following fields:

- accounting
- aerospace engineering
- agricultural economics
- agricultural education
- agricultural engineering
- agronomy & plant genetics
- American Indian studies
- anatomy*
- animal physiology
- animal science
- anthropology
- applied mathematics
- architecture
- art
- art education
- art history
- astronomy
- atmospheric sciences
- bilingual/bicultural education
- biochemistry
- botany
- business administration
- business education
- cellular & developmental biology
- chemical engineering
- chemistry
- civil engineering
- classics
- composition (music)
- computer science
- counseling & guidance
- creative writing
- dairy science
- electrical engineering
- elementary education
- engineering mechanics
- English
- English as a second language
- entomology
- exercise and sport sciences
- family and consumer resources
- finance
- food science
- foundations of education
- French
- general biology
- genetics
- geography
- geological engineering
- geosciences
- German
- health education
- higher education
- history
- home economics education
- horticulture
- hydrology
- industrial engineering
- journalism
- landscape architecture
- Latin American studies
- library science
- linguistics
- management and policy
- management information systems
- music education
- musicology
- music theory
- nuclear engineering
- nursing
- nutritional sciences
- optical sciences
- Oriental studies
- performance (music)
- pharmacology
- pharmacy
- philosophy
- physics
- physiology*
- planetary sciences
- planning
- plant pathology
- plant protection
- political science
- poultry science
- psychology
- public administration
- range management
- reading
- rehabilitation
- renewable natural resources studies
- Romance languages
- Russian
- secondary education
- sociology
- soil & water science
- Spanish
- special education
- speech & hearing sciences
**MAJOR FIELDS FOR SPECIALIST DEGREES**

Major work leading to a specialist degree is offered in each of the following fields:

<table>
<thead>
<tr>
<th>Educational Administration</th>
<th>Nursing Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Media</td>
<td>Reading Administration</td>
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<td>Educational Psychology</td>
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**MAJOR FIELDS FOR DOCTORAL DEGREES**

Major work and research leading to a doctoral degree are offered in the following fields. (Except as noted, the degree is Doctor of Philosophy.)

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| *Both Ph.D. and Ed.D. degrees are offered.*

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### ADVANCED DEGREES OFFERED

Full descriptions of programs and requirements for each of the following degrees may be found in the *Graduate Catalog*. A number of departments offer work leading to more than one degree, and a great many specializations are available within the degrees listed.

<table>
<thead>
<tr>
<th>Degree</th>
<th>Description</th>
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<tbody>
<tr>
<td>Master of Accounting (M.Ac.)</td>
<td>Master of Landscape Architecture</td>
</tr>
<tr>
<td>Master of Agricultural Education (M.Ag.Ed.)</td>
<td>Master of Library Science (M.L.S.)</td>
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<td>Master of Architecture (M.Arch.)</td>
<td>Master of Music (M.M.)</td>
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<tr>
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<td>Master of Public Administration (M.P.A.)</td>
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<td>Master of Business Administration (M.B.A.)</td>
<td>Master of Science (M.S.)</td>
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<td>Master of Education (M.Ed.)</td>
<td>Master of Teaching (M.T)</td>
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<td>Master of Fine Arts (M.F.A.)</td>
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<td>Master of Home Economics Education (M.H.E.Ed.)</td>
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<tr>
<td>Educational Specialist (Ed.S.)</td>
<td>Nursing specialist (N.S.)</td>
</tr>
<tr>
<td>Doctor of Education (Ed.D.)</td>
<td>Specialist in Microbiology (Sp.M.)</td>
</tr>
<tr>
<td>Doctor of Musical Arts (A.Mus.D.)</td>
<td>Doctor of Philosophy (Ph.D.)</td>
</tr>
</tbody>
</table>
The Department of Exercise and Sport Sciences offers course work in exercise and sport sciences and physical education leading to bachelors' degrees. Minor programs are available in physical education and in athletic coaching. The latter minor is designed for individuals who wish to coach interscholastic sports at the secondary school level while teaching in a field other than physical education. Refer to the Departments and Courses of Instruction section of this catalog for the specific details concerning each of these programs.

Master of Arts and Master of Science degrees are available with a major in exercise and sport sciences. A minor in exercise and sport sciences is available for Ph.D. and Ed.D. students with majors in other disciplines. For information regarding graduate programs, please consult the Graduate Catalog.

The department offers a broad elective program in physical activity course work which focuses on physical fitness and skill development. Students may choose from among more than forty different courses. Provision is made for those students with physical handicaps to participate in an adapted physical activity program which has many diverse offerings.

**ATHLETIC PROGRAMS**

**INTRAMURAL AND RECREATIONAL SPORTS PROGRAM** — Competitive and informal programs of activity intended for students, faculty, and staff of the University are sponsored by the Department of Intercollegiate Athletics throughout the year. The intramural program includes competitive sport activities in twenty-four sports for men, twenty-two sports for women, and twelve sports on a corecreational basis. Men and women are encouraged to join dormitory, sorority, fraternity or independent teams or register independently in this competitive sports program.

Informal activity is provided by scheduling most of the sports facilities for specific hours of recreational use. Gymnasia, handball/racquetball and tennis courts, swimming pools, weight room and field space are available for individual participation in recreational pursuits. All students, faculty, and staff are encouraged to utilize the facilities when they are available.

Complete information regarding the program of intramural and recreational sports can be obtained by calling the office of the coordinator.

**INTERCOLLEGIATE ATHLETICS** — The Intercollegiate Athletics Department at the University of Arizona conducts a challenging program in eighteen sports for men and women. The University is a member of the NCAA, and both the men's and women's programs are conducted under NCAA rules and participate in NCAA championships. The University athletic program participates in two athletic conferences.

The women's program is a member of the Pacific West Conference (Pac West) which includes, in addition to the University of Arizona, Arizona State University, Stanford University, University of California at Los Angeles and the University of Southern California. The intercollegiate athletics program for women includes the following sports: basketball, cross-country, golf, gymnastics, softball, swimming and diving, synchronized swimming, tennis, track and field, and volleyball.

The men's athletics program competes in the Pacific-10 Conference. Its members include, in addition to the University of Arizona, Arizona State University, Stanford University, Oregon State University, University of California, University of California at Los Angeles, University of Oregon, University of Southern California, University of Washington, and
Washington State University. The University of Arizona men's program participates in the following sports: football, basketball, baseball, track and field, cross-country, swimming and diving, golf and tennis.

The President of the University appoints an advisory committee on intercollegiate athletics, which consists of the Director of Athletics, the faculty representative to the NCAA, members of the faculty, alumni members, and students.

OFFICE OF INTERDISCIPLINARY PROGRAMS

One of the major problems facing higher education is the initiation and development of effective interdisciplinary programs of education and research. The traditional disciplinary structure of the University is being altered in diverse ways, some involving informal cooperation of interested faculty, others resulting in creation of centers, institutes and other organized units. The University of Arizona has responded to these needs by creating a number of interdisciplinary units: the Office of Arid Lands Studies, the Environmental Research Laboratory, the Optical Sciences Center, the Institute for Atmospheric Physics and others.

The Office of Interdisciplinary Programs was established as an agency responsible for furthering the development of new activities. The Coordinator of Interdisciplinary Programs works with the Dean of the Graduate College and the Vice President for Research in fostering both educational and research projects.

SCHOOL OF HEALTH-RELATED PROFESSIONS

The School of Health-Related Professions provides educational opportunities for students in the health-related professions. Close liaison exists with related colleges as a recognition of the interdisciplinary nature of the health field and an attempt to utilize valuable resources throughout the University.

DEGREES — The School offers the Bachelor of Science in Health Sciences degree with majors in health education, medical technology, and occupational safety and health, as well as a Master of Education with a major in health education.

ADMISSION — Students seeking admission to programs in the School of Health-Related Professions should contact the Office of Academic Services in the College of Arts and Sciences, Modern Language 347, or faculty advisors for the programs of health education or medical technology at the School of Health-Related Professions, 1435 N. Fremont.

SCHOOL OF MILITARY SCIENCE, NAVAL SCIENCE AND MILITARY AEROSPACE STUDIES

The Reserve Officer Training Corps (ROTC) has been an integral part of the University of Arizona since 1917. The School of Military Science, Naval Science and Military Aerospace Studies consists of three separate departments, the Department of Military Science (Army), Department of Naval Science (Navy), and the Department of Military Aerospace Studies (Air Force), under the administrative control of the military coordinator, a civilian member of the University staff designated by the President of the University.

General objectives of the course of instruction are to furnish leaders suitable for commissioning as Reserve Officers in the U.S. Army, U.S. Navy, and U.S. Air Force. Outstanding Army ROTC students who are designated Distinguished Military Students are eligible to apply for appointment as officers in the Regular Army. All graduating students in the Air Force ROTC program go on active duty. Intermediate objectives of the ROTC programs are to develop self-discipline; integrity; a sense of responsibility; an appreciation of the role of a participating citizen in the national defense; and the capacities for thoughtful and decisive leadership.
Army ROTC (Reserve Officers' Training Corps) is a program which offers college students the opportunity to graduate as officers and serve in the U.S. Army, the Army National Guard, or the U.S. Army Reserve. Army ROTC has been an integral part of the University of Arizona since 1917.

Army ROTC enhances a student's education by providing unique leadership and management training, along with practical experience. It helps a student develop many of the qualities basic to success in the Army, or in a civilian career. ROTC gives each college student a valuable opportunity to build for the future by earning a college degree and an officer's commission at the same time.

PROGRAMS — The School of Military Science offers a regular four-year program and a special two-year program.

The four-year program is divided into two parts called the Basic Course and the Advanced Course. The Basic Course is usually taken during the first two years of college and covers such subjects as management principles, national defense, military history and leadership development. In addition, a variety of outside social and professional enrichment activities are available. All necessary ROTC textbooks, uniforms, and other essential materials for the Basic Course are furnished to the students at no cost. The student participating in the Basic Course is under no military obligation. After completing the Basic Course, students who have the desire and have demonstrated the potential to become an officer and who have met the physical and scholastic standards are eligible to enroll in the Advanced Course.

The Advanced Course is usually taken during the final two years of college. It includes instruction in organization and management, tactics, ethics and professionalism and further leadership development. All necessary textbooks and uniforms in the Advanced Course are also furnished to students at no cost. During the summer between their junior and senior years of college, Advanced Course cadets attend a paid six-week training session at Fort Lewis, Washington, called ROTC Advanced Camp. Advanced Camp gives cadets the chance to practice what they've learned in the classroom, and introduces them to Army life at an active Army post. Advanced Course cadets receive a monthly subsistence allowance of $100.00 during their ROTC training.

The two-year program is designed for junior and community college graduates, students at four-year colleges who did not take ROTC during their first two years of school, students entering a two-year post-graduate course of study, and high school students planning to attend military junior colleges. To enter the two-year program, students must first attend a fully-paid six-week Basic Camp, normally held during the summer between their sophomore and junior years of college. Students going to a military junior college will attend camp the summer following high school graduation. At Basic Camp, students learn to challenge themselves physically and mentally, and to build their confidence and self-esteem. After successful completion of Basic Camp, students who meet all the necessary enrollment requirements may enroll in the Advanced Course of ROTC study. Students with prior military service may qualify for the Advanced Program without having to attend Basic Camp.

MILITARY SERVICE CREDIT — Credit toward graduation received for active military service (see "Evaluation of Military Training and Experience" in the Admission to the University section of this catalog) can be used in lieu of lower-division (Basic Course) ROTC units in the four-year program.

LOWER-DIVISION CREDIT — Two units of credit are given for each semester completed of the Basic Course (total four semesters).

UPPER-DIVISION CREDIT — Three units of credit are given for each semester completed of the Advanced Course (total four semesters). Advanced Course ROTC cadets are required to sign a contract with the government to continue in ROTC until the completion of ROTC training.

FINANCIAL ASSISTANCE — Subsistence pay of $100.00 per month, tax-free, for a maximum of twenty months during the Advanced Course is paid to upper-division ROTC cadets. Additionally, students receive pay for summer camp and travel pay to and from ROTC Advanced Camp.
Army ROTC scholarships are offered for four, three and two years and are awarded on a competitive basis to the most outstanding students who apply. Four-year scholarships are awarded to students who will be entering college as a freshman. Three- and two-year scholarships are awarded to students already enrolled in college and to Army enlisted personnel on active duty. Students who attend the Basic Camp of the two-year program may compete for two-year scholarships while at camp.

Each scholarship pays for college tuition and required educational fees, and provides a specified amount for textbooks, supplies and equipment. Each scholarship also includes a subsistence allowance of up to $1,000 for every year the scholarship is in effect.

**Department of Naval Science**

The mission of the Naval Reserve Officers Training Corps Unit is to develop midshipmen morally, mentally, and physically and to imbue them with the highest ideals of duty, honor, and loyalty in order to commission college graduates as naval officers who possess a basic professional background, are motivated toward careers in the naval service, and have a potential for future development in mind and character so as to assume the highest responsibilities of command, citizenship, and government.

**PROGRAMS** — The NROTC program offers a four-year college program and a two-year college program. All programs lead to service as a commissioned officer in the Navy or Marine Corps.

Applications for the four-year college program may be made to the NROTC unit at any time. Applications for the two-year college program may be made to the NROTC unit during the fall semester or early part of the spring semester of the sophomore year. Applicants are selected on the basis of demonstrated academic performance and expressed motivations.

**FINANCIAL AID** — The NROTC program offers four, three-and-a-half, three, two-and-a-half, and two-year scholarships. Students in the NROTC scholarship program receive tuition and scholastic fees, textbooks, uniforms and $100.00 per month for a maximum of 40 months. Students in the NROTC college program receive Naval Science textbooks and uniforms while they are in the program and $100.00 per month subsistence allowance during their junior and senior years.

Applications for the NROTC four-year scholarship program must be made to the Navy by December 1 for entry into the program the following fall semester. Applicants must compete nationally on the basis of ACT or SAT scores. High school and college academic performance weighs heavily on an applicant's selection. Applications for the NROTC two-year scholarship must be made to the Navy during the early part of the year for entry into the program in June. Applicants must be college sophomores and selection is based primarily on the student's academic performance.

Further information concerning the program may be obtained from high school and college counselors, recruiting stations, and the NROTC unit at the University of Arizona.

**COURSES OF INSTRUCTION** — Students in the NROTC scholarship program are encouraged to pursue majors in the engineering and hard science (mathematics, chemistry, and physics) fields of study to meet the technological requirements of today's growing Navy. Other fields of study are permitted with the approval of the Professor of Naval Science. There are no restrictions placed upon college program students or Marine Corps option students as to their academic majors.

While enrolled in the NROTC program the student will complete the following courses of study in addition to their academic major requirements.

**FIRST YEAR**
- Naval Science 101 Introduction to Naval Science
- Naval Science 102 Naval Ship Systems I

**SECOND YEAR**
- Naval Science 201 Naval Ship Systems II
- Naval Science 202 Seapower and Maritime Affairs
THIRD YEAR
Naval Science 301  Navigation and Naval Operations I
Naval Science 302  Navigation and Naval Operations II

FOURTH YEAR
Naval Science 401  Leadership and Management I*
Naval Science 402  Leadership and Management II

*Management 305 may be substituted for this course.

Course descriptions may be found under Naval Science in the departmental section of this catalog. Marine Corps option students will take Naval Science 310 — Evolution of Warfare; Naval Science 410 — Amphibious Warfare; and two elective courses (elective courses must be approved by the Professor of Naval Science) during their third and fourth years vice the above schedule.

All NROTC students attend Naval Science laboratory once a week. In addition, the NROTC scholarship students must take certain additional courses depending on major. Information concerning these additional courses may be obtained at the Department of Naval Science.

Department of Military Aerospace Studies

The Department of Military Aerospace Studies (Air Force ROTC), provides unique opportunities to students interested in entering the military profession as Air Force officers. Today's Air Force is a highly technologically advanced branch of the military forces. Whether a student's interest lies in flying the most advanced aircraft in the world or in the development of "state of the art" technology, the Air Force can offer exciting and challenging opportunities to those who qualify. Graduates go on active duty in career fields where they can immediately apply their university education. Additionally, they assume advanced leadership and management responsibilities not normally found in civilian entry level positions. Although a bachelor's degree is the minimum requirement, students working toward higher degrees can also join the program and receive a commission in the U.S. Air Force.

PROGRAMS — Air Force ROTC offers both a two- and four-year program. The four-year program consists of the General Military Course — four semesters of lower division aerospace studies classes; and the Professional Officer Course — four semesters of upper division aerospace studies classes. The first four semesters carry no military obligation, giving students the opportunity to look at the military profession and the Air Force before making a commitment. Since the first four semesters have no prerequisites, they are open to any student interested in exploring Air Force opportunities. The two-year program consists of the Professional Officer Course. Students must have at least a junior standing to enter the two-year program, and should apply during the fall or early spring of their sophomore year of study. Seniors and graduate students wishing to enter the two-year program must have or be willing to spend two years in ROTC as full-time students. All ROTC students attend a weekly one-hour leadership laboratory providing "hands-on" experience in the art and science of leading people.

FINANCIAL AID — Every student accepted into the Professional Officer Course receives a $100.00 per month, tax-free subsistence allowance during the academic year. Scholarships are also available. Air Force ROTC offers four, three-and-a-half, three, two-and-a-half, and two-year scholarships. Students must apply for four-year scholarships as seniors in high school. Subsequent to high school, students must be enrolled in an Air Force ROTC class to apply. A student enrolled in any lower division Air Force ROTC class may qualify for a scholarship. Scholarships pay tuition and fees, the cost of books, plus a $100.00 per month, tax-free subsistence allowance. Scholarships are awarded based on the student's achievement, not financial need, and do not extend the active duty commitment.

CREDIT — Lower division Air Force ROTC classes carry two units of credit each semester. Upper division classes carry three units each semester. People with prior military service and people accepted into the two-year program may receive credit for the lower division Air Force ROTC courses.

For more information, please contact the Department of Aerospace Studies.
DIVISION OF CONTINUING EDUCATION

The Division of Continuing Education is responsible for educational and community services as an outreach function of the University of Arizona. In cooperation with all academic colleges and departments of the University, specific courses and programs are developed to meet the ever-changing needs of people in the Tucson area and southern Arizona. Learning opportunities include a variety of credit and non-credit programs.

Credit Programs

UNIVERSITY EXTENSION — University Extension serves the needs of individuals who find it difficult or impossible to take regularly scheduled classes on campus. The Sierra Vista/Fort Huachuca Program Center is open five days a week. Both graduate and undergraduate courses are offered off-campus and all courses receive regular University credit. In all cases, admission to the graduate college is required to receive graduate credit.

INDEPENDENT STUDY THROUGH CORRESPONDENCE — Correspondence courses are designed to parallel, as nearly as possible, the same courses offered on campus. Neither age of the student nor place of residence is a deterring factor to the successful completion of an independent study program. All lessons and examinations are mailed to the instructor who grades and returns the lessons to the students. Tucson area students take examinations in the Independent Study Through Correspondence Office on campus. Students residing outside of the Tucson area take examinations in their local community under the auspices of an approved proctor. Regularly enrolled on-campus students may register for correspondence courses with the approval of the college dean. For information on restrictions governing the use of correspondence study to fulfill graduation requirements, see "Correspondence Study" and "University Credit Requirement" under the Graduate Requirements section of this catalog.

DISQUALIFICATION — Students disqualified from the University for disciplinary reasons may not register for credit courses of any nature through the Division of Continuing Education during their disqualification period. Those disqualified for scholastic reasons, however, may register for correspondence courses with the approval of the college dean.

Noncredit Programs

UNIVERSITY CONFERENCE DEPARTMENT — Working with colleges, departments and faculty, the conference department assists in planning regional, national and international conferences, short courses and seminars.

SPECIAL INTEREST — Offers classes, workshops of general interest to the public including a special program for children. The Great Decisions Program is sponsored by the department.

SPECIALIZED CLIENTELE — Works with colleges, departments, faculty and community members and organizations to develop workshops and seminars to meet specialized needs of a particular clientele.

ELDERHOSTEL — Continuing Education is the state coordinating office for Arizona Elderhostel. Arizona Elderhostel is part of the national Elderhostel network offering special low-cost academic programs for older adults.

OFFICE OF INTERNATIONAL PROGRAMS

The Office of International Programs serves as a campus-wide support and coordinating unit for all international activities of the University of Arizona. Numerous international development activities are coordinated through this office. These include active projects in Africa, the Middle East, and Latin America.
Study Abroad Programs coordinated from this office include summer and semester programs in Rio de Janeiro, Brazil; London, England; Florence, Italy; Segovia, Spain; and in France, Germany, Japan, and Taiwan. The University also operates a major summer program in Guadalajara, Mexico. Numerous international academic programs include formal faculty exchanges between the University and institutions in France, Austria, Britain, and Mexico.

The Office serves as a campus clearing house for information on international programs, studies, and projects, to students, faculty, and the general public. The Office also provides special services, by contractual arrangement, with sponsors of international students for which fees are charged.

The Peace Corps Office, which counsels and processes Peace Corps and U.N. Volunteer Program applicants, is part of the Office of International Programs.

OFFICE OF THE SUMMER SESSION

Summer session is an integral part of the academic structure of the University and consists of a three-week preession and two five-week terms. Courses offered are of the same character as those held during the regular academic year, with similar standards of academic achievement required. Over seven hundred courses are available during the summer terms.

The summer program is coordinated by the Office of Summer Session, with departmental academic programs determined by academic deans.

ADMISSION — Summer session enrollment is open to all regularly admitted students of the University. It is also open to students admitted at the undergraduate level for the summer session only.

For further information, please see the Summer Session Schedule of Classes, which is published each January.

Winter Session

A three-week winter session, consisting of a limited number of courses and coordinated by the Office of Summer Session, is held during the break between the fall and spring terms. Students are able to earn up to three units of credit.
Courses
Departments and Courses of Instruction

CURRICULAR CHANGE

Course listings in the following departmental sections are subject to change. Curriculum changes approved during the first year of the catalog's biennium are listed in the Supplement to the University of Arizona Catalog, published approximately one year after publication of the biennial catalog. A copy of this publication is available upon request from the Curriculum Office, Administration Building, Room 116. Because the catalog designation of semesters of offering is subject to change, students should consult the Schedule of Classes for curricular planning of a particular term. Schedules for fall and spring classes are available from the Information Desk, Administration Building, 2nd Floor, in April and October, respectively. The Summer Schedule of Classes is available in January from the Office of the Summer Session, Administration Building, Room 116. For a complete statement of the student's responsibility in maintaining acquaintance with current University requirements, see the copyright page of this catalog.

EXPLANATORY NOTES

CLASSIFICATION OF COURSES (THE NUMBERING SYSTEM) — The number by which a course is designated indicates the level of the course.

Courses numbered:

100-299 inclusive: Lower-division courses primarily for freshmen and sophomores.

100-199: Primarily introductory and beginning courses.


300-499 inclusive: Upper-division courses primarily for juniors and seniors.

300-399: Advanced-intermediate-level courses. Not available for graduate credit.

400-499: Advanced-level courses. Acceptable for graduate credit with the prior approval of the Graduate College, except 400-level individual studies courses (491, 493, 494 or 499, with or without subscripts).

500-599 inclusive: Graduate courses. Open to exceptionally well-qualified seniors with the prior written approval of the course instructor and the Graduate College.

600-699 inclusive: Graduate courses. Not open to undergraduate students.

700-799 inclusive: Graduate courses limited to doctoral students.

800-899 inclusive: Courses limited to students working toward degrees offered by the College of Medicine or the College of Pharmacy. Not available for credit toward other degrees.


SEMESTER COURSES (SINGLE NUMBERS) — A course designated by a single number (as Economics 248) is one semester in length.

YEAR COURSES (DOUBLE NUMBERS) — A course designated by a double number (as Political Science 233a-233b) is continued through two successive semesters, the work of the first semester being prerequisite to that of the second unless otherwise indicated in the statement of prerequisites. Credit is awarded for the first half of the course except in a few instances when credit in the first half is contingent upon completion of the second half.

PREREQUISITES — A student registering for a course must meet the prerequisites or otherwise satisfy the instructor of his or her preparation to take the course. Prerequisites can be waived only at the discretion of the instructor or department involved.

ADDITIONAL COURSES — In addition to the courses listed in this catalog, courses offered for no credit through the Division of Continuing Education are listed in the catalog for that division.
CANCELLATION OF COURSES — The University reserves the right to cancel courses not elected by an adequate number of students.

FOREIGN LANGUAGE COURSES — In addition to courses taught in the language departments, sections of other University courses may be taught in a foreign language from time to time.

KEY TO SYMBOLS

The standard course description includes a variety of symbols indicative of essential information. The following is a standard course description with the individual symbols explained in the order in which they appear in that description.

SAMPLE COURSE LISTING:

406. Social Structure in Modern Societies (3) [Rpt.] GC 1986-87 GRD Critical review of modern theory and research on social structure and social organization in modern societies. 2R, 3L. P, six units of soc. or CR. (Identical with Hist. 406) Smith

406. — Course number.
Social Structure in Modern Societies — Course title.
(3) — Number of units.
[Rpt.] — May be repeated for credit. A restriction regarding the number of times a course may be repeated for credit (beyond the student's first enrollment) or the total number of units of credit permitted for a course may be designated. [Rpt./2] indicates that the course may be repeated for credit twice, for a maximum of three enrollments in the course; [Rpt./6 units] means that the course may be repeated until the student has received a total of six units of credit. It is the student's responsibility to ensure that course content is not duplicated.
GC — Graduate credit available. (Applies to 400-level courses only.)
I — Semester offered. I indicates fall semester; II, spring; S, summer.
1986-87 — Year in which course is offered. If no year designation is given, the course is offered each year.
GRD — GRD and CDT indicate that the course is available by examination. GRD indicates that the course is available by examination for a grade and credit, and CDT indicates that the course is available by examination for credit only. These options are not available for graduate credit.
Critical review.... societies. — Course description.
2R, 3L — Class structure. R, L, and S indicate "recitation," "laboratory," and "studio." 2R, 3L indicates two hours of recitation and three hours of laboratory per week (based upon fifteen weeks). For courses consisting of lecture and recitation periods only, the number of class hours per week is the same as the unit value and is not specified in the course description.
P — Prerequisites.
CR — Concurrent registration.
(Identical with Hist. 406) — Other departments which give credit for the same course. If no course description appears, please consult the crosslisted department.
Smith — Professor in charge.

Note: Not all of the above information may be noted in any individual course.

Symbols in other University Catalogs

Prefix Definition
4 Course offered by correspondence — no university or graduate credit.
5 Course offered by television — limited applicability toward advanced degree.
6 Course shorter in duration than normal semester or term — full university credit.
UNIVERSITY-WIDE "HOUSE-NUMBERED" COURSES

189

195, 295, 395, 495, 595, 695, 795. Colloquium (Credit varies) The exchange of scholarly information and/or secondary research, usually in a small group setting. The exchange of ideas may involve written as well as oral communication. Research projects need not be required of course registrants.

GRADES AVAILABLE: (195, 295, 395, 495)—A, B, C, D, E, I, P/F, S/P, W.
(495, 595, 695, 795)—A, B, C, D, E, I, S/P, W. *

196, 296, 396, 496. Proseminar and 596, 696, 796. Seminar (Credit varies) The development and exchange of scholarly information, usually in a small group setting. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.

GRADES AVAILABLE: (196, 296, 396, 496)—A, B, C, D, E, I, P/F, S/P, W.
(496, 596, 696, 796)—A, B, C, D, E, I, S/P, W. *

197, 297, 397, 497, 597, 697, 797. Workshop (Credit varies) The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles.

GRADES AVAILABLE: (197, 297, 397, 497)—A, B, C, D, E, I, P/F, W.
(497, 597, 697, 797)—A, B, C, D, E, I, W.

'*Special or regular grades may be used as departmental policy dictates; however, in any given instance, all registrants must be graded by the same system.

Individual Studies

Individual-studies courses are those with numbers ending in 91, 93, 94, and 99, as well as all 900-level courses. Under their generic numbers and titles, and without subscripts, they are available for use by all departments at the course-number levels appropriate to the departments’ academic programs.

Individual studies courses at the 400-level are not available for graduate credit.

Supplementary Registration: Graduate students who have completed the course requirements of their programs and will be taking examinations or completing courses or projects initiated at an earlier date should register for supplementary registration. Students completing requirements for advanced degrees must be registered during the semester or summer term in which requirements are completed, or during the previous semester or term if requirements are completed during an intersession. Students who have previously enrolled for all the regular courses required for their degrees may register for supplementary registration (course number 930, one to nine units). All graduate students using University facilities or faculty time must register for 930 if not registered for anything else.

191, 291, 391, 491, 591, 691, 791. Preceptorship (Credit varies.) Specialized, advanced work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.

GRADES AVAILABLE: S/P, C, D, E, I, W.

193, 293, 393, 493, 593, 693, 793. Internship (Credit varies) Specialized, advanced, or graduate work, on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

GRADES AVAILABLE: S/P, C, D, E, I, W.

4931, 5931. Legislative Internship. [493 (12), 593 (9)] [II Working experience at the Arizona State Legislature; responsibilities draw upon student’s area of major expertise and include preparing written and oral reports, summarizing legislative proposals, and providing information to legislators and legislative committees. Participating programs include but are not limited to: architecture, economics, English, geography and regional development, history, hydrology, journalism, management, management information systems, marketing, political science, psychology, public administration, secondary education, sociology, statistics, and urban planning. Students in other programs are eligible and should consult the department head or, in the case of the College of Law, the dean, for appropriate arrangements.

GRADES AVAILABLE: A, B, C, D, E, I, W.

194, 294, 394, 494, 594, 694, 794. Practicum (Credit varies) The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation.

GRADES AVAILABLE: S/P, C, D, E, I, W.

199, 299, 399, 499, 599, 699, 799.* Independent Study (Credit varies) Qualified students working on an individual basis with professors who have agreed to supervise such work.

GRADES AVAILABLE: S/P, C, D, E, I, W.
DEPARTMENTS AND COURSES OF INSTRUCTION

900. Research (Credit varies) Individual research by graduate students, not related to a thesis or dissertation the student will write for an advanced degree.
GRADES AVAILABLE: S/P, C, D, E, K, W.

908. Case Studies (Credit varies) Individual study of a particular case, or report thereof.
GRADES AVAILABLE: S/P, E, K, W.

909. Master's Report (Credit varies) Individual study or special project or formal report thereof submitted in lieu of thesis for certain master's degrees.
GRADES AVAILABLE: S/P, E, K, W.

910. Thesis (Credit varies) Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.
GRADES AVAILABLE: S/P, E, K, W.

920. Dissertation (1 to 9) Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).
GRADES AVAILABLE: S/P, E, K, W.

925. Graduate Recitals (1 to 9) For graduate students in music performance.
GRADES AVAILABLE: S/P, E, K, W.

930. ** Supplementary Registration (1 to 9) For students who have completed all course requirements for their advanced degree programs. May be used concurrently with other enrollments to bring to total number of units to the required minimum.
GRADE AVAILABLE: K.
*Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
**Credit received for this course is in addition to the units required for the advanced degree.
†For Information on honors independent study courses (Honr. 299Ha-299Hb and 399Ha-399Hb-399Hc), see Honors in the Departments and Courses of Instruction section of this catalog.

ACCOUNTING

Professors Russell M. Barefield, Head, William B. Barrett, William L. Felix, Jr., Dee L. Kleespie Edward S. Lynn, Lyle H. Mclff, Louis A. Myers, Jr. (Emeritus)
Associate Professors Dan S. Dhaliwal, Jack O. Foltz, Michael D. Shields
Assistant Professors Marcia S. Niles, William K. Salatka, Charles W. Swenson, William S. Waller, S. Mark Young
Lecturer Joan W. Norvelle

The accounting program prepares students for careers such as the independent practice of public accounting, controllership, and general accounting management. Graduate work in accounting is offered for those who wish more background for the positions described above and for those who wish to teach in colleges and universities. In many instances, a five-year program leading to a Master of Accounting degree will be desirable to achieve a student's objectives. (See the Graduate Catalog.)

Students who desire the Bachelor of Science in Business Administration with a major in accounting will follow the program of studies shown in the College of Business and Public Administration section of the catalog.

The department offers graduate instruction leading to the Master of Accounting degree and participates in the programs leading to the Master of Business Administration and Doctor of Philosophy degrees with a major in business administration. For admission and degree requirements, please see the Graduate Catalog.

200. Introduction to Financial Accounting (3) I II CDT Concepts involved in accounting for assets, liabilities, and owners' equity; financial statements.


300a-300b. * Intermediate Accounting (3-3) Theory and methodology involved in contemporary accounting for assets, liabilities, stockholders' equity, net income, and funds; analysis and interpretation of financial statements. Credit allowed for this course or 553a-553b, but not for both. P, 210. Both 300a and 300b are offered each semester.

310. * Cost and Managerial Accounting (3) I II Concepts and analytical procedures necessary in the generation of accounting data for management planning and control. P, 210, Econ. 201a-201b or 300, M.A.P. 275, Math. 123.

320. * Introduction to Federal Taxation (3) I II Principles of federal income taxation, with emphasis on how individuals are taxed; additional topics. Credit allowed for this course or 556, but not for both. P, 210.

401. * Advanced Accounting I (3) GC I II Theory and methodology involved in the preparation of consolidated financial statements and in accounting for partnerships. P, 300b or CR.

402. * Financial Accounting Standards (3) GC II In-depth coverage of selected authoritative pronouncements and other special topics in financial accounting. P, 300b.

405. * Foundations of Accounting and Auditing Theory (3) GC I II Theoretical frameworks and analytical tools appropriate to the development and implementation of accounting and auditing theories. P, 310, M.A.P. 275.

410. * Advanced Cost Accounting (3) GC II Theoretical issues of process and standard costing, performance measurement, differential cost analysis, and other selected topics. P, 310, 405.


422. * Advanced Federal Taxation (3) GC I II Introduction to advanced topics: taxation of corporations and stockholders' transactions in stocks; taxation of partnerships and fiduciaries; gift and estate taxation. P, 320, 401.

431. * Principles of Auditing (3) GC I II The opinion formulation process of the professional auditor; the auditor's reports, professional standards, internal and operational auditing. P, 300b; 405 or M.A.P. 375.

461. * Accounting Information Systems (3) GC I II The analysis, design and implementation of information systems, with special emphasis on accounting applications. P, M.I.S. 121; 310 or 551. (Identical with M.I.S. 461)

472. * Fund Accounting (3) GC II Budgetary and financial accounting, control, and reporting for governments and other not-for-profit organizations. P, 210, 272, or 550.

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

510. Principles of Profit Planning and Control (3) I The design and use of accounting information for managerial planning and control purposes. P, 310 or 551.

522. Tax Planning and Practice (3) I Selected topics of a tax-planning and tax-practice nature; extensive individual reading and research. P, 422.

523. Estate Planning and Taxation (3) II Advanced topics on gift and estate taxation; emphasis on the planning and structuring of financial activities to minimize the impact of income and wealth-transfer taxes. P, 422, M.A.P. 426 or CR.

526. Corporate Taxation (3) II Advanced topics in the taxation of corporations and of stockholders' transactions in corporate shares. P, 401, 422.

527. Tax Aspects of Real Estate Transactions (3) II Gains and losses on sales and exchanges of property for tax purposes; capital and ordinary gains and losses, realization, transfer by gift or at death, use in trade or business, installment sales, and depreciation recapture provisions. P, CR 320.

531. Responsibilities of the Public Accountant (3) II A professional course for those who expect to pursue public accounting as a career. P, 431.

550. Financial Accounting Analysis (3) I II Principles and procedures underlying basic financial accounting processes and their application in the preparation and analysis of financial statements. Advanced degree credit available for nonmajors only. Open only to students admitted to BPA graduate programs.

551. Managerial Use of Accounting Data (3) I II Case studies and text readings focused on utilization of accounting data in determining the possible results of alternative executive decision. Advanced degree credit available for nonmajors only. Open only to students admitted to BPA graduate programs. P, 550, Econ. 500a or CR, M.A.P. 552 or CR.
553a-553b. Financial Accounting (3-3) S Theory and methodology of net income determination; accounting for assets, liabilities, and owners' equity. Credit allowed for this course or 300a-300b, but not for both. P, 210 or 551.

556. Tax Factors in Business Decisions (3) II Introduction to the federal taxation of income for all types of taxpayers and to the taxation of transfers of wealth, with emphasis on the effect of taxes on business decisions. Open only to students admitted to BPA graduate degree programs. Not open to accounting majors. Credit allowed for this course or 320, but not for both. P, 210 or 551.


596. Seminar a. Computers in Auditing (3) I II (Identical with M.I.S. 596a )

610. Contemporary Managerial Accounting Thought (3) II Special topics in accounting theory and research. Of special interest to doctoral students. P, 510.


696. Seminar a. Auditing (1 to 3) I II b. Managerial Accounting (1 to 3) I II c. Taxation (1 to 3) I II d. Theory (1 to 3) I II e. Behavioral (1 to 3) I II

AEROSPACE AND MECHANICAL ENGINEERING

Professors Chuan F. Chen Head, Roger A. Anderson (Emeritus), Francis H. Champagne, Harvey D. Christensen (Emeritus), Hermann F. Fasel, Arland G. Foster (Emeritus), Hussein A. Kamel, Dimitri B. Kececioglu, Robert B. Kinney, Donald M. McEligot, Edwin K. Parks, Henry C. Perkins, Jr., Russell E. Petersen, Willard L. Rogers (Emeritus), Lawrence B. Scott, Jr., William R. Sears (Emeritus), Quentin R. Thomson (Emeritus), Thomas L. Vincent, Paul H. Wirsching, A. Ralph Yappel (Emeritus)

Associate Professors Gregory R. Baker, Thomas F. Balsa, Edward B. Haugen (Emeritus), Parviz Nikravesh, Kumar N. R. Ramohalli, Robert B. Roemer, Bruce R. Simon

Assistant Professors Kee-Ying Fung, Ari Glezer, Juan C. Heinrich, Edward J. Kerschen, Seth H. Lichter, Robert A. Peterson, Arne J. Pearlstein

Associate Department Head Karl M. Pattison

The department offers the degrees of Bachelor of Science in Aerospace Engineering, Bachelor of Science in Mechanical Engineering, and Master of Science and Doctor of Philosophy with majors in aerospace engineering and mechanical engineering. (See the College of Engineering section of this catalog for specific undergraduate program requirements.)

132. Introduction to Engineering Design and Analysis I (3) I Participation in engineering projects involving analysis, construction, operation, testing, design. 2R, 3L. P, Math. 117e, 118.

133. Introduction to Engineering Design and Analysis II (3) II Engineering problem solving; application of mathematical methods to engineering analysis and design. P, CR Math. 125b, Phys. 103a.


312. Introduction to Production Engineering (3) I II Theory of economic material removal or forming; machine tool principles, potentialities, and limitations; cutting tools, consideration of cost, and adaptability from manual to servo controls, design project. 2R, 3L. P, C.E. 214.


333. A.M.E. Instrumentation (3) I II Basic principles of lab. practice and instrumentation. 2R, 3L. P, 331a, 340a, E.C.E. 208.

334. Dynamics of Machines (3) I II Analysis of motions and forces in machines, design exercises. P, 232.

340a-340b. Thermodynamics (3-3) 340a: Basic laws and examples of engineering applications of macroscopic thermodynamics; equations of state; reversible and irreversible processes. P, CR Math. 223, Phys. 103b. 340b: Power systems; non-reacting and reacting mixtures; heat transfer, design exercises. Both 340a and 340b are offered each semester.


402. Production Engineering (3) II Economic production principles; design relationship of materials and production processes; tooling, quality control, and packaging; design project. 2R, 3L. P, 312.


406. Engineering Quality Control (3) GC I (Identical with S.I.E. 406)

408. Reliability Engineering (3) GC I Time-to-failure, failure-rate, and reliability determination for early, useful and wear-out lives; equipment reliability prediction; spare parts provisioning; reliability growth; reliability allocation. P, Math. 223, S.I.E. 320. (Identical with S.I.E. 408)

409a-409b. Engineering Design (3-3) 409a: Role of design in engineering; strength design factors, stress analysis, application of Mohr's circle of stress and strain; deflection analysis and introduction to failure and fatigue theory. P, 232, C.E. 217. 409b: Springs, bearings, gears, brakes and design project.

410. Aerospace Design (3) I II Creative participation of student groups in the advanced design of a modern aerospace vehicle system. 2R, 3L. P, 409a, 461, CR 434.

413a-413b. Reliability and Quality Analysis (3-3) GC 413a: Probability theory and statistical models in reliability, life testing, and design; descriptive and mathematical statistics, basic graphical and analytical data analysis techniques. 413b: Monte Carlo methods in reliability analysis, polynomial curve fitting and linear models, Bayes estimation, decision analysis in engineering design, stochastic processes in design. P, Math. 223.

415. Mechanical Engineering Design (3) I II Engineering design process steps, idea generation techniques, optimal design of engineering systems, computer aided design, major design project. P, 409a, 340b.

416. Mechanical Engineering Design Implementation (3) I II Construction, testing and evaluation of prototype design; design iteration to arrive at final system configuration. 2R, 3L. P, 415. 415 and 416 must be taken in consecutive semesters.

417. Clinical Engineering (3) GC II (Identical with E.C.E. 417)

418. Physiology for Engineers (4) GC I (Identical with Psio. 418)

419. Physiology Laboratory (2) GC I (Identical with Psio. 419)


430. **Mechanical Vibrations** (3) GC I Free and forced vibrations of simple mechanical systems; effects of sampling; introduction to multidegree of freedom systems. P, 232, Math. 254.


436. **Finite Element Methods of Structural Analysis** (3) GC I II Matrix algebra, computers, theory of elasticity, work and strain energy, energy theorems, the finite element, the assembled structure, programming aspects of the problem, general purpose programs, application to aerospace structures. P, 409a.


442. **Heat Transfer** (3) GC I II Study of conduction, convection and radiation heat transfer, with applications to engineering problems. P, 331a, 340a.

450R. **Unit Operations in Metal Processing** (3) GC I (Identical with M.S.E. 450R)

450L. **Metal Processing Laboratory** (1) GC I (Identical with M.S.E. 450L)


453. **Air Conditioning Engineering** (3) GC I Analysis and design of systems and components for control of temperature, humidity, air cleanliness and acoustics; applications to residential and commercial buildings. P, 340b, CR 331a. (Identical with N.E.E. 453)

454. **Power Systems Analysis** (3) GC I II Performance of gas and vapor power cycles, processes and components; fundamentals of combustion; nuclear and unconventional energy sources. P, 340b.

455. **Power Systems Laboratory** (2) I II Lab. investigations involving thermal power systems and energy conversion devices. 3L. P, 340b, CR 333. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

456. **Introduction to Turbo-Machines** (3) [Rpt./1] GC I Theory of energy transfer in turbo-machine components; application to pumps, turbines, and compressors. P, 311b, 340b.

458. **Wind Energy Conversion Systems** (3) GC I Aerodynamic theory of vertical and horizontal axis propellers and windmills; optimal design of blades and electrical components; lab. and field measurements of operating systems. 3R, 1L. Field trips. P, 331a, E.C.E. 208.

460. **Aerodynamics** (3) GC II Basic equations and their approximation; potential flow theory; fundamentals of airfoil and wing theory; axisymmetric flows; application to aero-dynamics of wings and bodies. P, 361, 432.

461. **Gasdynamics** (3) GC II Thermodynamics review; equations for one-dimensional flow; wave propagation and acoustics; isentropic flow; shock waves; simple two-dimensional flows; friction and heat addition. P, 331a, 340a.

462. **Aerodynamics Laboratory** (1) I Low-speed and high-speed wind tunnel testing; aircraft flight tests. P, 333, 361, 461.

463. **Dynamics of Space Flight** (3) GC I Spacecraft dynamics; orbital and attitude maneuvers, lunar and interplanetary transfer, re-entry. P, 232.

466. **Stability and Control of Aerospace Vehicles** (3) GC I Static and dynamic stability of rigid and nonrigid vehicles; automatic control of aircraft, missiles and space craft. P, 361.

467. **Solar Energy Engineering** (3) GC I (Identical with N.E.E. 467)

469. **Energy Engineering Laboratory** (3) GC I II (Identical with N.E.E. 469)
485. Biomechanical Engineering (3) GC II One subject covered yearly from: Biomechanical-solid mechanics (orthopedic, vascular, muscle, skin); feedback control (physiological systems); heat transfer, thermodynamics (temperature regulation/exercise, hyperthermia, instrumentation). P, 310, 331b, 340b, CR 409a.

495. Colloquium s. Senior Colloquium (1) I II

503. Modeling and System Identification in Dynamic Engineering Systems (3) I 1985-86 Principles of mathematical modeling of engineering problems; state and parameter identification techniques; lumped and distributed system; open loop (explicit) and closed loop (implicit) applications; frequency and time domain representation; deterministic and stochastic inputs. P, 310, CR 405.


505. Modern Control Theory (3) II 1986-87 Controllability and stability for linear and nonlinear systems, observer design, qualitative methods of optimal control and game theory applied to control system design. P, 405. (Identical with E.C.E. 505)

506. Advanced Quality Control and Reliability (3) II (Identical with S.I.E. 506)


508. Advanced Reliability Engineering (3) II Extension of 408; Complex systems reliability; maintainability engineering; reliability and availability of maintained systems; operational readiness; system effectiveness; maintainability demonstration. P, 408, S.I.E. 420. (Identical with S.I.E. 508)

510. Airplane and Helicopter Design (3) I Helicopter and airplane design and analysis; optimization of takeoff, climb, specific range, endurance; energy methods. P, 466.

512. Advanced Probabilistic Design (3) II Continuation of 423; advanced methods for mechanical and structural reliability analysis, system reliability analysis, random loading models, applications to fatigue, fracture, buckling, creep, etc. P, 423.

518. Reliability Testing (3) II Mean-time-between-failure and reliability confidence limits; sequential testing; sampling; accelerated, sudden-death, and suspended-items, non-parametric, and Bayesian testing. P, 408, S.I.E. 420. (Identical with S.I.E. 518)

520a-520b. Fundamentals of Fluid Mechanics (3-3) 520a: Fundamental equations of motions; surface tension; kinematics of vorticity; integral solutions; irrotational flows; simple viscous flows. P, 331b, CR 532a. 520b: Small-disturbance inviscid theory; low Reynolds number flow; vorticity dynamics; boundary layers. P, CR 532b.


532a-532b. Engineering Analysis (3-3) 532a: Mathematical models; operational techniques; functions of a complex variable; Fourier analysis. P, Math. 254. 532b: Linear analysis; ordinary and partial differential equations; methods of solution.


538. Finite Element Analysis in Nonlinear Solid Mechanics (3) I Finite element methods, including material nonlinearity (elastic, plastic, viscoelastic); geometric nonlinearity (finite deformations), numerical solution methods, and nonlinear programs. P, 436.

539. Advanced Structural Mechanics (3) II Advanced problems in structural analysis using the finite element method; analysis and optimization of complex systems; nonlinear and composite structures and material systems; application to other disciplines. P, 436. (Identical with E.M. 539)
Advanced Thermodynamics (3) I Reversible and irreversible macroscopic thermodynamics; selected engineering applications. P, 331a, 340a.

Convective Transport Phenomena (3) I Convective energy, mass and momentum transfer; internal and external flow; exact, approximate and numerical solutions; application to current problems. P, 442, CR 532a, computer programming ability.


Combustion Generated Air Pollution (3) II Pollutant formation in combustion processes and methods of control; diffusion models for atmospheric dispersion, including plume rise calculations. P, 331a, 340a. (Identical with Ch.E. 545)

Nature of Turbulent Shear Flow (3) II 1986-87 Physical phenomena in turbulent shear flows; experimental techniques; observations and physical consequences; prediction methods; recent advances. P, 520a-520b, 532b.

Aerodynamics of Propulsion (3) I 1985-86 Interior ballistics of rocket motors; ramjets, turbojets, turbfans; detonation wave theory; combustion chamber instability analysis; nozzle design. P, 461.

Combustion Gasdynamics (3) II 1985-86 Aerothermochemistry; fluid mechanics, thermodynamics, chemistry of propulsion and air pollution; reaction kinetics, combustion stability, detonation; singular perturbations in deflagration. P, 532a, 461.

Applied Combustion (3) II 1986-87 (Identical with Ch.E. 557)

Fluid Mechanics of Viscous Flows (3) I Behavior of viscous fluids over a range of Reynolds numbers; Navier-Stokes equations; boundary layer equations; slow flow; compressible boundary layers. P, 520b.

Compressible Aerodynamics (3) II Inviscid flow of compressible fluids; governing equations and their method of solution for subsonic, transonic, supersonic, and hypersonic flows. P, 532a, 461.

Advanced Solar Engineering (3) II (Identical with N.E.E. 567)

Advanced Biomechanics (3) II 1986-87 Fluid mechanics of the circulatory system; application of mechanics to soft and hard tissues, such as blood, blood vessels, muscle, skin, bone, tissue structure, properties and rheology; peristalsis and urodyanmics. (Identical with Ch.E. 585)

Aeroscociatics (3) I 1985-86 Generation, propagation and attenuation of acoustic waves. Effects of mean flow and applications of engineering importance. P, 520a-520b, 532a-532b.

Hydrodynamic Stability (3) I Introduction to linear stability theory in fluid mechanics; the Orr-Sommerfeld equation, behavior of eigen solutions, stability limits, extensions to problems in two component systems. P, 520a-520b, 532a-532b.

Advanced Computational Aerodynamics (3) I Governing equations for aerodynamic applications; iterative techniques for solving partial differential equations; grid generation and multi-grid techniques; applications to compressible viscous flows. P, 421, 520b, 532b.

Colloquium
a. Research Conference (1) I II

Seminar
g. Graduate Seminar (1) I II

AGRICULTURAL BIOCHEMISTRY AND NUTRITION
(See Nutritional Sciences)

AGRICULTURAL ECONOMICS

Professors Jimmye S. Hillman, Head, Robert C. Angus, A. Gordon Ball, Robert S. Firch, Roger W. Fox, Maurice M. Kelso (Emeritus), William E. Martin,
Associate Professors Edwin H. Carpenter, Dennis C. Cory, James C. Wade
Assistant Professors David L. Barkley, Eric A. Monke, Bonnie C. Saliba, Paul N. Wilson
The department's program is designed to relate agricultural problems and issues in contemporary society to their underlying economic explanations. Through the choice of elective courses the major in agricultural economics may build programs in: agricultural business to prepare for careers in the management of farms, ranches and farm-related firms; economic development for careers in rural area development and foreign agricultural development; resource economics for careers in the management of public resources of land and water; preparation for graduate study for careers in business, teaching and research.

The following degrees are offered: Bachelor of Science in Agriculture with a major in agricultural economics and Master of Science with a major in agricultural economics. The Doctor of Philosophy degree with a major in economics and an emphasis in agricultural economics is administered by the combined faculties of the Departments of Economics and Agricultural Economics.

The major: A minimum of eighteen units in a.e.c. including 403, 404, 439, 464, and six additional units at the 400 level. Additional required courses include Econ. 201b, 300 or 361, 330 or 332, Math. 119, 123, three units of acct., and three units of computer applications.

Students in agricultural economics follow the agricultural business curriculum (see College of Agriculture) with the following additions: six units of basic agricultural courses (Group II); three units of phys., atmo., geos. (Group III); four units of biological or physical sci. electives (Group III); and six units of social sci. and hum. (Group IV). The business core is not required. Students who have majors in other departments and who choose an agricultural business curriculum will also be assigned an adviser in the Department of Agricultural Economics.

213. Introduction to Agricultural Marketing (3) II Basic economic principles and marketing methods for agricultural crops, livestock, and livestock products. Field trip. P, three units of econ. Firch

215. Agricultural Business Management (3) I II Applying economic principles in decision making for the farm or ranch firm; analytical techniques and management control; problems in organization, management, and operation of an agricultural business. P, Econ. 201a Wilson

217. Resource and Environmental Economics (3) I Relationship between man and use of natural resources and environmental systems, with emphasis on the economic implications of alternative environmental, energy and land-use policies. P, Econ. 201a. (Identical with Econ. 217) Cory

231. Agricultural Input Marketing and Sales (3) II Economics of agricultural input markets, agricultural input selling process, sales organization and management. P, Econ. 201a.

242. World Food Economy (3) II World resources of agriculture; population and food supply; economics of hunger, world trade and agricultural policies. P, Econ. 201a. Monke.

313. Economics of Futures Markets (3) II Futures market participants, evolution, functions, performance, regulation, financial instruments, and options on futures contracts, with emphasis on hedging uses of the futures market for agricultural commodities. P, Econ. 201b. (Identical with Econ. 313 and Fin. 313) Firch


403. Marketing and Price Analysis (3) GC II Market functions, costs, price forecasting, and regulation in the movement of agricultural products. Advanced degree credit available for nonmajors only. P, 439, Econ. 300. Monke

404. Production Economic Analysis (3) GC I Application of production economics principles and analytical techniques to the solution of agricultural economics problems. Advanced degree credit available for nonmajors only. P, Math. 117e, Econ. 300. Wade

412. Agricultural Economic Development in Latin America (3) GC II Review and analysis of economic growth and development in Latin America with special emphasis on the agricultural sector. P, Econ. 201a-201b. (Identical with Econ. 412 and Anth. 412) Fox

414. Rural Area Development (3) GC I Identification of current U.S. nonmetropolitan problems, economic principles useful in analyzing these problems, and possible program alternatives for rural area development. P, Econ. 201b or Geog. 305. (Identical with Geog. 414) Barkley

440. Forest Resource Economics (3) GC II (Identical with Ws.M. 440)

442. Transformation of Agarian Societies in the Middle East (3) GC II (Identical with Or.S. 442).
450. Agricultural Finance (3) GC I Applying business principles to problems confronting farm-ranch and incorporated agribusiness firms in the acquisition, allocation, control and transfer of capital resources. P, 215, or Econ. 300 and three units of acct. Wilson

464. Agricultural Policy (3) GC II Economic analysis of the policy issues and proposals impacting on agriculture and rural America, with emphasis on the historical and continuing role of government in price and income policies. Advanced degree credit available for nonmajors only. Hillman

470. Economics of Outdoor Recreation (3) GC II (Identical with N.R.R. 470)

471. Problems in Regional Development (3) GC I II (Identical with Geog. 471)

476. Natural Resource Economics (3) GC II Economic principles useful in analyzing natural resource problems and policies in the Southwest and nationwide. P, Econ. 201a-201b (Identical with Econ. 476, W.R.A. 476, and Ws.M. 476) Saliba

477. Economics of Water and Land Resources (3) GC I Economic analysis of policy issues in rural and urban water use and development. Economic analysis of multiple uses of public lands. P, 217 or 476 or Econ. 201a. (Identical with R.N.R. 477). Martin

480. Forest Policy and Administration (3) GC II (Identical with Ws.M. 480)

500. Research Methodology in Agricultural Economics (3) II Study of the research process in agricultural economics as an efficient means for acquiring reliable knowledge for problem solutions. Martin

504. Production Economics (3) I Theory of the firm and industry; single and multiple products; risk and uncertainty. (Identical with Econ. 504) Barkley/Wilson

512. International Agricultural Economic Development (3) II The role of agriculture in economic growth and development, including economic policies related to agriculture, and to world trade in agricultural commodities. (Identical with Econ. 512) Fox/Monke

513. Agricultural Price and Marketing Analysis (3) II Market organization, efficiency, and functions in a dynamic economy. (Identical with Econ. 513)

514. Cost-Benefit Analysis (3) II Theoretical bases and empirical techniques, with emphasis on LDCs. Consumer-producer surplus; social and private costs; macroeconomic distortions; non-market goods; uses in policy analysis. (Identical with Econ. 514 and M.A.P. 514).


539. Statistical Methods (2) I II (Identical with Agri. 539)


AGRICULTURAL EDUCATION

Professors Floyd G. McCormick, Head, Gordon J. Graham, Clinton O. Jacobs, Kenneth S. Olson
Associate Professor Phillip R. Zurbrick
Assistant Professor David E. Cox
Lecturers R. Thomas Jones, Christopher J. Kalangi

The programs of study in agricultural education prepare students for teaching careers at secondary and community college levels; for positions in agricultural mechanics sales and service; for careers in agricultural communications; and for positions in international agricultural extension available in state, federal and international agencies, business and industry. These positions require preparation in basic sciences, technical agriculture, knowledge of the principles and techniques of the teaching-learning process, communication skills and the ability to work with people.

The department offers the degree of Bachelor of Science in Agriculture with majors in agricultural education and agricultural communications. The degree is available through the agriculture, agricultural science, or agricultural business curricula.
The department also offers programs of study leading to the degrees of Master of Science and Master of Agricultural Education. A strong emphasis in international agricultural extension is offered at the graduate level.

**Degree requirements:** Students with a major in agricultural education will meet the minimum requirements for the Bachelor of Science in Agriculture degree under the selected curriculum. In addition, students will complete the following courses according to their area of emphasis:

1. **Agricultural Teaching:** 100a-100b, 221, 301, 338a, 385, 389, 396a, 396b, 397a, 409; Ed.P. 311; S.W. 200; A.Ed. 213, or 215; An.S. 134 or 430.

2. **Agricultural Mechanics:** 100a-100b, 221, 397a, 397b, 397c, 493; S.W. 404.

Students pursuing a degree of Bachelor of Science in Agriculture with a major in agricultural communications will complete the following courses in addition to meeting the minimum requirements under the selected curriculum: 

**Agricultural Communications:** Jour. 205, 206, 208, 301, 302, 320, 411 or 412 or 413, 422, 450.

Students who do not plan to teach may meet department requirements by completing a minimum of 18 credits in agricultural education and education. Students registering for 389 must have a cumulative grade point average of 2.000 or better and approval of the head of the department.

**100a-100b Agricultural Mechanics (3-3) GRD**
- Principles and techniques in construction and maintenance. 100a: Utilizing wood, concrete masonry materials and electrical energy. 100b: Metal fabrication processes in agricultural occupations and production applications. 100a is not a prerequisite to 100b. (Identical with A.En. 100a-100b).

**221. Introduction to Agricultural Education (1) I Objectives, nature, and scope of vocational education in agriculture; types of programs; qualifications of personnel; career opportunities.**

**301. Youth Leadership Development (3) I Characteristics of effective advisers; leadership styles; strategies for the management and organization of youth groups in agriculture; practice in leadership development techniques.**

**338a. The Teaching of Agriculture (4) II (Identical with S.Ed. 338a):**

**389. Supervised Teaching in Agriculture (1 to 8) [Rpt./I] II Observation and teaching vocational agriculture in the classroom and field under supervision.**

**397. Workshop**
- a. Applications in Agricultural Mechanics (3) I
- c. Fabrications in Agricultural Mechanics (2) II

**409. Principles of Vocational Education (2) II (Identical with S.Ed. 409)**

**422. Community Communications Media (3) I Characteristics of balanced communications serving education and information programs; participating experience utilizing newspapers, radio, television, and newsletters. (Identical with Agri. 422)**

**448. Extension Program Planning and Evaluation (3) GC II (Identical with H.E.E. 448)**

**485. Methods in Teaching Agricultural Mechanics (2) II Problems and procedures in teaching mechanics and operative skills; conducting demonstrations; providing space and teaching facilities.**

**496. Proseminar**
- a. Instructional Materials Development (3) I Field trip. P, 389 or CR.
- b. Techniques in Teaching Agricultural Mechanics (1) I Open to majors only. P, student teacher placement.

**497. Workshop**
- a. Curriculum Development (1 to 3) [Rpt./3] GC I II
- b. Occupational Experience Program (1 to 3) [Rpt./3] GC I II
- c. Youth Leadership Development (1 to 3) [Rpt./3] GC I II
- d. Continuing Education in Agriculture (1 to 3) [Rpt./3] GC I II
- e. Program Planning and Evaluation (1 to 3) [Rpt./3] GC I II
- h. Instructional Realia (1) [Rpt./3 units] I 3L P, CR 396a.
  i. * Extension Communications (1 to 2) [Rpt./2] GC (Identical with H.E.E. 497i)
  m. * Human Motivation in Extension Programs (1 to 2) [Rpt./2] (Identical with H.E.E. 497m)
  n. * Youth Development through 4-H Programs (1 to 2) [Rpt./2] (Identical with H.E.E. 497n)
  r. * Public Relations in Extension (1 to 20) [Rpt./2] GC (Identical with H.E.E. 497r)
509. **Concepts of Vocational Education**: (2) II Vocational education's role in fulfilling school and societal needs. Its effect on economic and social problems plus consideration of appropriate delivery systems and articulation.

538. **Philosophy and Principles of Extension Education** (3) I Social and economic significance of extension education in domestic and international situations. P, twelve units of ag. or f.c.r. (Identical with H.E.E. 538)

539. **Extension Education Methods** (3) II Acquisition of competencies in the development and application of non-formal education methods used by change agents to diffuse practical information. P, six units of a.ed. or education. (Identical with H.E.E. 539)

597. **Workshop**
   c. Extension Credibility and Accountability (1 to 2) (Rpt./2) (Identical with H.E.E. 597c)
   d. Extension Supervision and Administration (1 to 3) (Rpt./2) (Identical with H.E.E. 597d)
   g. Microcomputers-Extension (1 to 2) (Rpt./2) (Identical with H.E.E. 597g)
   t. Principles of Extension Training (1 to 3) I (Identical with H.E.E. 597t)
   u. Evaluation in Extension Education (1 to 3) I (Identical with H.E.E. 597u)
   v. Volunteer Staff Development in Extension (3) I (identical with H.E.E. 597v, which is home)
   x. Administration of Extension Programs (1 to 3) I (Identical with H.E.E. 597x)

*Offered only through the Cooperative Extension Service Winter School.*


615. **Investigations and Studies in Agricultural Education** (3) I Study and analysis of research literature, methods, techniques and procedures for conducting investigations; selecting a problem and developing plans for a study. P, nine units of a.ed. or education. Zurbrick

621. **Program Planning** (3) II Developing programs in agricultural teaching and extension; situation analysis, objectives, policies, content, procedures, and evaluative criteria. P, six units of a.ed. McCormick

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**AGRICULTURAL ENGINEERING**

*(See Soils, Water and Engineering)*

**AGRICULTURE**

Several courses offered within the College of Agriculture are applicable to broad subject matter areas. Therefore, they are offered by the College rather than by a specific department. Courses are taught by faculty within the College. For specific questions, see the Associate Dean and Director of Instruction.

422. **Community Communications Media** (3) I (Identical with A.Ed. 422)

450. **Alternative Futures in Energy and Environment** (3) I GC Energy and environment status and future alternatives; interaction of food-fiber production and natural resource use, with emphasis on student discussion of diverse views. Caldwell

509. **Information Sources for Agricultural Scientists** (1) I Information systems and retrieval techniques, with particular reference to concepts, uses and limitations; emphasis on abstracts, indexes, alerting services, journals and government documents. (Identical with Li.S. 509) McDaniel/Caldwell/Follott

539. **Statistical Methods** (2) II Concepts and methods of inferential statistics, including probability distributions, estimation and testing hypotheses for common statistical problems. 10-week course. P, Math. 117e. (Identical with A.Ec. 539) Kuehl

A student should also take a third related unit, taught during the last five weeks of the semester and selected from among the following options:

- **539a. Analysis of Variance** (1) II P, 539.
- **539n. Nonparametric Methods** (1) I P, 539.
- **539r. Regression Analysis** (1) II P, 539.
- **539s. Sample Surveys** (1) II P, 539.
540. **Design and Analysis of Experiments (3)** II Design principles for complete and incomplete block designs, analysis of factorial experiments, split plot designs, analysis of covariance, analysis of series of experiments, orthogonal polynomials and multiple regression. P, 539a. Kuehl

609. **Scientific Communication and Research Funding Methods (1)** II 1985-86 Techniques and limitations of written, oral, and visual scientific communication; procedures and policies for research funding sources.

**AGRONOMY AND PLANT GENETICS**

(See Plant Sciences)

**AMERICAN INDIAN STUDIES**

Committee on American Indian Studies

Professors Robert K. Thomas, *Director*, James W. Clarke (Political Science), Vine Deloria, Jr. (Political Science), Jane H. Hill (Anthropology), N. Scott Momaday (English), James Officer (Anthropology), Susan W. Steele (Linguistics)

Associate Professors Barbara Babcock (English), Courtney Cleland (Sociology), Lawrence C. Evers (English), James R. Reid (Anthropology)

Assistant Professors Thomas M. Holm (Political Science), Earl W. Jernigan (Anthropology), Alice Paul (Elementary Education), Leslie Silko (English)

Instructor Ofelia Zepeda (Linguistics)

Lecturer Emory Sekaquaptewa (Anthropology)

The minor in American Indian studies consists of at least twenty units selected by the student in consultation with the chairperson of the committee and approved by the student's major professor. The minor provides a wide range of instruction in the history, culture, lifeways, and contemporary problems of the native people of the New World. The Departments of Anthropology, Art, English, Linguistics, and Political Science, and Sociology and various departments in the College of Education contribute to this program, which provides American Indian students with basic information on their cultural heritage and its significance in the contemporary world. It also provides other students with a greater appreciation for the lifeways and value systems of American Indians. Prelaw students interested in legal problems of American Indians may combine prelaw and American Indian studies and American Indian policy courses in the Department of Political Science with the minor in American Indian studies.

A Master of Arts with a major in American Indian studies is also available. For admission and degree requirements, please see the Graduate Catalog. For information concerning the concentration in American Indian policy studies, see also the Department of Political Science.

102. **Linguistics for Native American Communities (3)** I S (Identical with Ling. 102)

203a-203b. **Elementary Navajo Language (4-4)** (Identical with Ling. 203a-203b)

205. **Prehistoric Peoples of the Southwest (3)** I II (Identical with Anth. 205)

206. **Native Peoples of the Southwest (3)** I II (Identical with Anth. 206)

207a-207b. **Elementary Papago Language (3-3)** (Identical with Ling. 207a-207b)

210. **Native Languages of North America (3)** I (Identical with Ling. 210)

334. **Politics and the American Indians (3)** II (Identical with Pol. 334)

404. **Sociology of the Southwest (3)** GC I (Identical with Soc. 404)

415a-415b. **Southwestern Indian Arts (3-3)** GC (Identical with Anth. 415a-415b)

416. **Contemporary Indian America (3)** GC II 1985-86 (Identical with Anth. 416)

423. **Peoples of Mexico (3)** GC II (Identical with Anth. 423)

437. **Issues in Indian Education (3)** GC II (Identical with Ed.F.A. 437)

438. **The Indian in the Literature of the Americas (3)** II 1986-87 (Identical with Engl. 438)
445a-445b. Structure of an American Indian Language (3-3) [Rpt./2] GC (Identical with Ling. 445a-445b)

449a-449b. Folklore (3-3) GC (Identical with Engl. 449a-449b)

461. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)

477a. Ethnic Literature (3) (Identical with Engl. 477a)

482. Hopi Language in Culture (3) GC II (Identical with Anth. 482)

484a-484b. Development of Federal Indian Policy (3-3) GC (Identical with Pol. 484a-484b)

487. Race and Public Policy (3) GC I (Identical with Pol. 487)

502a-502b. Dynamics of Indian Societies (3-3) Philosophies, institutions and characteristics of tribal life in North America. 502a : American Indian lifestyles prior to European contact. 502b : Impact of European immigration on tribal groups of North America. (Identical with Anth. 502a-502b)

596. Seminar
   h. American Indian Law and Policy (3) [Rpt./2] I II (Identical with Pol. 596h, which is home.)
   m. Studies in the Oral Tradition (3) [Rpt./9 units] I II (Identical with Engl. 596m, which is home)

695. Colloquium
   a. Theory and Indian Studies (3) II P, 502a-502b or 484a-484b.

ANATOMY

Acting Head Douglas G. Stuart, Professor of Physiology
Professors Jay B. Angevine, Jr., Joseph T. Bagnara, Bryant Benson, Mac E. Hadley, Philip H. Krutzsch
Associate Professors David E. Blask, C. Ward Kischer, Albert V. LeBouton
Assistant Professors Mary J. C. Hendrix, Christopher A. Leadem
Lecturers William D. Barber, Norman E. Koelling

The Department of Anatomy offers work leading to the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

401. Human Gross Anatomy (3) II Survey of the gross structure of the human body. 1R, 6L. Open to pharmacy students only. (Identical with Pcol. 401)

415. Vertebrate Reproductive Biology (2) I Structure, function and control of the vertebrate reproductive system.

456. Developmental Biology (4) GC I (Identical with M.C.B. 456)

457. Experiments in Developmental Biology (4) GC II (Identical with M.C.B. 457)

467R. Endocrinology (3) GC II Neural and endocrine integration in the regulation of mammalian physiological functions. P, M.C.B. 103. (Identical with M.C.B. 467R)

467L. Endocrinology Laboratory (1) GC II Techniques in endocrinology. P, CR 467R (Identical with M.C.B. 467L)

495. Colloqulm
   a. Introduction to the Neurosciences I (2) GC (Identical with Med. 495a, which is home)

550. Topics in Pigment Cell Biology (2) I Selected topics on the development function and control of normal and abnormal pigment cells in various pigmentary phenomena. (Identical with M.C.B. 550)

555. Cancer Biology (3) II 1986-87 (Identical with Micr. 555)

558. Advanced Subjects in Endocrinology (2) [Rpt.] I Selected topics in vertebrate and invertebrate endocrinology. P, 467R. (Identical with M.C.B. 558)

601. Human Gross Anatomy (8) I Comprehensive survey of the development and gross structure of the human body. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; Ecol. 101b; consult department before enrolling.

602. Microscopic Anatomy (5) I Essentials of microscopic human anatomy. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; Ecol. 101b; consult department before enrolling.

603. Microscopic Structure (1 to 3) II Selected concepts of structural organization at light and electron microscopic levels of the anatomy and development of the cells, tissues, and organs of vertebrates. P, 601, 602.
604. **Gross Human Anatomy (2 to 6)** [Rpt.] II Study in depth of the gross human anatomy of selected areas or systems. P, 601, 602.

605. **Neurosciences (6)** II Essentials of mammalian neural development, structure and function. P, Chem. 103b, 104b, 243b, 245b; Phys. 102b; Ecol. 101b; M.C.B. 410a-410b. Consult department before enrolling. (Identical with Psio. 605)


610a-610b. **Anatomical Techniques (1 to 4 - 1 to 4)** Introduction to special techniques and procedures of analytical anatomy. P, 601, 602; consult department before enrolling.

616. **Introduction to Anatomical Literature (1)** I II A problem-oriented, bibliographic approach to basic anatomical references. Primarily for those students planning a career in anat. and wishing to prepare themselves for further grad. study. 3L.

896. **Seminar a. Embryology (1 to 6)**

**ANIMAL PHYSIOLOGY**

**Committee on Animal Physiology (Graduate)**

Professors Fred B. Roby, Chairperson, Robert B. Chiasson, Mac E. Hadley, Dewey E. Monty, Jr., Raymond E. Reed, Gerald H. Stott (Emeritus), Charles M. Tipton

Associate Professors Ronald E. Allen, Ronald W. Hilwig

Assistant Professors Victor Convertino, Roger M. Enoka, William A. Schurg, Mark E. Wise

The interdisciplinary graduate program in animal physiology offers the opportunity for study toward the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

596. **Seminar a. Animal Physiology (1)** [Rpt.] I II

**ANIMAL SCIENCES**


Associate Professors Ronald E. Allen, R. Spencer Swingle

Assistant Professors Sue DeNise, William A. Schurg, Mark E. Wise

Lecturers Gary R. Amundson, Thomas N. Wegner

Extension Specialists Dennis V. Armstrong, Albert M. Lane, Edward A. LeViness, Franklin D. Rollins

The curriculum prepares students for careers with livestock and poultry, farms, ranches, feedlots, dairies, agribusiness firms, banks and industries serving these enterprises. By the selection of different electives a student may also prepare for graduate work, agricultural communications, government service or race track management.

The degree of Bachelor of Science in Agriculture with a major in animal sciences is available through the agriculture, agricultural business or agricultural science curriculum. The department also offers programs leading to the Master of Science degree.

The major: In addition to the requirements of the College of Agriculture, the following courses are required: 180, 413, 415R, 430, 436 (students in the race track management option are not required to take 180 and may substitute N.F.S. 458 for 436); and three courses
DEPARTMENTS AND COURSES OF INSTRUCTION

selected from 440, 442, 472, 473, 474, 475, 476, and 477 or 478. 102 is recommended but not required for all freshmen. A minimum graduation average of 2.0000 is required for all courses taken in animal sciences. M.I.S. 111 is required for all majors in animal sciences. All students enrolling in the agriculture or agricultural sciences curriculum must take P.I.S. 100 and S.W.200. However, students in the race track management option may substitute 6 units selected from Agricultural Economics, Nutrition and Food Science, Plant Sciences, or Soil Science. Also, majors in the agriculture curriculum must choose an option in business, production, science or race track management.

Business option: In addition to the courses listed under the major, the student must take Acct. 200 and four courses from the following: Acct. 320; A.Ec. 213, 215, 313, 450; Fin. 201, 251; M.A.P. 320, 330; Mktg. 361.

Production option: In addition to the courses listed under the major, the student must take 205; P.I.S. 268 or 272 or R.N.R. 202 or Ra.M. 305; V.Sc. 403 or 405; and three courses from the following: A.Ec. 253, 213, 215; Acct. 200; Fin. 201; M.A.P. 320, 330.

Science option: In addition to the courses listed under the major, the student must take Chem. 241a-241b and either 243a-243b or 322 and 323; Ecol. 104; Math. 119 or 123 or 125a or 263; Phys. 102a.

Race track management option: In addition to the courses listed under the major, the student must take 142, 270, 295r, 342, 344, and 8 units of approved business courses.

102. Animal Industry (3) I II A comprehensive view of the livestock and poultry industries, including the way the science of biology is used in modern livestock practice. 2R, 3L. Not open to students with more than seven units of animal sciences.

134. Feeds and Feeding (3) I II Selection, evaluation, and use of feeds for specific purposes; balancing rations for livestock and poultry. Not open to students with credit or CR in 430 or 436.

142. Breeds and Registry Associations (2) I Breeds of horses and dogs used in racing; their history, formal breed associations, and registry rules.

180. Science of Meat and Meat Products (3) I II Techniques used in meat processing, with special reference to structure and composition of the various meats. Student has option to select a processing or selection-identification lab. 2R, 3L. Field trip. (Identical with N.F.S. 180)

205. Live Animal and Carcass Evaluation (3) I II A comprehensive view of meat animals, dairy and horse selection techniques, including the evaluation of meat animals and their carcasses as related to economic importance; the selection of breeding animals based upon visual appraisal and performance records. 1R, 6L.

213. Animal Genetics (3) I Principles of inheritance as applied to domestic animals. P, four units of bio. (Identical with W.F.Sc. 213)

270. Introductory Horse Science (2) I The feeding, management and training of horses.


397. Workshop a. Livestock Judging (2) I 1L, P, 205.
   b. Advanced Livestock Judging (1 to 3) [Rpt./4 units] I 1L 3L. Field trips. P, 205, 397a.

413. Principles of Animal Breeding (3) GC II Basic concepts involved in the improvement of economically important traits of livestock through application of genetic principles. Field trips. P, 213 or Ecol. 321 or P.I.S. 228; Math. 117e.


415R. Physiology of Reproduction (3) GC I Study of the organs of reproduction and their accessories; physiology and endocrinology as related to the process of reproduction and milk secretion. P, Chem. 101b, 102b, Ecol. 101a and three units of animal anat.-psio. (Identical with V.Sc. 415R)

415L. Physiology of Reproduction Laboratory (1) GC I Practice in semen collection and storage, artificial insemination, and hormone assay. P or CR, 415R. (Identical with V.Sc. 415L)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Laboratory</th>
<th>Field Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>430</td>
<td>Principles of Nutrition (3) GC I II</td>
<td>Digestion, absorption and metabolism of carbohydrates, lipids, proteins, vitamins and inorganic nutrients. Field trip. P, Chem. 101b and 102b or 103b and 104b. (Identical with W.F.Sc. 430 and N.F.S. 430)</td>
<td>3</td>
<td>P, Chem. 101b and 102b or 103b and 104b.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>436</td>
<td>Applied Animal Nutrition (4) GC II</td>
<td>Application of principles of nutrition to the feeding of livestock and poultry, nutrient composition and characteristics of feeds, nutrient requirements and diet formulation. 3R, 3L. P, 430.</td>
<td>4</td>
<td>P, 430.</td>
<td>3L</td>
<td>3</td>
</tr>
<tr>
<td>440</td>
<td>Race Track Business and Financial Management (3) GC II</td>
<td>Operational strategies involving taxes and other financial aspects of the animal racing industry. P, 342.</td>
<td>3</td>
<td>P, 430.</td>
<td>3R</td>
<td>3</td>
</tr>
<tr>
<td>442</td>
<td>Race Track Tax and Investment Concepts (3) I</td>
<td>Methods and principles of establishing race horses and breeding animals as agriculture businesses. Overall understanding of syndications, hobby vs. business, and general treatment of racing industry as a taxable entity. P, 142.</td>
<td>3</td>
<td>P, 430.</td>
<td>4</td>
<td>3</td>
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<tr>
<td>463</td>
<td>Food Analysis (3) GC II 1986-87 (Identical with N.F.S. 463)</td>
<td></td>
<td>3</td>
<td>P, 430.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>472</td>
<td>Dairy Herd Management (3) GC I</td>
<td>Proper milking, efficient housing, and health management of dairy cattle; marketing milk from the farm; milk production costs. Field trip. P, 430.</td>
<td>3</td>
<td>P, 430.</td>
<td>3L</td>
<td>3</td>
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<tr>
<td>473</td>
<td>Swine Production (2) GC I</td>
<td>The production, feeding and management of swine in intensive production systems. Field trip.</td>
<td>2</td>
<td>P, 430.</td>
<td>3L</td>
<td>3</td>
</tr>
<tr>
<td>474</td>
<td>Sheep Production (2) GC II</td>
<td>The production, feeding and management of sheep on the farm and ranch. 1R, 3L. P, 430.</td>
<td>2</td>
<td>P, 430.</td>
<td>3L</td>
<td>3</td>
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<tr>
<td>475</td>
<td>Poultry Production (3) GC II</td>
<td>Application of biological principles to modern poultry production. Field trips. P, 430.</td>
<td>3</td>
<td>P, 430.</td>
<td>3</td>
<td>3L</td>
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<tr>
<td>476</td>
<td>Horse Production (3) GC II</td>
<td>Production, feeding, management, reproduction, and business aspects of modern horse management. 2R, 3L. Field trips. P, 415R, 430.</td>
<td>3</td>
<td>P, 430.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>477</td>
<td>Beef Cattle Production (2) GC I</td>
<td>The production, feeding, and management of beef cattle prior to finishing. Field trip. P, 430.</td>
<td>2</td>
<td>P, 430.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>478</td>
<td>Feedlot Beef Production (2) GC II</td>
<td>Feeding and management systems of beef cattle in the feedlot. All-day field trips. P, 430, 436.</td>
<td>2</td>
<td>P, 430.</td>
<td>3</td>
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<tr>
<td>480</td>
<td>Composition and Structure of Meat (2) GC II 1985-86</td>
<td>The detailed structure, growth and biochemical constitution of muscle and its conversion to meat. Field trip. P, 180 and Chem. 103b, 104b. (Identical with N.F.S. 480)</td>
<td>2</td>
<td>P, 180 and Chem. 103b, 104b.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>501</td>
<td>Animal Growth and Development (2) II 1986-87</td>
<td>Growth and development of domestic animals, with emphasis on skeletal muscle, bone and adipose tissue growth, from the cellular level to the whole animal. P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>2</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>3</td>
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<tr>
<td>596</td>
<td>Seminar a. Animal Sciences (1) (Rpt./3) I II</td>
<td></td>
<td>1</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>3</td>
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<tr>
<td>601</td>
<td>Bioenergetics (2) I (Identical with N.F.S. 601)</td>
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<td>2</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>3</td>
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<tr>
<td>609</td>
<td>Nutritional Biochemistry Techniques (3) I (Identical with N.F.S. 609)</td>
<td></td>
<td>3</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>3</td>
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<tr>
<td>622</td>
<td>Mineral Metabolism (2) I 1985-86 (Identical with N.F.S. 622)</td>
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<td>2</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
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<tr>
<td>635</td>
<td>Ruminant Nutrition (3) I Recent findings in ruminant nutrition; the physiochemical processes of digestion and absorption; importance and metabolism of rumen microflora; normal metabolic and abnormal metabolic disorders; modes of action of feed stimulants. P, 430, 436; Chem. 241a, 243a</td>
<td>3</td>
<td>P, N.F.S. 406a or Bioc. 460 or 462a.</td>
<td>3</td>
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</tbody>
</table>

ANTHROPOLOGY


Associate Professors Constance Cronin, Mary Ellen Morbeck, Susan U. Philips, J. Jefferson Reid, Alice E. Schiegel, Richard A. Thompson, Norman Yoffee, Stephen L. Zegura

Assistant Professor E. Wesley Jernigan, John W. Olsen

The science of anthropology is the study of human beings, their origins, thought, and behavior. The Department of Anthropology offers graduate and undergraduate course work in four subdisciplines: cultural anthropology, physical anthropology, archaeology, and linguistic anthropology, as well as specialized training for field research. Special programs in museum studies, cultural resource management, and forensic anthropology draw upon the extensive resources of the Arizona State Museum. The Bureau of Applied Research in Anthropology is a center for applied anthropological research in the American Southwest and similar multicultural and ecological settings elsewhere in the world. The department cooperates with the Arizona Center for Health Sciences in offering a program in medical anthropology.

The degrees offered by the department are the Bachelor of Arts, Master of Arts, and Doctor of Philosophy with a major in anthropology.

The major requires a minimum of 36 units of anthropology, eighteen of which must be in upper-division courses. All majors must take 100, 102, 200, 235, 265, and 276, which provide the student with basic training in all four subdisciplines. The student may then select one of three programs: (1) a general program which requires one upper-division course in each of the four subdisciplines plus two additional upper-division courses (a minimum of six courses); (2) a special program which requires three upper-division courses in each of two subdisciplines (a minimum of six courses); or (3) a topical or areal specialization approved by the undergraduate adviser (a minimum of six upper-division courses).

The supporting minor may be chosen from any department or program within the University.

Honors: The department participates in the Honors Program.

100. Introduction to Physical Anthropology and Archaeology (3) I II Basic concepts and methods used by physical anthropologists and archaeologists.

102. Introduction to Cultural Anthropology and Linguistic Anthropology (3) I II Basic concepts and methods used by cultural and linguistic anthropologists.

110. Exploring Archaeology (3) I An introduction to the past as revealed by archaeological research; from Neanderthals and their antecedents to Stonehenge, Maya pyramids, and Homer's Troy.

111. Biological Anthropology (3) I II An introduction to human evolution for the non-science student. Credit is allowed for this course or 100, but not for both.

171. Ancient Civilizations of the Near East (3) I (Identical with Or.S. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II (Identical with Or.S. 172)


205. Prehistoric Peoples of the Southwest (3) I II Nontechnical discussion of the lifeways of the ancient people of the Southwest. (Identical with A.In.S. 205)

206. Native Peoples of the Southwest (3) I II Nontechnical discussion of Southwestern Indian cultures from historic times to the present. (Identical with A.In.S. 206)

210. Survey of Anthropology for Engineers and Scientists (3) II Topics in human physical and cultural development: human ancestors back to 3 million B.C.; ancient Maya civilization as a case study of cultural complexity outside the Western tradition.

235. Principles of Archaeology (3) I II History of archaeological research; survey of concepts and methods for the study of prehistoric cultures. P, 100 or 110.

240a-240b. Introduction to Classical Art and Archaeology (3-3) 1985-86 (Identical with Clas. 240a-240b)
265. **Human Evolution** (3) I II Neontological and paleontological approaches to human evolution and variation, nonhuman primate studies, bio-molecular and anatomical variation, bio-cultural responses to environmental stress. P, 100 or 111.

276. **The Nature of Language** (3) I II An introduction to the basic concepts of linguistic anthropology and their implications for the study of culture and society. (Identical with Ling. 276)

301. **Paranormal Anthropology** (3) I Witchcraft and the occult in cross-cultural perspective with emphasis on the positive implications of psychic phenomena.

303. **Sex Differences and Language** (3) I 1985-86 Sex/gender differences in language use among adults and children and their social and biological bases. (Identical with Ling. 303 and W.S. 303)

304. **Introduction to Archaeological Fieldwork** (3) II Practical excavation, class discussion, mapping and the preliminary stages of artifact analysis. 2R, 6L. Field trips.


307. **Ecological Anthropology** (3) I Cultural adaptation, with emphasis on the systematic interaction of environment, technology, and social organization among hunter-gatherers, nomadic herders, and peasant farmers.

308. **Family in the Modern World** (3) I Introduction to the cross-cultural analysis of family systems in contemporary society.

310. **Culture and the Individual** (3) I II Cultural and psychological dimensions of human development and human behavior. (Identical with Soc. 310)

315. **World Ethnography** (3) I The comparative study of selected societies of the world through extensive use of the media. Writing-Emphasis Course.*

319. **Mexican American Culture** (3) I Historical background, cultural institutions, identity problems, social relations, and expectations of people of Mexican ancestry in the United States. (Identical with M.A.S. 319)

335. **Archaeological Interpretation** (3) II Survey of modern methods and theories in archaeology, with emphasis on current archaeological problems being investigated throughout the world. P, 235.

337. **Studies in Modern Material Culture** (3) II 1986-87 Studies relating contemporary behavior and material culture will be planned, implemented and evaluated to test methods of archaeological interpretation in modern societies and to develop new nonreactive methods of social science research. P, three units of soc. sci.

342a-342b. **Field Training in Archaeology** (3-3) S Archaeological methods, theory, and field techniques. 342a: Three-week field excavation and survey. 342b: Three-week laboratory processing and analysis. Registration limited. Contact department for application, which must be returned by April 1.

364. **Sociology of Latin American Societies** (3) II (Identical with Soc. 384)

400. **Processes of Culture Change** (3) GC II Intensive investigation of specific theories and varieties of culture change. P, 200.

401. **Ancient Mesopotamia** (3) GC I 1986-87 Sumerian, Babylonian, and Assyrian civilization from the first cuneiform documents to the fall of the neo-Babylonian empire, with special attention to issues of sociopolitical organization. (Identical with Hist. 401 and Or.S. 401)

402. **Kinship and Social Organization** (3) GC I Principles in the comparative study of social systems; types of social structure. P, 200, or nine units of soc. (Identical with Soc. 402) Writing-Emphasis Course.*

403. **Anthropology of Conflict Resolution** (3) GC II 1985-86 Decision making, conflict, and violence from a cross-cultural perspective, aiming to build both understanding of conflict processes and skills for managing and resolving them. 2R, 3L.

404. **Sociology of the Southwest** (3) GC I (Identical with Soc. 404)

405. **Urban Adaptation of Ethnic Groups** (3) GC I 1985-86 A survey of adaptations of ethnic and social groups to urban areas, focusing on a different group or region each semester.

407. **Peasant Communities** (3) GC I Comparative analysis of traditional and contemporary peasant communities. (Identical with Soc. 407) Writing-Emphasis Course.*
DEPARTMENTS AND COURSES OF INSTRUCTION

408. Anthropology and Public Policy (3) GC II Examines the development, goals, techniques, and practices of anthropology as a policy science.

409. Economic Anthropology (3) GC II Analysis of production, exchange, distribution, consumption, property, economic surplus, inheritance, and types of economic structure. P, 200, or twelve units of econ. (Identical with Econ. 409)

410. Perspectives in Anthropology (3) GC II Designed specifically for nonmajors to provide an introduction to the concepts and methods of anthropology.

411. Anthropology of Religion (3) GC I Comparative approaches to the study of religion; systems of ritual and symbolization in the primitive world; shamanism and possession; religious movements; religion in the modern world. (Identical with Reli. 411)

412. Agricultural Economic Development in Latin America (3) GC II (Identical with A.Ec. 412)

413. Ethnology of the Southwest (3) GC II Culture history and economic, social, and religious institutions of the living people of the Southwest. P, 200. Writing-Emphasis Course.

414a-414b. Indians of the Southwest (3-3) GC S History, arts and crafts, economics, social institutions, religions, and mythology of the present-day Indians of the Southwest.

415a-415b. Southwestern Indian Arts (3-3) GC 415a: Prehistoric utilitarian and aesthetic arts. 415b: The art of the modern Indians of the Southwest. 415a is not prerequisite to 415b. (Identical with A.In.S. 415a-415b and Art. 415a-415b)

416. Contemporary Indian America (3) GC II 1985-86 The historical development and contemporary significance of the reservation system in the life of the Native American of the United States. (Identical with A.In.S. 416)

417. Cultures of Ancient Mexico (3) GC S Archaeological and ethnohistoric survey of the civilizations of ancient Mexico from earliest times to the period of the Spanish Conquest. Field trips. Fee.

418a-418b. Scientific Illustration-Photography (2 to 4 - 2 to 4) GC (Identical with Ecol. 418a-418b)

420a-420b. Contemporary American Culture (3-3) GC II 1985-86 Diverse perspectives on American values as expressed in organization of kinship, space, bureaucracies, media, ethnic groups, religious sects and movements. 420a is not prerequisite to 420b.


422a-422b. Pre-Columbian Art (3-3) GC (Identical with Art. 422a-422b)

423. Peoples of Mexico (3) GC II Cultural background and contemporary economic, social, and religious life of the Indian and mestizo populations of Mexico. (Identical with A.In.S. 423 and M.A.S. 423)

424. Gender and Social Identity (3) GC II Theories of sexual equality and inequality, plus an overview of sex roles and sex status in different types of societies and in different areas of social organization. (Identical with W.S. 424)

425. Ethnology of South America (3) GC I 1985-86 Comparative study of culture and history of South American indigenous peoples, including contemporary situation and Latin American policies toward them. P, 200.

427. Religion and Mythology of Mesopotamia (3) GC II 1985-86 Readings in translation of Sumerian and Babylonian myths and rituals stressing anthropological techniques in the interpretation of Mesopotamian cosmology. P, 100. (Identical with Or.S. 427 and Reli. 427)

428. Anthropology of Law (3) GC II 1986-87 Issues in the anthropology and history of law, focusing on the nature of law in its social context; selected case studies. (Identical with Or.S. 428)


431. Anthropology and Development (3) GC II 1985-86 The role of anthropology in interdisciplinary projects involving economic development and planned change on the national and international levels.

432. Peoples of the Pacific (3) GC I 1985-86 Populations and cultures of Polynesia, Micronesia, and Melanesia; variability of these "natural laboratory" settings in an ecological framework.

433. Advanced Scientific Illustration (4) GC S (Identical with Ecol. 433)

435. Principles of Archaeological Fieldwork (3) GC II Introduction to the principles of archaeological fieldwork, with emphasis on method and theory of survey and excavation. 2R, 3L. P, 235.

437. The Relationship of Early Hominids and Contemporary Faunas (3) GC II 1986-87 The faunal association of contemporary animals and hominids world-wide. Peopling the New World. Methods utilized to analyze fossil assemblages when associated with hominids.

438. Zooarchaeology (3) GC I Animals in relation to man, with emphasis on past cultures, especially in the Southwest; morphology of animal skeletons; identification and interpretation of fragmentary remains.


440. Laboratory in Zooarchaeology (3) GC 1986-87 Fragmentary animal remains in archaeological interpretation. Diagnostic morphological features; role in cultural interpretation. Analytical techniques; lab. analysis; report preparation. 1R, 6L.

441. Organization of Museums (3) GC I An intensive introduction to museum studies, with emphasis on the history, philosophy, structure, and function of museums.

442. Museum Collections Management (3) GC II Principles and procedures governing the acquisition, documentation, care and use of museum collections. 2R, 3L. P, 441.

443. The Archaeology of Neolithic and Bronze Age Greece (3) GC (Identical with Clas. 443)


445. Introduction to Museum Conservation (3) GC II A basic introduction to the examination of the nature and properties of materials in anthropological collections and their deterioration, restoration, and preservation.

446. Organization, of Museums (3) GC I An intensive introduction to museum studies, with emphasis on the history, philosophy, structure, and function of museums.

447. Archaeology of North America (3) GC I Intensive survey of the development of culture in North America from the time of the initial peopling of the New World to the historic period.

448. Archaeology of the Southwest (3) GC I Development of culture in the prehistoric Southwest from the late Pleistocene to the historic period. Field trip.

449. Archaeology of the Southwest (3) GC II The nature of archaeological data recovered in the Southwest, with emphasis on their potential for the drawing of both cultural and chronological inferences. P, 452R.

450. Mesoamerican Archaeology (3) GC I Development of culture in Mexico and Central America from the early hunters and gatherers through the conquest of the Aztecs and Mayas by the Spanish. (Identical with M.A.S. 453) Writing-Emphasis Course.*

451. Andean Archaeology (3) GC II Development of culture in the Andean countries of South America from hunters and gatherers of the terminal Pleistocene through Inca civilization.


453. Old World Prehistory (3) GC II Man's cultural development in the Old World, as revealed by prehistoric archaeology, from earliest evidence through the development of agricultural villages.

454. Prehistoric Mesopotamia (3) GC I 1985-86 Theories of the rise of civilization tested against archaeological data from Mesopotamia with comparative material from other areas. Time period: end of the Paleolithic to historic (Sumerian) civilization. (Identical with Or.S. 457)

455. Historical Archaeology (3) GC II Survey of the basic data and methods of research in the material culture of modern history. The New World from first European contacts to the 20th century. (Identical with Hist. 459)

456. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)

457. Introduction to Quaternary Ecology (3) GC I (Identical with Geos. 462)

458. Introduction to Dendrochronology (3-3) GC (Identical with Geos. 464a-464b)

459. Women in International Development (3) GC I 1985-86 The impact of international development on women as agricultural producers, householders, migrants, workers in formal/informal labor markets and participants in planned change. (Identical with W.S. 469; F.C.R. 469)
466. **Paleoanthropology** (3) GC I Evidence for human and nonhuman primate evolution including laboratory study of fossil casts and modern skeletal biology. P, 265 or consult dept. before enrolling. Writing-Emphasis Course.*

468. **Human Osteology** (3) GC I Human osteology for the archaeologist and physical anthropologist; techniques of *in situ* and laboratory identification, preservation and measurement. P, consult dept. before enrolling.

470a-470b. **Human Adaptability** (3-3) GC Study of human adaptability focusing on physiological plasticity, growth, nutrition, population ecology, demography, epidemiology and paleopathology. P, 265 or consult dept. before enrolling. 470a is not prerequisite to 470b. (470a identical with Ger. 470a)

471. **Introduction to Indic Civilization** (3) GC I (Identical with Or.S. 471)

473. **Primate Anatomy** (4) GC I 1985-86 Comparative primate functional anatomy from an anthropological viewpoint including extensive laboratory dissection and study of behavior, ecology, and evolution. P, 265 or consult dept. before enrolling.

474R. **Ethnobotany** (3) GC II Survey, with emphasis on cultural uses of plants, both past and present; discussions of contributions to the theory and techniques of the emergence of agriculture, archaeological botany, ethnomedicine, and other aspects of ethnobotany. P, eight units of biology or anthropology.

474L. **Ethnobotany Laboratory** (1) GC II Field-lab course treating sampling, processing, storage, and identification techniques, procedures, and interpretation in selected areas of ethnobotany. Field trips. P, eight units of biology or anthropology.

475. **Origins and Development of Cultivated Plants** (3) GC I Evaluation of theories of origins and early development of cultivated plants in general, with attention given to crop plants of world-wide economic importance and selected crops of local economic importance. Three-day field trip. P, Ecol. 321.

476. **Language in Culture** (3) GC II Survey of the nature of the interrelationships between language and other cultural phenomena. P, 276. (Identical with Ling. 476)

477. **Discourse and Text** (3) GC 1985-86 Analysis and cross-cultural comparison of patterns of communication in discourse; modern approaches to discourse and text. P, 276, Ling. 200 or consult department before enrolling. (Identical with Ling. 477)

480. **Historical Comparative Linguistics** (3) GC I Types and mechanisms of linguistic change; language and dialect formation; determination of prehistorical relationships; reconstruction of proto-languages and cultures, and their origins in time and space. P, 276. (Identical with Ling. 480) Writing-Emphasis Course.*

481a-481b. **Archaeology of Syria-Palestine in the Bronze and Iron Ages** (3-3) GC (Identical with Or.S. 481a-481b)

482. **Hopi Language in Culture** (3) GC II A conversational introduction to Third Mesa dialect of Hopi, with emphasis on cultural context and covering essentials of Hopi language structure. (Identical with A.In.S. 482)

484a-484b. **Akkadian Linguistics** (3-3) GC 1986-87 Introduction to the standard literary language of the Babylonians and Assyrians. (Identical with Or.S. 484a-484b)

485. **Social Organization of India and Pakistan** (3) GC I (Identical with Or.S. 485)

486. **Comparative Community Development** (3) GC I (Identical with Soc. 486)

487. **Poverty and Health** (3) GC II (Identical with Nurs. 487)

489. **Anthropology and Education** (3) GC I (Identical with Ed.F.A. 489)

495. **Colloquium**
   a. Bilingual Health Communication (3) GC II (Identical with Nurs. 495a)

496. **Workshop**
   g. The Archaeology of Pre-Han China (3) GC II P, 100 or consult department before enrolling. (Identical with Or.S. 496g)
   j. The Prehistory of East Asia (3) GC I P, 100 or consult department before enrolling. (Identical with Or.S. 496j)


501a-501b. **Medical Anthropology** (3-3) Focuses on the sociocultural and biological dimensions of medical systems, institutions, and behaviors in modern and developing societies relating to
ANTHROPOLOGY 211

ethnic, tribal, and peasant populations. 501a is not prerequisite to 501b. Consult department before enrolling.

502a-502b. Dynamics of Indian Societies (3-3) (Identical with A.In.S. 502a-502b)

514. Late Quaternary Geology (3) I 1986-87 (Identical with Geos. 515)

524. Theoretical Population Genetics (3) I (Identical with Ecol. 524)

551. Paleoindian Origins (3) I Chronological development of Paleo-Indian occupation of the New World; site discovery, case studies, development of theories on origins and impact of early man on the environment. (Identical with Geos. 561)


581. Quaternary Palynology (4) II (Identical with Geos. 581)

582. Sociolinguistics (3) I Contributions of the ethnography of communication, language variation studies, and conversational-discourse analysis to the interdisciplinary development of sociolinguistics. (Identical with Ling. 583)

584a-584b. Readings in Akkadian (3-3) 1985-86 Readings in selected literary, religious and economic texts designed not only to improve language mastery but to use those documents in elucidation of specific topics in Mesopotamian culture. P, 484a-484b. (Identical with Or.S. 584a-584b)

588. Clinical Anthropology (3) I II (Identical with Nurs. 588)

596. Seminar
   b. Pre-Columbian Art (3) [Rpt./4] I (Identical with Art. 596a, which is home)
   c. Near Eastern Archaeology (3) [Rpt.] I II (Identical with Or.S. 596q, which is home)
   d. Quaternary Geochronology (1 to 4) I II (Identical with Geos. 596r, which is home)

597. Workshop
   a. Physical and Forensic Anthropology I (2) I Consult dept. before enrolling.
   b. Physical and Forensic Anthropology II (2) II Consult dept. before enrolling.

600a-600b. Foundations of Cultural Anthropology (3-3) An intensive introduction to social and cultural anthropology, with emphasis on theories and concepts of culture, society, and the individual. Open to majors only.

604. Educational Administration in Anthropological Perspective (3) I (Identical with Ed.F.A. 604)

635a-635b. Foundations of Archaeology (3-3) An intensive introduction to archaeology. 635a: Major problems in the culture sequence. 635b: Methods and concepts. Open to majors only.


642a-642b. Advanced Field Course in Archaeology (3-3) S Archaeological methods, theory, and field techniques. 642a: Three-week field excavation and survey; 642b: Three-week laboratory processing and analysis. Registration limited. Contact department for application, which must be returned by April 1.

645. Early Civilizations (3) II Comparative analysis of early civilizations from both the Old World and the New World, with emphasis on regularities in cultural development. P, 457, 456, 454 or 650.

650. Ancient Civilizations of Mesoamerica (3) 1985-86 Comparative study of cultural development in Mesoamerica, with emphasis on agricultural beginnings, settlement pattern and urbanization, hieroglyphic writing, and calendrical systems.


679. Language and Ethnography (3) II 1986-87 Training in the use of ethnographic method in linguistic and cultural research where naturally occurring speech is data. Analysis of data from observation, tape recording and videotaping. P, six units of ling.

680a-680b. Foundations of Linguistic Anthropology (3-3) Major theoretical and methodological issues in linguistic analysis. Language as a cultural code, biological foundations, universals and typology, language and social reality, textual analysis.
DEPARTMENTS AND COURSES OF INSTRUCTION

696. Seminar
   a. Archaeology (1 to 3) I II
d. Physical Anthropology (1 to 3) I II
   b. Cultural Anthropology (1 to 3) I II
e. Museology (1 to 3) I II
c. Linguistic Anthropology (1 to 3) I II

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

APPLIED MATHEMATICS

Committee on Applied Mathematics


Associate Professors Gregory R. Baker (Mathematics), William Filippone (Nuclear & Energy Engineering), Barry C. Ganapol (Nuclear & Energy Engineering), Olgierd Palusinski (Electrical and Computer Engineering), Randall Richardson (Geosciences), Tudor Ratiu (Mathematics), Richard E. Michod (Ecology and Evolutionary Biology), John Palmer (Mathematics), Timothy W. Secomb (Arizona Research Laboratories)

Assistant Professor K. Y. Fung (Aerospace & Mechanical Engineering), Juan C. Heinrich (Aerospace & Mechanical Engineering), Chris K. Jones (Mathematics), Edward J. Kerschen (Aerospace & Mechanical Engineering), Daniel I Meiron (Mathematics), Richard E. Michod (Ecology and Evolutionary Biology), John Palmer (Mathematics), Timothy W. Secomb (Arizona Research Laboratories)

The program in applied mathematics encourages and supports cross-disciplinary research covering a broad spectrum of disciplines in science, engineering and business in which mathematics and modelling play fundamental roles. Students have considerable flexibility in the design of their individual programs. The program attempts to draw out from young men and women their ability to think maturely and more laterally and to train them in all facets of modern applied mathematics. Standards are high but the rewards are great, and graduates have made successful careers in industry and academia.

The committee offers programs leading to the Master of Science and Doctor of Philosophy degrees with a major in applied mathematics. For admission and degree requirements, please see the Graduate Catalog.

ARABIC
(See Oriental Studies)
ARCHITECTURE


Associate Professors Harry der Boghosian, Dennis Doxtater, Robert W. Dvorak, James L. Larson (Adjunct), Robert L. Nevins

Lecturer Richard Ebeltoft

Undergraduate Program: The College of Architecture offers a five-year curriculum leading to the first professional degree, Bachelor of Architecture. The electives program enables the student to develop concentrations in science and technology, social science and humanities, business and management, or art as these disciplines relate to architecture or allow for development of breadth in general education. For requirements for the Bachelor of Architecture, see the College of Architecture section of this catalog.

Architectural Design Courses (201, 202, 301, 302, 401, 402, 451, and 452): The design courses deal with buildings, design methods, building consequences and student development and maturation. The design sequence begins with 201, an introductory course for all students enrolled in the professional phase of the College. Early experiences are involved with an overview of design fundamentals, methods and vocabulary. Intermediate and advanced design courses deal with the technical and environmental factors that influence architectural form, with the evaluation and communication of design ideas and with analysis and planning for large scale projects. All design courses stress synthesis and the application of previous course content and experience to current projects. Student projects may be retained by the College for exhibition and archives unless previous arrangements are made with the faculty member responsible for the course.

101. Architecture and Society (3) I An overview of architecture and its relationship to society through a study of its history, its contemporary forms and its future; designed for nonmajors.

112. Graphic Communication I (3) I II Overview of the principles of architectural drawing; lectures on various types of graphic communication, supplemented by studio exercise; experience in orthographic projection, perspective, and shade and shadow.

114. Introduction to Architectural Theory (3) II A broad introduction to the historical, physical and cultural forces that affect the formation of buildings and physical environments. Lectures with slides examine current and recurring problems and principles.

118. Structure in Architecture (2) I II An introduction to the role of structure in architecture; to the principles of structure, and to the behavior of structural elements, subsystems and systems.

201. Fundamentals of Architectural Design (6) Introduction to design of buildings and exterior space, with attention to human factors, horizontal systems of circulation, natural siting and site analysis, climatic analysis and passive methods of control, rudimentary structural forms and basic materials. P, 112, 114, 118, admission to professional phase, min. 2.0000 gpa.

202. Architectural Design (6) Design of buildings and exterior space with horizontal and vertical organization and systems of circulation, urban and suburban sites, active environmental control methods, advanced structural forms and materials (e.g., steel and concrete). P, 201, 222a.

222a-222b. Graphic Communication II (3-3) 222a : Techniques used to study and communicate architectural ideas, concepts, and space; conceptual diagramming, freehand perspective and sketching, shade and shadow, reflections, reproduction techniques and model building. 222b : Rendering techniques and media for use in finished architectural presentation. Lecture and studio. P, 112 and admission to professional phase.

228a-228b. Elements of Structure (3-3) The study of forces in static equilibrium, the internal response of structural members to such forces, and the design of structural components in wood and steel. P, 118, admission to professional phase.


236. Fundamentals of Environmental Control Systems (3) II Systems and means of environmental control with emphasis on passive and active methods and principles, energy conservation, and satisfying basic human needs with respect to heat, light and sound. P, 235.
DEPARTMENTS AND COURSES OF INSTRUCTION

244. Architecture Since 1945 (3) I Reflections of traditional, modern, contemporary and post-modern movements and trends.

263. Architectural Design and Drawing (3) [Rpt./1] S Studio-based coursework in architectural design or drawing with supplemental lectures. Emphases in building design, perspective and rendering, or construction documents. Students must select one area of concentration. Open to non-majors.

270. Introduction to Architectural Computing (3) I II Computing as found in architectural firms using interactive time-sharing systems, including text editing and analysis of buildings; emphasis on major problems confronting architects in day-to-day activities and programming techniques to solve these problems.

287. Architecture and Behavior (3) [Rpt./1] I Human behavior, information processing, social organization and culture as related to the built environment; readings and projects analyzing specific environments; applications for pre-design programming and post-occupancy evaluation.

301. Synthesis in Architectural Design (6) Design of buildings with emphasis on principles of order, space and place making, and integration of building systems; synthesis of space, light, structure, environmental control systems and building code and zoning ordinance constraints. P, 202, 222b.

302. Enclosure Systems in Architectural Design (6) Continued building design with emphasis on the design of alternative means of enclosing architectural space; synthesis of the relationships of elements used in making the interface between natural and built environments. P, 301.


336. Environmental Control Systems (3) I Analysis of contemporary systems of environmental control including heating, ventilation, air conditioning, lighting, power distribution, plumbing and hygiene. Emphasis on integration of these systems into buildings and understanding the impact of systems upon architectural design and each other. P, 236.


343. Watercolor Techniques for Architects (2) Techniques of watercolor communication utilized in architecture.

344. Architecture in Mexico (2) I Survey of architectural development in Mexico during the pre-hispanic, Spanish colonial and contemporary periods, with emphasis on design ideas from each period.


403. Solar Utilization in the Built Environment (3) GC I Survey of solar energy utilization principles, methods and case studies focused upon building and site planning design.

412. Advanced Graphics (3) GC I Advanced graphics, with specific emphasis on photographic techniques for use in portfolio preparation; general review of professional public relations presentation techniques. 2R, 6L. P, 222b, 302.

413. Architecture and the Arid Region (2) GC I Studies of the relationship between architecture and the climatic characteristics of arid regions with emphasis on passive cooling techniques. P, 302.

414. History of Architecture: American Architecture (2) GC II Developments in American architecture from the colonial to the early modern period. P, six units of art hist. or arch. hist. Nonmajors may petition to enroll.

422. Process and Synthesis in Design (3) GC II Traditional and contemporary models of concept formation in design, including a study of their underlying assumptions and values. P, 302.

428. Field Methods in Environmental Psychology (3) GC II (Identical with Psyc. 428)

429. Pre-Design Services (3) GC I Principles and operations of gathering, analyzing, interpreting, translating and presenting information and ideas pertinent to architectural design. P, 302.

433. Lightweight Construction Techniques (3) GC II Survey of lightweight construction techniques, including pneumatics, tensile membranes, three-dimensional cable nets, grid shells and flexure stiff plates.

439. Construction Documents (3) GC II Content, intent, functions and practice of preparing documents needed for various construction delivery systems. 2R, 3S. P, 302.

444. Site Planning (2) GC II Studies relating to design determinants for development of outdoor space, P, 302.

449. Construction Quality Assurance (3) GC II Theory and practice of specifying, text editing and cost forecasting; both manual and automated. P, 270 or M.I.S. 111. Nonmajors may petition to enroll.

451. Topics in Architecture (6) GC Studio work in one of the following: building design, community design, design development, historic preservation, design technologies, economics and politics in architecture, housing design, design in arid regions, and energy-conscious design. Offerings are limited by faculty availability, and all topics may not be offered each year. Other topics may be introduced. P, 335, 336, 338b, 424b, 402.

452. Senior Project (6) GC Studio-based project related to one of the topics in 451. The program for the senior project must be completed and approved prior to enrollment. P, 451.

459. Ethics and Practice (3) GC I Standards and values of architectural services and professional project and practice management. P, 270 and 402.

463. Introduction to the Delivery Process and Economics of Housing (3) GC I The architect's role in the development of housing as related to economic considerations and the overall housing industry's delivery process. Field trips.


473. Introduction to the Conservation of Cultural Resources (3) GC I An overview of the Historic Preservation movement in America, including discussion of concepts, rationale for and methods of resource utilization, implementation of plans, legislation, etc. Field trips.

474. Environmental Planning (2) GC I A lecture survey dealing with the origins and implications of the physical manifestations of communal ordering systems. An analytic vocabulary is developed with which current and historic settlement patterns are visually compared to discover spatial attributes as a dimension of human experience. P, 302 and 424b.


497. Workshop
   i. Community Design for Non-Designers (3) GC I Field trips. Open to nonmajors only. (Identical with L.Ar. 497i)

596. Seminar
   a. Readings in Architecture (2) [Rpt.] I II Open to majors only.
   u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Idis. 596u, which is home)

597. Workshop
   a. Architecture (3 to 8) [Rpt.] I II Open to majors only.

ARID LANDS RESOURCE SCIENCES

Committee on Arid Lands Resource Sciences (Graduate)

Professors Robert B. Bechtel (Psychology), Daniel D. Evans (Hydrology and Water Resources), C. John Maré (Veterinary Science), Paul S. Martin (Geosciences), Richard W. Reeves (Geography), Ervin H. Zube (Renewable Natural Resources)
Associate Professors Michael E. Bonine (Oriental Studies), James C. Wade (Agricultural Economics)
Assistant Professor Charles F. Hutchinson, Chairperson (Arid Lands)

The Committee on Arid Lands Resource Sciences offers a program of graduate study leading to a Ph.D. degree. The program is designed for students whose educational goals are not found in the degree programs offered in traditional departments. The program is interdisciplinary and allows the student to select areas of study from within a variety of social, physical, and biological sciences.

The interested student should request additional information from the coordinator of the program. For admission and degree requirements, please see the Graduate Catalog.

ART

Assistant Professors Jackson G. Boelts, Joan A. Holladay

The Department of Art is a division within the Faculty of Fine Arts and offers course work leading to the following degrees: Bachelor of Fine Arts with majors in studio art and art education, and Bachelor of Arts in Art with a major in art history. The graduate degrees of Master of Fine Arts and Master of Arts are also available. For admission and degree requirements, please see the Graduate Catalog.

The major in studio art is for students planning professional careers in art. At least eighteen units of art must be taken in residence at the University of Arizona. In addition to the group units required, as described under Bachelor of Fine Arts in the Faculty of Fine Arts section of this catalog, students must complete 75 units in art as described below:

- Foundations requirements — 15 units: 101, 102, 104, 117, 118.
- Distribution requirements — 30 units: 2-Dimensional Studies: 9-12 units chosen from 205, 241, 251, 265, 280. 3-Dimensional Studies: 6-9 units chosen from 271, 273, 276, 287. Art history: 9-12 units of upper-division art history and/or related courses.
- Major area of concentration — 24 units in any one emphasis area:
  - 2-D studio emphasis in drawing, painting, printmaking, or an approved combination: 24 units of upper-division studio art courses.
  - 3-D studio emphasis in sculpture, ceramics, fibers, or metals: 24 units of upper-division courses including 15 units in primary medium and 3 units in each of 2 secondary media.
  - Photography emphasis: 244 and 21 units of upper-division courses to be selected from 341, 342, 344, 346, 441, 445, 447, 596p, and 5971.
  - Graphic design emphasis: 266 and 21 units of upper-division courses including 364, 365, 368, 464, 465, 468 (twice).
  - Illustration emphasis: 266 and 21 units of upper-division courses including 364, 365, 368, 369, 465, 466, 469.
- Art electives — 6 units from other courses in studio art and/or art history.

The major in art education is for students planning to teach art in the elementary and secondary schools. Graduates qualify for the K-12 Art Specialist Endorsement on a Secondary Certificate for the State of Arizona. This program approximates certification requirements of most states. At least twelve units of art must be taken in residence at the University of Arizona. In addition to the group units required, as described under the Bachelor of Fine Arts in the Faculty of Fine Arts section of this catalog, the following major area of study requirements must be met: Foundations courses and Distribution courses as described in the major in studio art requirements (above), 230, 431, and nine units of upper-division
studio art courses. The candidate for the degree with this major must also complete the following education courses: Ed.P. 311, S.Ed. 329, 330, 338I, 435, 493a, 494b, and three to six units of general academic electives. A teaching minor is not required, but those students anticipating employment in areas where a teaching minor might be advantageous should consult with their adviser. The student should also consult with his or her adviser regarding any possible changes in certification requirements and consequent adjustments to degree requirements. Minimum total units required for the degree with this major — 127.

The major in art history is for students planning professional careers in art history or seeking an essentially cultural undergraduate education. This program provides an appropriate basis for advanced study of art history at the graduate level. To qualify for the degree with this major, nine units of art (six units specifically in the history of art) must be taken in residence at the University of Arizona. In addition to the group units required, as described under the Bachelor of Arts in the Faculty of Fine Arts section of this catalog, the following requirements must be met: 101, 117, 118, eighteen units of art hist., and seven units of elective art courses — fourteen units of the last two areas shall be upper-division courses. A minor of twenty units is also required (see Faculty of Fine Arts section of this catalog). Minimum total units required for the degree with this major — 125.

Writing-Emphasis Course: A writing-emphasis course may be selected from 300 and 400 level art history courses. Consult adviser before selection. (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.)

### Studio Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Drawing (3)</td>
<td>I II</td>
<td>Visual perception and the principles of composition presented through various drawing problems and materials. 6S.</td>
</tr>
<tr>
<td>102</td>
<td>Color and Design (3)</td>
<td>I II</td>
<td>Elements and principles of two-dimensional composition, with emphasis on color mixing, interaction and control. 6S. P, 101.</td>
</tr>
<tr>
<td>104</td>
<td>Three-Dimensional Design (3)</td>
<td>I</td>
<td>Study of volume, mass, and space relationships through modeling, casting, carving, and construction. 6S.</td>
</tr>
<tr>
<td>186</td>
<td>Beginning Design in Wood (3)</td>
<td>I II</td>
<td>Design and fabrication of wood products, both utilitarian and sculptural. 6S.</td>
</tr>
<tr>
<td>205</td>
<td>Figure Drawing (3)</td>
<td>I II</td>
<td>Drawing from the model and other subjects to develop pictorial and perceptual skills. 6S. P, 101.</td>
</tr>
<tr>
<td>241</td>
<td>Beginning Photography (3)</td>
<td>I II</td>
<td>Familiarization with basic photographic processes and aesthetics. 2R, 2S. Field trips. (Identical with R.T.V. 241)</td>
</tr>
<tr>
<td>244</td>
<td>Beginning Non-Silver Photography (3)</td>
<td>I</td>
<td>Fundamentals and techniques of various non-silver processes including blueprint, gum bichromate and xerography. 2R, 2S. Field trips. P, 241.</td>
</tr>
<tr>
<td>251</td>
<td>Printmaking (3)</td>
<td>I</td>
<td>Studio in relief, intaglio, and planographic media, including mixed techniques and color processes. 6S. P, 102, 205.</td>
</tr>
<tr>
<td>255</td>
<td>Beginning Graphic Design (3)</td>
<td>I II</td>
<td>Introductory study of principles, tools, and techniques of advertising layout. 6S. P, 101, 102.</td>
</tr>
<tr>
<td>266</td>
<td>Beginning Illustration (3)</td>
<td>I II</td>
<td>Exploration of techniques, styles and media for illustration. 6S. P, 102, 205, 265.</td>
</tr>
<tr>
<td>271</td>
<td>Beginning Jewelry and Metalsmithing (3)</td>
<td>I II</td>
<td>Introduction to the fundamentals of jewelry and metalwork processes. 6S. P, 104.</td>
</tr>
<tr>
<td>273</td>
<td>Beginning Ceramics (3)</td>
<td>I II</td>
<td>Introduction to the basic clay processes of hand construction, potter's wheel, surface decoration and glaze application. 1R, 4S. P, 104.</td>
</tr>
<tr>
<td>276</td>
<td>Beginning Fibers (3)</td>
<td>I</td>
<td>Structural development of fibers into woven forms, using the frame loom; fiber as a fine arts medium. 6S. P, 104.</td>
</tr>
<tr>
<td>280</td>
<td>Painting I (3)</td>
<td>I II</td>
<td>Elementary course in the methods and techniques of painting with oils and/or acrylics. 6S. P, 101, 102.</td>
</tr>
<tr>
<td>285</td>
<td>Watercolor Painting I (3)</td>
<td>I II</td>
<td>Introductory course in watercolor painting exploring basic materials and techniques. 6S. Field trips. P, 101, 102.</td>
</tr>
<tr>
<td>286</td>
<td>Intermediate Design in Wood (3)</td>
<td>I II</td>
<td>Continued design and fabrication of wood products, both utilitarian and sculptural. 6S. P, 166.</td>
</tr>
</tbody>
</table>
287. Beginning Sculpture (3) I II Composition in various sculpture techniques. 6S. P, 104, 205.

305. Figure Drawing II (3) [Rpt./2] I II Intermediate course in drawing problems using the model. 6S. P, 205.


342. Photography Since 1950 (3) I Slide presentations and discussions of major photographers since 1950. 2R, 2S.

344. Non-Silver Photography (3) [Rpt./2] II Familiarization with alternative processes of photographic printing. 2R, 2S. P, 244, 341, acceptance of portfolio by Portfolio Committee.

346. Color Photography (3) [Rpt./2] II Exploring conceptual and practical aspects of color picture-making with an emphasis on darkroom skills and the development of personal imagery. 2R, 2S. P, 341, acceptance of portfolio by Portfolio Committee.

352. Basic Lithography (3) [Rpt./1] I II Techniques of image-making and printing from lithographic plate or stone; emphasis on drawing and concept. 6S. P, 305.

364. Production Problems in Graphic Design (3) I II Preparation of visual material for reproduction by various printing processes. 6S. P, 265, 266, and acceptance of portfolio by Portfolio Committee.

365. Intermediate Graphic Design (3) I II Further exploration of design as a communications tool. Solutions to realistic promotional programs are executed from rough to comprehensive stage. 6S. P, 102, 205, 265, acceptance of portfolio by Portfolio Committee.

366. Rendering Techniques (3) [Rpt./1] I Drawing and rendering techniques with various media in the creation of editorial and advertising illustration. 6S. P, 265, 266, acceptance of portfolio by Portfolio Committee.

369. Advertising Illustration (3) [Rpt./1] II 6S P, 265, 266, acceptance of portfolio by Portfolio Committee.

371. Intermediate Jewelry and Metalsmithing I (3) [Rpt./2] I Design and creation of jewelry and metalsmithing forms by construction methods. Emphasis on form development through raising, forging, repousse, casting, etc. 6S. P, 271.

372. Intermediate Jewelry and Metalsmithing II (3) [Rpt./2] II Emphasis on surface enrichment through stone setting, reticulation, enameling, mokume, etc. 6S. P, 271.

373. Intermediate Ceramics (3) [Rpt./4] I II Continuation of form investigation, using hand construction and wheel; studio problems in clay and glaze formulation, kiln firing and ceramic history. 1R, 4S. P, 273.

376. Intermediate Fibers I (3) [Rpt./3] I Two-dimensional fibers techniques including 4-harness loom weaving (loom and weaver-controlled weaves) and tapestry weaving (cartoon as well as spontaneous methods). Emphasis on individual interpretation of traditional woven techniques. 6S. P, 276.


380. Painting II (3) [Rpt./2] I II Intermediate course in developing expressive and pictorial skills in oil and/or acrylic media. 6S. P, 280.


387. Intermediate Sculpture (3) I II In-depth exploration of the media and concepts of sculpture. 6S. P, 287.

405. Figure Drawing III (3) [Rpt./5] GC I II Advanced drawing with emphasis on personal expressive development. 6S. P, six units of 305.

409. Drawing Critique (3) [Rpt./5] GC I II Individual exploration and development of visual concepts through drawing, accompanied by individual and class critiques. P, six units of 405.

411. Advanced Photography (3) [Rpt.] GC I II Current trends, philosophies and experimentation in still photography. 2R, 2S. P, 341, acceptance of portfolio by Portfolio Committee.

447. Mixed Media Book (3) [Rpt/1] GC I II Investigation of the book as a format for presenting visual material; the process of making simple books. Contemporary bookmakers will be presented. 2R, 2S. Field trips. P, twelve units of studio art courses.

452. Advanced Lithography (3) [Rpt/] GC I II Autographic lithography as personal creative medium and professional skill; multiple-color printing with emphasis on controls and quality. 6S. Field trips. P, 352.

454. Advanced Relief and Intaglio (3) [Rpt/] GC I II Traditional modes of relief block and intaglio plate printmaking expanded via individual research and experiment; emphasis on development of personal aesthetic and professional standards. 6S. Field trips. P, 251.

464. Packaging Design [Rpt/] II Retail packaging, point-of-purchase displays, and lines of related products, with emphasis on graphic treatment, logotype design, and three-dimensional structure. 6S. Field trips. P, nine units of graphic design courses and acceptance of portfolio by Portfolio Committee.

465. Portfolio Preparation (3) [Rpt/] GC II Final approach to completion of portfolio. Student's portfolio is critiqued in areas of order, style, and degree of presentation to bring it to a professional level. 6S. P, nine units of graphic design courses and approval of portfolio by Portfolio Committee.

466. Editorial Illustration (3) [Rpt/1] GC I Problems in editorial and book illustration. 6S. P, 9 units of illustration courses and approval of portfolio by Portfolio Committee.

468. Graphic Design Studio (3) [Rpt/1] GC I Classroom experience in a professional designer capacity with studio solutions to graphic design problems submitted from campus and community. 6S. Field trips. Consult dept. before enrolling. P, nine units graphic design courses, acceptance of portfolio by Portfolio Committee.

469. Experimental Illustration (3) [Rpt/2] GC II Experimentation, interpretation and problem-solving through illustration. 6S. Field trips. P, 368, 369, acceptance of portfolio by Portfolio Committee.

471. Advanced Jewelry and Metalsmithing I (3) [Rpt/4] GC I Advanced study of the various materials and methods in the construction of jewelry and metalwork. 6S. P, nine units of metalwork.

472. Advanced Jewelry and Metalsmithing II (3) [Rpt/] GC II Advanced Problems in design and execution of jewelry and metalsmithing projects. Preparation of professional credentials including portfolio, photographing, rendering, exhibitions, and resumes. P, 471.

473. Advanced Ceramics (3) [Rpt/] GC I II Individual studio research and instruction, with emphasis on personal creative development. 1R, 4S. P, 373.

476. Advanced Fibers (3) [Rpt.] GC I II Individual interpretations of concept into finished fiber works. P, 176; 9 units of intermediate fibers.

477. Design on Fabric (3) II Surface design application on fabric, including silkscreen printing, block printing and direct dye application techniques (canning, batik, dye-drawing). 6S.

480. Painting III (3) [Rpt/] GC I II Advanced painting concepts, with emphasis on personal expressive development and change. 6S. P, six units of 380.

481. Readings in Contemporary Art (3) GC I Discussion of contemporary art and artists, based upon assigned readings and slide presentations. Field trips.

483. Combining Media (3) [Rpt.] GC Individual and group projects, including collages, constructions, image sequences, and elements from other art forms (sound, language, movement, etc.).


486. Advanced Design in Wood (3) [Rpt/4] GC I II S Advanced design and fabrication of wood products, both utilitarian and sculptural. 6S. P, 286.

487. Advanced Sculpture (3) [Rpt/] GC I II S Advanced design and fabrication of wood products, both utilitarian and sculptural. 6S. P, 387.

505. Graduate Figure Drawing (3) [Rpt/] GC I II Special problems in drawing, using the classroom model and outside sources as references for personal expression. 6S.

509. Graduate Drawing Critique (3) [Rpt/] GC I II Individual exploration in drawing media and visual concepts. Classroom and individual critiques.

565. Graduate Graphic Design Problems (3) [Rpt/1] GC I II Two- and three-dimensional design considerations with emphasis on conceptualization and presentation. 6S. Field trips. P, acceptance of portfolio by Portfolio Committee.
567. Graduate Illustration (3) [Rpt./1] I II Exploration of any optical material or phenomenon as a possible solution to illustration problems. 6S. P, 466, acceptance of portfolio by Portfolio Committee.

560. Graduate Painting (3) [Rpt./5] I II Graduate study in painting with an emphasis on the development of a personal imagery and body of work. 6S.

581. Intermedia Studio (3) [Rpt.] I Individual and group projects incorporating elements of vision, sound, dance, drama, literature; access to camera, tape recorder is helpful. Field trips.

585. Graduate Watercolor Painting (3) [Rpt./5] I II High level experimentation in personal expression with watercolor and related media. Demonstration and critique.

596. Seminar p. Photography and Language (3) [Rpt./1] II 2R, 2S. Open to majors only.

597. Workshop s. 3-D Concepts (3) [Rpt./1] II.

642. Studio Photography Critique (3) [Rpt./5] I II Investigation of practical methods of critique and their influence on an artist's developing body of work. Limited to art majors with photography concentration.

671. Graduate Jewelry and Metalsmithing (6 to 10) [Rpt./6] I II Graduate study in all phases of jewelry and metalwork. 12 to 20S.

673. Graduate Studio in Ceramics (6 to 10) [Rpt./6] I II Studio research and instruction with emphasis on personal creative development. 12 to 20S. Field trips. P, 473.

676. Graduate Fiber Studies (6 to 10) [Rpt./6] I II Graduate experimentation in all aspects of fiber work, with emphasis on the development of a personal style within the medium. 12 to 20S. P, 476.

680. Graduate Studio (6 to 10) [Rpt./6] I II P, twelve units of grad. credit in art.

687. Graduate Problems in Sculpture (3) [Rpt./6] I II Personal response to form and composition using a variety of technical means including welding, casting, carving and nontraditional techniques. 6S. P, 487.

Art History Courses

117. Survey of World Art, Prehistoric-Gothic (3) I II The art and architecture of Western civilizations through the Gothic era, and of world prehistoric and primitive cultures.

118. Survey of World Art, Renaissance-20th Century (3) I II The art and architecture of Western civilization, Renaissance through the 20th century.

224. Introduction to the History of Photography (3) Technical and aesthetic considerations from 1839 to the present.

229. Art History of the Cinema (3) I (Identical with Clas. 229)

310. Classical Art (3) Stylistic analysis of the emergence of classical art and architecture from Minoan Crete to the transformation of the classical spirit in the Hellenistic world — 800 to 32 B.C. P, both surveys (117, 118) or six units of hist. (Identical with Clas. 310)

319. Introduction to American Art (3) II Survey of American architecture, painting, sculpture, photography, and the decorative arts from colonial times to present.

320. Introduction to European Modern Art (3) I Painting and sculpture in Europe from about 1886 to recent times. P, 117, 118.

411. Roman Art and Architecture (3) GC The origin and development of Italian art and architecture from Etruscan beginnings through the Republic to the late Empire. P, both surveys (117, 118) or six units of ancient hist. (Identical with Clas. 411)

412a-412b. Medieval Art (3-3) GC 412a: I Arts of the nomadic invasions of Western Europe and Hiberno-Saxon, Merovingian, and Carolingian art. 412b: II 1985-86 Survey of Ottonian, Romanesque, and Gothic art from A.D. 1000 through 1250. 412a is not prerequisite to 412b.

413a-413b-413F. Renaissance Art in Italy (3-3-6) GC Painting, sculpture and architecture in Italy. 413a: I 13th-15th centuries. 413b: II High Renaissance to 1600. 413F: S Art of Florence, 13th-15th centuries. Offered in Florence only. P, six units of hist. or art hist. 413a is not prerequisite to 413b or 413F.
414a-414b. Netherlandish Art (3-3) GC 414a: Development of painting in the Netherlands and France from the 14th through the 16th centuries. 414b: Painting, sculpture, and architecture in Holland and Flanders. P, six units of hist. or art hist. 414a is not prerequisite to 414b.

415a-415b. Southwest Indian Arts (3-3) GC (Identical with Anth. 415a-415b)

417a-417b. 19th-Century European Art (3-3) GC Painting and sculpture. 417a: From the French Revolution to about 1850. 417b: From about 1850 through Impressionism. P, six units of hist. or art hist.

418a-418b. 20th-Century Art (3-3) GC Painting and sculpture in Holland and Flanders. 418a: 1886 to World War I. 418b: Between the World Wars. P, six units of hist. or art hist. 418a is not prerequisite to 418b.

422a-422b. Pre-Columbian Art (3-3) GC 422a: Art of the high cultures of Mesoamerica, with the focus on architecture, sculpture, painting and crafts prior to European contact. 422b: Pre-Columbian art of Central and South America, with particular attention to the Andean area. 422a is not prerequisite to 422b. (Identical with Anth. 422a-422b)

424a-424b. History of Photography (3-3) GC 424a: From its invention to 1895; impact of photography on the art and culture of the 19th century. 424b: As an art medium from 1895 to 1965. P, six units of art hist. 424a is not prerequisite to 424b.

426a-426b. German Art (3-3) GC Painting, graphics, architecture and sculpture. 426a: German Renaissance. 426b: Baroque, Classical, Romantic, and Modern Germany. P, six units of hist., art hist., or Ger. 426a is not prerequisite to 426b. (426b is identical with Ger. 426b)

429a-429b-429c-429d. American Art (3-3-3-3) GC Art in the United States. 429a: Colonial art. 429b: 19th century art. 429c: From 1900 through 1940. 429d: Twentieth century American art from the 1930’s to recent times. May be taken in any order. P, six units of hist. or art hist.

511. Methods of Art History (3) I Major intellectual approaches to the visual arts developed within the past 150 years. Field trips. Open to majors only.

512. Early Christian and Byzantine Art and Architecture (3) I An historical analysis of artistic changes from paleo-Christian time through the last stages of the Byzantine style. P, both surveys (117, 118) or six units of hist.

596. Seminar
a. American Art (3) [Rpt./2] I II
b. Problems in Renaissance-Baroque (3) [Rpt./2] II
c. Studies in Medieval Art (3) [Rpt./2] I II
e. Pre-Columbian Art (3) [Rpt./4] I Consult instructor before enrolling. (Identical with Anth. 596e)
f. History of Photography (3) [Rpt./4] I II P, 424a or 424b.
g. Colonial and 19th-Century American Art (3) [Rpt./3] I 1986-87 Field trips.

693. Internship
a. Art Museum Training (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, twelve units of grad. art hist. courses.
b. Curatorial Training for Archives of Photography (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 511, twelve units of grad. art hist. courses.
c. Archivist Training for Collection of Photography (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 511, twelve units of grad. art hist. courses.
d. Archives of Photography: Preservation/Cataloging (1 to 6) [Rpt./12 units] I II Open to students concentrating in museum studies only. P, 511, twelve units of grad. art hist. courses.

696. Seminar
a. Colonial and 19th-century American Art (3) [Rpt./2] I II Field Trips.

Art Education Courses


338b. The Teaching of Art (3) I II Carries credit in ed. only. (Identical with S.Ed. 338b)

430. Visual Arts in Elementary Education (3) I Perceptual development, and introduction to art elements, principles, and media through studio participation and the use of learning objectives to study art in relation to culture and aesthetic values. 2R, 2S. P, Ed.P. 301 or 311.

433. Art in Society (3) GC II Analysis and interpretation of influences, attitudes, and concerns involving the relationship of art and artists to contemporary society.

434. Environmental Aesthetics (3) GC I Critical analysis and interpretation of visual forms, their content and varying styles, in the everyday, man-made environment.

435. Art and Visual Perception (3) GC II Theories of visual perception in relation to the pictorial process and the study of vision as a perceptual system: the eye, color, space, illusion, perceptual learning, current research.

436. Community Arts Careers (3) GC I Structure and function of community arts agencies with emphasis on their relationship to art education theory and practices.

438. Art Criticism in Art Education (3) GC Methods of analyzing art works and aesthetic experiences appropriate to art classroom teaching. Videotapes, films, and readings illustrate concepts and terminology.

530. Introduction to Research in Art Education (3) I II Development of competency in application of language, methods, and diverse research procedures used in the visual arts and education as demonstrated by a scholarly written research report.


630. History and Philosophy in Art Education (3) Critical examination of literature containing fundamental concepts that have shaped the development, scope, and current significance of art education.

633. Issues and Recent Research in Art Education (3) I The identification of problems in art education at various curricular levels; examination of related research with possible implications for practice. P, S.Ed. 493a (in art), or teaching experience.


ASTRONOMY


Associate Professors Marc Aaronson, John Black, William J. Cocke, Charles J. Lada, James W. Liebert, Andrzej G. Pacholczyk, Marcia Rieke, Raymond E. White, Simon White

The department offers the degrees of Bachelor of Science and Bachelor of Arts with a major in astronomy, Master of Science and Doctor of Philosophy.

The major for the B.S. is designed for students who plan to pursue graduate studies in astronomy or a related science. The requirements for the major are thirty units of upper-division courses in astronomy, physics and mathematics, including Astr. 400a-400b; other courses are to be selected in consultation with the departmental adviser.

Entering freshmen should take a mathematics class (Math. 117e and/or 118, or 125a), followed by Astr. 271 and Phys. 110. The supporting minor should be physics, although other minors may be selected with the consent of the adviser. A double major in astronomy and physics is also possible. It is recommended that the language requirement be fulfilled in French, German or Russian.

The major for the B.A. is oriented toward students with interests in science education, such as high school or junior college teaching, planetarium work, library science, and journalism. The requirements for the major are 35 units, including 120, 271, 272, 400a, Phys. 330 and three additional upper-division units of phys.; six units in the history or philosophy of science. The remaining units should be mostly upper division and must be courses chosen from the sciences, mathematics, engineering, history or philosophy of science. The minor need not be in the sciences.

With foresight in course selection, a student could maintain the option of obtaining either the B.S. or the B.A. degree into the senior year.
Honors: The department participates in the Honors Program.

100.* Essentials of Astronomy (3) I II S A survey of astronomy, with attention to its interdisciplinary aspects and its relationships to other sciences. Planetarium work and some night-time observing sessions and field trips supplement class lectures. Primarily for nonscience majors.

100L Astronomy Laboratory (1) I II S Projects, telescope observing, planetarium work, discussions. Can be taken alone or with 100. Combination is equivalent to 110a.

105. The Universe and Humanity: Origin and Destiny (3) I II (Identical with Pty.S. 105)

106. Survey of the Solar System (4) I II (Identical with Pty.S. 106)

110a-110b.* Introductory Astronomy (4-4) A broad introduction to traditional and modern astronomy combining class lectures, planetarium and lab. work, and night-time observing and field trips. 110a : P, one semester high-school algebra. 110b : P, 100 or 110a.

*Credit will be allowed for only one of the following: 100 or 110a.

120. Philosophical and Historical Aspects of Astronomical Thought (3) III Historical development of astronomical concepts and the scientific method; cosmological concepts from ancient times to the present; controversies in astronomy in the recent past and at present.


272. Introduction to Observational Astronomy (3) III Observational applications of coordinate systems and time; basics of astronomical instruments; photodetectors; measuring equipment and reduction techniques. Practice in observing. 2R, 3L. P, Math. 125a.

311. Classical and Solar System Astronomy (3) I Coordinate systems and time; orbits and ephemerides; atmospheres, surfaces, and interiors of planets and satellites; the small bodies; the Sun; origins. P, CR Phys. 410.


403. Introduction to the Solar System (3) GC I (Identical with Pty.S. 403)

404. Man's Exploration of the Solar System (3) GC S (Identical with Pty.S. 404)

502. Introductory Astronomical Instrumentation and Technique (3) I 1986-87 Survey of instrumentation and techniques applicable to astronomical problems; noise sources, mechanical and optical technology, spectrum analyzers, polarimetry, image analyzers, video and electronic techniques.

515. Gaseous Nebulae and the Interstellar Medium (3) II 1986-87 Ionization equilibrium; heating and cooling of HI and HII regions; determination of physical conditions from emission-line spectra; dark and reflection nebulae; interstellar grains.


535. Stellar Structure (3) II 1985-86 Virial theorem; gas spheres in hydrostatic equilibrium; polytropes; convective and radiative equilibrium; equations of state; opacities; nuclear reaction rates; stellar model computation; stellar atmospheres and evolution. Strittmatter

540. Basic Properties of Galaxies (3) II 1986-87 Classification, mass determination, photometric properties, dust and gas content, stellar content, systems and clusters, distance scales, galactic dynamics. Tifft/Strittmatter

545. Stellar Atmospheres (3) I 1985-86 Radiative transfer, gray atmosphere, opacity, line formation, non-LTE, curves of growth, stellar hydrodynamics.

551. Satellite and Planetary Perturbation Theory (3) II (Identical with Pty.S. 551)

556a-556b. Electrodynamics of Conducting Fluids and Plasmas (3-3) 1986-87 (Identical with Pty.S. 556a-556b)

575. General Relativity and Cosmology (3) II 1986-87 General relativity, with applications to cosmology and stellar structure; formation of stars and galaxies. Cocke/Weymann

ATMOSPHERIC SCIENCES

Professors William D. Sellers, Head, Louis J. Battan, George A. Dawson, Robert L. Gall, Benjamin M. Herman, E. Philip Krider, Richard M. Schotland, Dean O. Staley, Sean A. Twomey

Associate Professor Kenneth C. Young

The department offers the degrees of Bachelor of Science, Master of Science, and Doctor of Philosophy with a major in atmospheric sciences.

The major: 30 units in Atmo. The following courses are required: Math. 125a-125b, 223, 254, 461 or Agri. 539; S.I.E. 272; Phys. 110, 116, 121; Chem. 103a-103b 104a-104b; Atmo. 300, 350, 421, 441a-441b, 451a, 471, 472.

In conjunction with the Institute of Atmospheric Physics, the Department of Atmospheric Sciences offers opportunities for study and research in the atmospheric sciences.

101a-101b. The Atmospheric Environment (4-4) Exposition of the atmosphere about us and its interaction with human activity; atmospheric evolution and pollution; weather and climate and their inadvertent modification; local and severe storms. Course includes demonstrations and lab. exercises. Credit will not be given for both 101a-101b and 171.

171. Introduction to Meteorology and Climatology (3) II Basic elements that constitute the weather, including fronts and cyclones, precipitation processes, the wind systems of the world, severe storms, and weather modification. Credit will not be given for both 101a-101b and 171. (Identical with Geog. 171)

271. Elementary Weather Analysis and Forecasting (3) II Nonmathematical presentation of methods for analyzing weather data and weather forecasting techniques. 2R, 3L. Field trip. P, 171.

300. General Meteorology (3) I Survey of physical and dynamic meteorology, recommended for students wanting a more quantitative approach to meteorology than provided in 171. P, Math. 123.

350. Atmospheric Measurements (3) I Theory and practice in the use of meteorological instruments; lab. and field demonstrations and practices. 2R, 3L. Field trip. P, Phys. 103a-103b, or 116 and 121.

421. Physical Climatology (3) GC II Heat and water balances of the earth-atmosphere system viewed from both the local and global scales; paleoclimatology and theories of climatic change; man's impact on climate. P, 171. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

427. Bioclimatology (3) GC II Description and analysis of the environmental boundary layer and its interaction with animal and plant life, Models are developed for energy and mass transfer in this region. P, 171. (Identical with Wa.M. 427)

441a-441b. Dynamic Meteorology (3-3) GC Thermodynamics and its application to planetary atmospheres, hydrostatics, fundamental concepts and laws of dynamic meteorology. P, Phys. 121; Math. 254.

450. Air Pollution Meteorology (3) GC II 1986-87 Theoretical description and experimental practice relating to the dispersion of gases and particulate matter in the atmosphere. Attention given to the scales of dispersion and the scales of atmospheric turbulence as related to local, regional and global pollution. P, 300 or consult department before enrolling.

451a-451b. Physical Meteorology (3-3) GC Introduction to atmospheric physics, including atmospheric radiation, fluid mechanics, aerosol physics, cloud physics, and atmospheric electricity. P, Phys. 121; Math. 254.

465. Mesoscale Meteorology (3) GC II 1985-86 Description and dynamics of weather systems of the mesoscale. Topics may include fronts, thunderstorms, gravity waves, lake effect storms and sea breezes. P, 300.

471. Synoptic Analysis (3) GC I 1986-87 Principles of meteorological analysis, including surface and upper-level charts, cross-sections, kinematic analysis, structure of the troposphere and tropospheric systems, thermodynamic diagrams. 1R, 6L. P, CR 441a, or 300.

472. Weather Forecasting (3) GC II 1986-87 Techniques for weather forecasting and actual forecasting experience; advanced synoptic analysis. 1R, 6L. P, 471.

489. Sunlight and Skylight (3) GC II 1985-86 The nature of the sun and solar radiation. Optical phenomena in the atmosphere such as mirages, rainbows, haloes, and glories. P, 451a.

530. **Micrometeorology** (3) I 1985-86 Theoretical aspects of atmospheric turbulence, including discussions of laminar flow, turbulent flow, the mechanical energy equations, and the shearing stress and the wind profile. P, 441b.

535. **Air/Sea Interactions** (3) I 1986-87 Physical characteristics of the oceans; the dynamics of ocean currents and their interactions with the atmosphere; El Niño and other teleconnections between the oceans and the atmosphere. P, 300.

544. **Physics of the High Atmosphere** (3) II 1985-86 (Identical with Pty.S. 544)

555. **Computational Methods for Radiative Transfer** (3) I 1986-87 An introduction to numerical methods used in radiative transfer calculations. P, 656 or Phys. 420 or Math. 422 or Opti. 552.

561. **Radar Meteorology** (3) I 1985-86 Propagation, scattering, and attenuation of microwaves in the atmosphere and the use of radar for observing clouds, precipitation, thunderstorms, tornadoes and other meteorological phenomena.

575. **Atmospheric Aerosols** (3) I 1985-86 Physics, mechanics, and optics of individual atmospheric aerosol particles. Topics include formation dynamics, nucleation and growth, coagulation, scattering and absorption of radiation.

585. **Tropospheric Chemistry** (3) I 1985-86 A study of tropospheric chemistry, with emphasis on the controls and feedbacks involving the major constituents, the cycles of the minor constituents, methods of measurement, and applications.


595. **Colloquium**
   a. **Atmospheric Measurement Techniques** (1 to 3) II 1985-86


641. **Theoretical Meteorology** (3) I Methods of solution of the hydrodynamic equations; identification and analysis of acoustic, gravity, Kelvin-Helmholtz, inertial, Kelvin, barotropic and baroclinic waves. P, 441b.


656a-656b. **Atmospheric Optics and Radiation** (3-3) 1986-87 Theory of atmospheric radiative transfer processes; specific methods for solving relevant equations; applications to problems in radiative transfer and optics. P, Phys. 420. (Identical with Opti. 656a-656b)

683. **Principles of Atmospheric Remote Sensing** (3) II 1986-87 For remote sensing applications, mathematical methods are developed to infer the physical properties of the atmosphere. Techniques using optical and microwave frequencies are examined for their information content. P, 656b; Math. 254. (Identical with E.C.E. 683)

**BIOCHEMISTRY**


Associate Professors Hans J. Bohnert, Don P. Bourque, Wah Chiu, William J. Grimes, Jennifer D. Hall (Molecular and Cellular Biology), Martinez J. Hewlett (Molecular and Cellular Biology)

Assistant Professors Danny L. Brower (Molecular and Cellular Biology), James F. Deatherage, Carol Dieckmann, Nancy W. Downer, John W. Little, Ivan Rayment, Marc E. Tischler
Biochemistry provides the fundamentals for study of the molecular principles in biology, medicine, and the health sciences and agricultural sciences. Teaching and research in biochemistry are carried out in several locations in the University. The faculty members listed above constitute the University Department of Biochemistry, which is responsible for instruction in biochemistry in the Colleges of Agriculture, Arts and Science, and Medicine. These programs serve as an excellent background for graduate study in biochemistry or the many health-related sciences, including a major preprofessional program for qualification for professional schools of medicine, dentistry and osteopathy.

The University Department of Biochemistry offers the Bachelor of Science, Bachelor of Arts, Master of Science and Doctor of Philosophy degrees with a major in biochemistry. Applicants are not admitted directly to the Master of Science program. The degree is awarded only in rare instances when individuals admitted to Ph.D. programs terminate early.

**The major for the B.S.:** Chem. 103a-103b, 104a-104b, or 105aH-105bH, 241a-241b, 245a-245b, 325, 326, 480a and 480b or 481, Math. 125a-125b, 223; Phys. 103a-103b; M.C.B. 103 or Ecol. 104; Bioc. 462a-462b, 463, 494, 496a (two units), and ten upper-division units in bio., chem., math., or phys., exclusive of individual studies. All students will participate in a senior research practicum (494) for a minimum of three units after taking 462a-462b and 463. Senior research is conducted in the laboratory of a faculty member with approval of the adviser.

**The major for the B.A.:** Chem. 103a-103b, 104a-104b, or 105aH-105bH, 241a-241b, 243a-243b, 325, 326, 480a; Math. 117f, or Math. 117e and 118, 125a; Phys. 102a-102b; M.C.B. 103, 104; Bioc. 462a-462b, 463, 496a (two units); and six upper-division units in bio., chem., math., or phys., exclusive of individual studies. Those applying for medical school should take Ecol. 320 in preparation for the Medical College Admission Test (MCAT).

**The minor for both undergraduate degrees consists of 20 units of lower-division courses in chem. and math.**

**Honor:** The department participates in the Honors Program.

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**460. General Biochemistry (5) GC I** Fundamentals of biochemistry, including proteins, nucleic acids, enzymes, carbohydrates and lipids and their metabolic relationships. Open to nonmajors only. P, Chem. 241b. (Identical with Chem. 460 and N.F.S. 460)

**462a-462b. Biochemistry (4-3) GC II** Introduction to the properties and metabolism of proteins, nucleic acids, enzymes, carbohydrates and lipids. Designed primarily for majors and minors in chem., bioc, and biol. P, Chem. 241b, 325. (Identical with Chem. 462a-462b and Tox. 462a-462b)

**463. Biochemistry Laboratory (2) GC II** Introduction to experimentation with biochemical systems, processes and compounds of biochemical importance. 1R, 5L. P, 460 or CR 462a-462b.

**473. Recombinant DNA Techniques (3) GC II** (Identical with M.C.B. 473)

**496. Proseminar a. Biochemistry (1) [Rpt./1]** I II Open to majors only. P, 462a or CR. Consult department before enrolling. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

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**501. Medical Biochemistry (5) I** Comprehensive treatment of general biochemistry, oriented towards human biology, with emphasis on basic concepts; protein and nucleic acid chemistry and metabolism, enzymology, metabolism of lipids and carbohydrates, metabolic regulation and closely related topics. P, Chem. 103b, 104b, 241b, 245b; Phys. 102b.

**504. Intermediate Medical Biochemistry (5) I** An intermediate treatment of several areas of general biochemistry including metabolism and nutrition, genetics and membranes. Designed to build on the student's prior knowledge of biochemistry. Consult dept. before enrolling. P, 462a-462b.

**561a-561b. Introduction to Biochemical Literature (1-1)** Designed to supplement 462a-462b with a more detailed consideration of subject matter of lectures. Primarily for those students planning a career in bioc and wishing to prepare themselves for future grad. study. P, CR 462a-462b. 561a is not prerequisite to 561b. (Identical with Chem. 561a-561b)


569. **Structure and Function of Biological Membranes** (3) II 1986-87 Physical and chemical properties of membranes and membrane components, photosynthesis, vision. P, 462b. (Identical with Chem. 569)

570. **Molecular Biology of the Cell Membrane** (3) I 1985-86 Cell membrane functions including biosynthesis, structures of membrane components; importance of cell communication, differentiation, adhesion, immune response, and cancer. Discussions on the use of monoclonal antibodies, recombinant DNA technology, and DNA transfections in studies on the biology of the cell membrane. (Identical with Chem. 570 and M.C.B. 570)


595. Colloquium
   a. Topics in Electron Microscopy (2) [Rpt./2] 1985-86 II (Identical with M.C.B. 595b, which is home)

617. **Steroid Chemistry and Biochemistry** (3) I 1986-87 (Identical with N.F.S. 617)

665. **Chemistry of Food Proteins** (3) II 1985-86 (Identical with N.F.S. 665)

681. **Introduction to Biochemical Research** (1 to 2) I II Supervised research experiences in the labs. of individual faculty members. 3 or 6L. Open only to first-year majors. P, CR 561a-561b.

696. Seminar
   a. Biochemistry I (1 to 3) I
   b. Biochemistry II (1 to 3) II

800. Research (1 to 16) Yr.

801. **Medical Biochemistry** (5)

804. **Intermediate Medical Biochemistry** (5) I

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**BIOLOGY**

Three departments (Ecology and Evolutionary Biology, Microbiology and Immunology, and Molecular and Cellular Biology) teach and do research in biology. They share a common core of courses. Details of their programs may be found under their respective listings.

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**BIOMEDICAL ENGINEERING**

*Committee on Biomedical Engineering*

Biomedical engineering can be defined as a multidiscipline in which physical scientists and engineers interact with life scientists and physicians to solve problems ranging from basic biomedical engineering research to applications in clinics and health care delivery systems. The University Committee on Biomedical Engineering coordinates an option available to students in the Colleges of Engineering and Mines (Chemical Engineering).

Upper-division undergraduate students may select biomedical engineering courses and projects as technical electives in all engineering departments. Graduate students working toward the Master of Science or Doctor of Philosophy in an engineering department may select courses and research topics in biomedical engineering as part of their minor programs. No biomedical engineering degree is offered. Courses available in biomedical engineering are offered through engineering departments and include A.M.E. 485, 585; E.C.E. 411, 415, 417, 515; Ch.E. 485, 586; and Psio. 418, 419. Additional courses in biomedical engineering are being developed, and supporting research work in the life sciences is also available. Collaborative research projects permit the student to participate in interdisciplinary associations which can enhance progress in the fields of biology, medicine, and engineering. Individual programs are determined by the student and an engineering departmental adviser.

For additional information contact Dr. J. F. Gross (Chemical Engineering) Chairperson, Committee on Biomedical Engineering, or Dr. K. C. Mylrea (Electrical and Computer Engineering) Director, Clinical Engineering.
BLACK STUDIES

Committee on Black Studies

Professors James W. Clarke (Political Science), Vine De Loria (Political Science)
Associate Professors Edwin M. Gaines (History) Chairperson, Celestino Fernandez (Sociology)

The minor in Black Studies consists of at least twenty units selected by the student in consultation with the adviser of the Black Studies Program. This minor is designed to provide all students with basic information about Black Heritage around the world. Students will have an opportunity to examine topics, materials and research methods to expand their knowledge of African and Black American history and culture.

160. Minority Relations and Urban Society (3) I II (Identical with Soc. 160)
220. Introduction to Black Studies (3) I Introductory survey of the literature, history, culture and social issues affecting Black Americans.
230. The History of Black America (3) I (Identical with Hist. 230)
330. Minority Groups and American Politics (3) I (Identical with Pol. 330)
347. The Old South (3) (Identical with Hist. 347)
348. The South Since the Civil War (Identical with Hist. 348)
429. Cultures and Societies of Africa (3) GC II (Identical with Anth. 429)
435. The Coming of the Civil War, U.S. 1845-1861 (3) GC I (Identical with Hist. 435)
436. Civil War and Reconstruction, U.S. 1861-1876 (3) GC II (Identical with Hist. 436)
437. Black Literature in the Americas (3) II 1985-86 (Identical with Engl. 437)
450a-450b. French Literature of Black Africa and the West Indies (3-3) GC 1986-87 (Identical with Fren. 450a-450b)
452. American Ethnic History (3) GC II (Identical with Hist. 252)
461. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)
468. Government and Politics of Africa (3) II (Identical with Pol. 468)
477c. Ethnic Literature (3) (Identical with Engl. 477c)
483. Urban Economics (3) GC II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Econ. 483)
487. Race and Public Policy (3) GC I (Identical with Pol. 487)
495. Colloquium
   b. Studies in Black America (3) GC I II (Identical with Hist. 495b, which is home)

BUSINESS ADMINISTRATION

Committee on Business Administration

Professors Richard O. Mason (Management Information Systems), Chairperson, William B. Barrett (Associate Dean, Academic Affairs), Gerald O. Bierwag (Finance and Real Estate), Averill M. Law (Management Information Systems)
Associate Professors David A. Conn (Economics), Melanie R. Wallendorf (Marketing)
Assistant Professors Margaret A. Neale (Management and Policy), William S. Waller (Accounting)

The graduate program in business administration is designed to meet the demand for professors, consultants, and management personnel trained in the application of scientific research to business problems. Both the Master of Business Administration and the Doctor of Philosophy degrees are offered. For admission and degree requirements, please see the Graduate Catalog.
BUSINESS AND CAREER EDUCATION

Professors Mark C. Smith, Acting Head, Richard A. Kidwell
Assistant Professor Sally N. Clark

The department offers technical and professional courses for the preparation and certification of teachers of business education (office or distributive), and for the preparation of noncertificated office administration personnel. All basic service courses are open to any student, regardless of major.

The degree of Bachelor of Science in Education is available with a major in business education. A major and minor are offered in business education (office or distributive) for the Master of Education degree. A minor in business education is offered for doctoral programs.

The major in business education requires 44 units of course work selected from one of three areas of specialization: (a) a teaching program for office education, (b) a teaching program for distributive education, or (c) a nonteaching program for office administration. Business education majors must include Econ. 201a-201b as part of the social science requirement.

Required courses for the office education specialization include Acct. 200, B.C.Ed. 108, B.C.Ed. 276, 373, 389, and 482. Additional courses will be selected from departmental offerings or, with adviser's approval, from the College of Business and Public Administration. Students may select in the office education program either a 24-unit major with an approved teaching minor, or a 44-unit teaching major with no minor.

Required courses for the distributive education specialization include Acct. 200, B.C.Ed. 106 or 108, 482, 485; and Mktg. 361, and 455 or 458. A minimum of six additional units must be taken in each of the areas of marketing, management and finance.

Required lower-division courses for the office administration specialization include arts-and-sciences courses as outlined in the secondary education program, plus the following basic courses not included in the major: Acct. 200 or 272, B.C.Ed. 106 or 108, M.I.S. 111 or B.C.Ed. 174, and Math. 117e and 160. The 44-unit major consists of 15 to 25 units from B.C.Ed., including 373 and 493a (6), and 20 to 29 units selected from three or more departments in the College of Business and Public Administration. In addition, a twelve-unit core of education and career-related courses will be developed in consultation with an adviser from this department.

Candidates for any one of the above three specializations should register in the College of Business and Public Administration during the freshman and sophomore years but are to be advised by this department.

The teaching minor in business education includes a minimum of 24 units, selected in consultation with an adviser from the department.

At the time the catalog was edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

Service Courses

The following courses are offered as a service to the University community:

106. Basic Typing (3) I II CDT For students with no knowledge of touch typing or with insufficient typing experience to meet the prerequisite for 108.

108. Advanced Typing (3) I II CDT Designed to build superior typing speed and develop skills in all forms of business communications. P, typing speed of 40 w.p.m. or two yrs. of h.s. typing.

174. Beginning Shorthand (3) I CDT Shorthand theory and fundamentals; beginning dictation and transcription. P, 106 or typing speed of 40 w.p.m.

175. Intermediate Shorthand (3) II CDT Continuation of 174. P, 174 or shorthand speed of 60 w.p.m.

274. Advanced Shorthand (3) II CDT Review of shorthand theory; English, punctuation, and spelling; development of dictation and transcription; emphasis on mailable letters and other correspondence. P, 175 or ability to take dictation at 90 w.p.m. for five minutes.

276. Office Services (3) II Functions of service departments of the office; word processing, reprographics, calculating machines, special purpose typewriters, filing. P, 108.
Regular Courses

338b. Teaching Business Courses (3) I (Identical with S.Ed. 338b)

373. Introduction to Business Communications (3) I II Introduction to writing clear and concise sentences and paragraphs in basic office communications.

379. Records Management (3) I II Systems of filing; storage and transfer of office records; management aspect of establishing filing systems and evaluating filing efficiency.

389. Foundations of Business Education (3) II Curriculum construction and implementation in business and distributive education; objectives, history, and philosophy of training for vocational office and distributive education; development and administration of vocational student organizations.

471. Office Procedures and Problems (3) GC II Effective procedures in handling routine office duties; creativity in planning for innovation in the solution of office problems; emphasis on preparation for advancement to administrative positions.

472. Office Administration (3) GC I Analysis of functions of office departments, their organization and administration; development and use of office manuals, selection, training, and promotion of office employees; quality and quantity of office production.

474. Word Processing Concepts (3) GC II S Basic concepts of information/word processing with emphasis on proper utilization of people, procedures, and equipment.

482. Teaching Vocational Office and Distributive Education (3) GC I Development of vocational and career education; the organization and methods of teaching office and distributive education programs. (Identical with S.Ed. 482)

483. Development and Instruction of Adult Vocational Education Programs (3) GC I Organization, administration, promotion, curriculum construction, teaching methods, and evaluation of instruction in adult education programs. (Identical with S.Ed. 483)

484. Organization and Supervision of Vocational Education Programs (3) GC I The organization, administration, and supervision of vocational education programs, including a study of vocational curricula, funding, reporting, training, personnel, coordination, and evaluation, with primary emphasis on reimbursed vocational business education programs. (Identical with S.Ed. 484)

485. Cooperative Vocational Education Programs (3) GC II The role of the teacher-coordinator in the coordination, teaching, guidance, public relations, and administration of work-experience programs. (Identical with S.Ed. 485)

487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)

488. Microcomputer Application (3) GC I II S (Identical with Ed.F.A. 488)

493. Internship
   a. Directed Work Experience or Observation (1 to 6) [Rpt./1]

497. Workshop
   h. Teaching Data Processing/Word Processing (3) [Rpt./3] GC S

BUSINESS ECONOMICS
(See Economics)

CELLULAR AND DEVELOPMENTAL BIOLOGY
(See Molecular and Cellular Biology)

CHEMICAL ENGINEERING

Professors Gary K. Patterson, Head, Joseph F. Gross, Richard M. Edwards (Emeritus), Alan D. Randolph, Thomas R. Rehm, Jost O. L. Wendt, Donald H. White
Associate Professors William P. Cosart, Thomas W. Peterson, Farhang Shadman
Assistant Professors Heriberto Cabezas, Simon P. Hanson

Chemical engineering is concerned with utilization and application of scientific theory and principles to develop economically sound manufacturing processes in which chemical and/or physical changes take place. The curriculum prepares the student for employment in the research, development, design and operations aspects of the chemical, petroleum, metals, plastics, food, energy and related industries.
The department offers the following degrees: Bachelor of Science in Chemical Engineering, Master of Science and Doctor of Philosophy with a major in chemical engineering.

The major requires 137 units of science, engineering and humanities-social science courses as shown in the College of Mines section of this catalog. No minor is required but opportunity for specialization is offered through a number of technical electives options.

102. Chemical Engineering Techniques (3) I, II The philosophy of process synthesis and analysis as applied to the chemical engineering with an introduction to material balances. P, Math. 125a.

201. Elements of Chemical Engineering (3) I Chemical engineering calculations and principles of energy and material behavior. P, 102, Chem. 103a-103b, 104a-104b, Math. 125a, S.I.E. 170.


204. Chemical Engineering Mass Transfer (3) I Theory and practice in the unit operations of distillation, gas absorption, extraction, drying, and filtration. P, 201, 203.

304. Chemical Engineering Operations Laboratory (3) II Lab. investigation of process equipment. A field trip is made in mid-January of the jr. year. Students will deposit travel expenses, not more than $150, with the University before trip. P, 201, 203, 204.


306. General Thermodynamics (4) I Properties and fundamental equations of gases and vapors; thermodynamics of heat cycles, compressors, and engines; applications of thermodynamics to physical and chemical equilibria. P, 201; Chem. 480a.


322. Chemical Engineering Industrial Methods (2) II Practical aspects of design and manufacturing methods in the chemical process industry; management of personnel problems. P, 304.

341. Senior Project (1 to 3) I, II Preparation of an engineering report based on independent application of chemical engineering principles to a literature or experimental project.

402. Intermediate Engineering Analysis (3) GC I Solution of complex chemical engineering problems utilizing both analytical and numerical techniques. P, Math. 254, Ch.E. 202, CR 204.

413. Process Control and Simulation (3) GC I Theory of automatic control as applied to elementary chemical engineering processes. Use of continuous system simulation languages for study of practical control problems in the process industries. P, CR 402.

418. Physiology for Engineers (4) GC II (Identical with Psio. 418)

419. Physiology Laboratory (2) GC II (Identical with Psio. 419)

421. Topics in Real-Time Computing (3) GC I Introduction to microcomputer- and minicomputer-based real-time computing for data acquisition and process control. Includes study of various languages and operating systems. 2R, 3L.


435. Corrosion (2) GC II (Identical with M.S.E. 435)

442. Chemical Engineering Design Principles (3) GC I Preliminary economic and design principles associated with chemical process equipment. P, 201, 203, 204, 304, 305; CR 430.

443. Chemical Engineering Plant Design (3) GC II Design project from scoping and process selection, through material and energy balances, equipment design and sizing, to economic analysis of capital cost and operating expense. P, 442.


461. Chemical Process Simulation (2) GC II Use of existing large, modular computer programs for computer-aided process design and analysis; program structure, convergence accelerators and control blocks. P, 442.
DEPARTMENTS AND COURSES OF INSTRUCTION

465. Current Problems in Energy and Power (1 to 4) [Rpt./1 GC II (Identical with N.E.E. 465)


532. Solid-Fluid Reactions (3) I Characterization of solid structural properties; principles of heterogeneous reactions involving a fluid and a reacting solid. P, 306 and 430, or M.S.E. 450R and 442. (Identical with M.S.E. 532)

545. Combustion Generated Air Pollution (3) II (Identical with A.M.E. 545)


567. Advanced Solar Engineering (3) II (Identical with N.E.E. 567)

585. Advanced Biomechanics (3) III 1986-87 (Identical with A.M.E. 585)


589. Energy Use: Analysis and Management (3) I (Identical with N.E.E. 589)


696. Seminar
   a. Chemical Engineering (1) [Rpt./6] I II
   b. Combustion (1) [Rpt./6] I II
   c. Kinetics (1) [Rpt./6] I II
   d. Pollution Control (1) [Rpt./6] I II
   e. Crystallization (1 to 3) [Rpt./6] I II
   f. Extrusion (1) [Rpt./6] I II
   g. Biomedical (1) [Rpt./6] I II
   h. New Developments (1) [Rpt./6] I II

CHEMISTRY

Professors George H. Atkinson, Head, Michael Barfield, Robert B. Bates, Michael Cusanovich (Biochemistry), M. Bonner Denton, John H. Enemark, Robert D. Feltham, Quintus Fernando, Leslie S. Forster, Henry Freiser, Richard S. Glass, H.
The Department of Chemistry provides both general and professional training, giving
a strong foundation upon which to base a career in the fields of medicine and related health
sciences, in secondary education, or leading to industrial work or graduate specialization in
chemistry.

The degrees of Bachelor of Science and Bachelor of Arts with a major in chemistry,
and Bachelor of Science in Education and Bachelor of Arts in Education with a teaching
major or minor in chemistry are offered. A Master of Arts, Master of Science and Doctor of
Philosophy with a major in chemistry are also available, as is a Master of Education with a
teaching major in chemistry.

The major for the B.A.: 103a-103b and 104a-104b, or 105aH-105bH; 241a-241b,
243a-243b or 245a-245b, 325, 326, 400a, 424, 480a-480b. Not less than fifteen units must be
upper-division course work. Math. 125b; Phys. 102b or 103b and 180b, or 121; and S.I.E. 170
or 272 are prerequisite to courses in the major.

The major for the B.S.: 103a-103b and 104a-104b, or 105aH-105bH; 241a-241b,
245a-245b, 325, 326, 400a-400b, 424, 480a-480b, and six additional units in chem., includ-
ing one 3-unit lab. course. Not less than 23 units must be in upper-division course work. It is
highly recommended that the foreign language requirement be fulfilled in German or Rus-
sian, and all students are encouraged to participate in undergraduate research (499). Math.
223; Phys. 103b and 180b, or 121; and S.I.E. 170 or 272 are prerequisite to courses in the
major. Twenty units in the first two fields meet the requirements for a split minor. Other
minors may be chosen with the consent of the major professor.

The teaching major includes 103a-103b and 104a-104b, or 105aH-105bH; 241a-241b,
243a-243b or 245a-245b, 325, 326, 400a, 424, 480a-480b.

The teaching minor includes 103a-103b and 104a-104b, or 105aH-105bH; 241a-241b,
243a-243b or 245a-245b, 325 or 322, 326 or 323.

Honors: The department participates in the Honors Program.

101a*-101b. ** Lectures In General Chemistry (3-3) 101a: General principles and elements of
inorganic chemistry. 101b: Principles of organic and biochemistry. Designed for students who do
not intend to take further chem. Not to be used as prerequisite to further courses in the dept.
without special permission. P, CR 102a-102b. Both 101a and 101b are offered each semester.

102a*-102b. ** General Chemistry Laboratory (1-1) Introduction to lab. techniques and experiments in
inorganic, organic and biological chemistry. P, CR 101a-101b. Both 102a and 102b are offered each
semester.

103a-103b. * Fundamentals of Chemistry (3-3) Essential concepts and problem-solving techniques,
with emphasis on chemical bonding, structure and properties, stoichiometry, kinetics, equilibria,
and descriptive organic and inorganic topics. 103a : P, CR 104a; Math. 116. Both 103a and 103b
are offered each semester. Honors section for 103a-103b and 104a-104b is listed as 105aH-105bH.

104a-104b. * Fundamental Techniques of Chemistry (1-1) Basic techniques in college chemistry, with
emphasis on experimental methods, techniques of measurement, separation, purification, and
analysis of organic and inorganic substances. P, CR 103a-103b. Both 104a and 104b are offered
each semester.

105aH-105bH. * Fundamentals of Chemistry (4 to 5 - 3t to 5) Fundamental concepts of chemistry, with
emphasis on theoretical and physical principles; atomic and molecular structure and theory,
properties of gases, liquids and solids, thermodynamics and equilibria, kinetics, descriptive
inorganic chemistry. Lab. stresses individual studies and library research. Extra unit credit avail-
able for students pursuing optional original lab. research problem. 4R, 3 or 6L. Open to students
who have had high school chem. and phys. and received acceptable scores on the ACT tests.

†Without lab.
DEPARTMENTS AND COURSES OF INSTRUCTION

112.* Foundations of Science: Chemistry (3) II Chemical principles developed through examples important in daily life. Topics range from atmospheric pollution to human metabolism, with emphasis on demonstrations and laboratory experiences. Designed for non-sciences majors. 2R, 3L.

*Credit is allowed for only one of the following lecture-lab. combinations: (1) 101a, 102a, (2) 103a-103b, 104a-104b, (3) 105aH-105bH, or (4) 112.

241a-241b.* Lectures in Organic Chemistry (3-3) General principles of organic chemistry. P, 103b and 104b, or 105bH. Both 241a and 241b are offered each semester.

243a-243b.* Organic Chemistry Laboratory (1-1) Preparation, reactions, and analysis of organic compounds and an introduction to the lab. techniques of organic chemistry. 3L. Not open to B.S. chem. majors except with permission of dept. P, CR 241a-241b. Both 243a and 243b are offered each semester.

245a-245b.* Organic Chemistry Laboratory (1-1) Similar to 243a-243b. Designed for chem. majors and chemical engineers. 5L. P, CR 241a-241b.

241a-241b.** Principles of Analysis I (2) I II Principles of modern quantitative analysis. Open to nonmajors only. P, 103b and 104b, or 105bH; CR 323.

232.** Principles of Analysis I Laboratory (1-1) Experiments in modern quantitative analysis. Open to nonmajors only. 3L. P, CR 322 or 325.

244. Principles of Analysis II (2) I GRD Survey of modern instrumental methods of analysis: spectroscopy, gas chromatography, electroanalytical and thermal methods of analysis, radiocrochemistry. Open to nonmajors only. P, 322 or 325.

232.** Analytical Chemistry (2) I II Principles of modern quantitative analysis, including consideration of stoichiometry, equilibrium principles, treatment of experimental data, titrimetric and photometric analysis, and analytical separation processes. P, 103b and 104b, or 105bH; CR 323 or 326.

232.** Analytical Chemistry Laboratory (2) I II Experiments in modern quantitative analysis. Designed for chem. majors. 6L. P, CR 325.

396. Proseminar
a. Reports on Current Research (1) II

400b. Chemical Measurements Laboratory (2-2) GC II Lab. work in modern chemical measurements and instrumentation. 1R, 6L. 400a: P, 424 or CR; for majors, S.I.E. 170 or 272. 400b: P, 480b. Writing-Emphasis Course (400a). P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

410. Inorganic Chemistry (3) GC I Fundamentals of inorganic chemistry. P, 480a or CR.

412. Inorganic Preparation (3) GC II Standard inorganic lab. preparations, including coordination compounds, isomeric compounds, and compounds typifying the groups of the periodic table. 9L. P, two semesters of lab. chem. beyond the first yr.

424.** Instrumental Analysis (3) GC II Principles of modern instrumental methods of analysis treating basic instrumentation and data acquisition, spectrochemical methods, mass spectrometry, gas chromatography, and electroanalytical and thermal methods. P, 241b, 325 or 322, Phys. 102b or 103b, 180b.

440. Qualitative Organic Analysis (3) GC II 1985-86 The systematic classification and identification of organic compounds. 1R, 6L. P, 241b, 243b, 245b, 325 or 322.

446. Organic Preparations (3) GC I 1986-87 Special experimental methods for the synthesis of organic compounds. 1R, 6L. P, 241b, 243b or 245b.

460.** General Biochemistry (5) GC I (Identical with Bioc. 460)

462a-462b.** Biochemistry (4-3) GC (Identical with Bioc. 462a-462b)

**Credit is allowed for one course only in each of the following groups: 101b, 241a-241b; 102b, 243a-243b, 245a-245b; 322, 325; 424; 432, 325; 460, 462a-462b.

480a-480b. Physical Chemistry (3-3) GC Fundamental principles of physical chemistry. P, 103b and 104b, or 105bH; Math. 125b; Phys. 102b or 103b or 116 or CR.

481. Biophysical Chemistry (3) GC II Topics in physical chemistry pertinent to the biological sciences, including chemical dynamics, transport processes, thermodynamics, bonding, and spectroscopy. P, 480a.


503. Intermediate Physical Chemistry (3) I General survey of physical chemistry, including thermodynamics, structure, kinetics and electrochemistry. P, 480b.

510a-510b. Advanced Inorganic Chemistry (3-3) II Survey at the advanced level of the chemistry of the elements. P, 410.

512. Advanced Inorganic Preparations (2 to 4) II Modern inorganic syntheses, including instruction in the use of high pressure, temperature, and vacuum techniques and in the manipulation of unstable compounds. 6 to 12L.

517. Structural Chemistry (3) II 1986-87 Introduction to the determination of structures of complex molecules by X-ray crystallography; the evaluation of structural information; current topics in structural chemistry. 2R, 3L.


521. Advanced Instrumental Analysis (2) I Topics in spectrophotometry, emission spectrometry, chromatography, electroanalysis, principles of instrumentation and data acquisition at an advanced level. P, 424, 480b.

522. Electroanalytical Methods (3) II 1986-87 Principles of electrochemistry and electroanalysis, including topics on electrochemical equilibrium and kinetics, potentiometry, voltammetry, amperometry, coulometry, chronopotentiometry, and modern cyclic and pulse methods. P, 480b.


524. Chemical Instrumentation (4) I Data acquisition and experiment control by analysis and digital techniques; design of chemical instrumentation. 3R, 3L. P, 424.

525. Chemistry of Metal Chelates (3) I 1985-86 Theory underlying the application of chelating reagents in chemical analysis. P, 523.


530. Radiochemistry and Radiation Detection (3) I (Identical with N.E.E. 530)

540. Organic Syntheses (3) I Organic reactions and the methods by which they are applied to synthetic problems in organic chemistry. P, 241b, 480b.


561a-561b. Introduction to Biochemical Literature (1-1) (Identical with Bioc. 561a-561b)

565a-565b. Proteins, Enzymes and Physical Biochemistry (3-3) 1986-87 (Identical with Bioc. 565a-565b)

569. Structure and Function of Biological Membranes (3) II 1986-87 (Identical with Bioc. 569)

570. Molecular Biology of the Cell Membrane (3) I 1986-87 (Identical with Bioc. 570)

572. Metabolic and Hormonal Control of Cell Function (3) I 1986-87 (Identical with Bioc. 572)

580. Chemical Bonding and Structure (3) I An introduction to quantum mechanics, with applications to atomic structure and spectra, the nature of chemical bonding and molecular structure. P, 480b.

581. Chemical Thermodynamics (3) II Advanced concepts in both classical and modern thermodynamics, with particular emphasis on thermodynamics in solution. P, 480b.

582. Statistical Thermodynamics (3) I Introduction to classical and quantum statistical thermodynamics with application to ideal gases and simple solids; equations of state and elementary solution theory. P, 480b.


614. **Organometallic Compounds** (3) I 1986-87 Compounds containing carbon-to-metal bonds, with emphasis on those of the transition elements, and the determination of their structures. P, 410.

615. **Coordination Chemistry** (3) I 1985-86 Selected topics in the area of coordination compounds of transition metals, with particular emphasis on ligand field theory, the symmetry aspects of the spectral properties of transition metal complexes and their magnetic behavior. P, 510b or CR.

616. **Chemistry of the Main Group Elements** (3) I 1985-86 Theory, structure, and chemistry of the group III, IV, and V elements. The chemistry of the hydrides, particularly of boron, are emphasized. Current theoretical approaches and experimental techniques are stressed. P, 510a.

617. **Steroid Chemistry and Biochemistry** (3) I 1986-87 (Identical with N.F.S. 617)

642a-642b. **Polymer Chemistry** (3-3) 1985-86 Synthesis, stereochemistry, and mechanisms of formation of high polymers. 642a: Condensation and ring-opening polymers. 642b: Vinyl polymers. P, 540. 642a is not prerequisite to 642b.

644. **Heterocyclic Compounds** (3) I 1985-86 The behavior of the more important heterocyclic systems. P, 540.

645. **Chemistry of Natural Products** (3) II 1986-87 Isolation, structural elucidation, total synthesis, biogenesis, metabolism, and physiological importance of natural products. P, 540.


687. **Molecular Spectroscopy** (3) I 1985-86 Applications of quantum mechanics to the interpretation of the spectra of molecules of chemical and biological interest. P, 580.

696. **Seminar**
   a. Analytical Chemistry (1 to 3) I II
   b. Inorganic Chemistry (1 to 3) I II
   c. Organic Chemistry (1 to 3) I II
   d. Physical Chemistry and Chemical Physics (1 to 3) I II

**CHILD DEVELOPMENT AND FAMILY RELATIONS**

*(See Family and Consumer Resources)*

**CHINESE**

*(See Oriental Studies)*

**CINEMA STUDIES**

*(See College of Arts and Sciences, General Fine Arts Studies, Cinema Option)*

**CIVIL ENGINEERING AND ENGINEERING MECHANICS**


Associate Professors Gary L. Amy, Donald B. Hawes (*Emeritus*), Edward A. Nowatzki, Robert H. Wortman
Assistant Professors Curtis W. Bryant, Jay S. DeNatale, Mohammad R. Ehsani, Tribikram Kundu, James M. Witkowski

The department offers the Bachelor of Science in Civil Engineering, and the Master of Science and Doctor of Philosophy degrees with majors in civil engineering and engineering mechanics. (See the College of Engineering section of this catalog for specific undergraduate program requirements.) Additional information relating to each of these programs may be obtained by contacting the department head.

Civil Engineering

In addition to the courses listed below, the faculty of the Department of Civil Engineering and Engineering Mechanics is prepared to offer temporary courses in the following areas, subject to faculty availability and student interest: public works planning and engineering, construction engineering, hydraulic engineering, sanitary and environmental engineering, structural engineering, soils engineering, transportation engineering, surveying and mapping, and urban planning and engineering. Credit for these courses is offered in both civil engineering and engineering mechanics.

101. Environmental Issues (3) I II Sources and effects of pollution of the air, water, and land; legal and economic aspects of environmental quality management. Open to engineering students only.

110. Engineering Graphics (3) I II S GRD Representations and analysis of systems of orthographic projection and graphical methods used in engineering design and production, correlated with technical sketching. 1R, 6L.

121. Man and His Use of the Sea (3) I The study of the past, present and future engineering, economic, and environmental issues raised by man’s use of the sea.

151. Elementary Surveying (3) I II GRD Theory of measurements and errors; vertical and horizontal control methods; topographic, public land and construction surveys; use of surveying instruments. 2R, 3L. P, 110, Math. 118.

214. Statics (3) I II S GRD Equivalent force systems; equilibrium; geometric properties of areas and solids; friction; virtual work; potential energy. P, Phys. 103a, Math. 125b.


300. Civil Engineering Projects (3) I II Individual design study in fields of the student’s major emphasis or completion of a research and development project under direct staff supervision.


307. Contracts, Specifications and Engineering Relations (2) I II Law as applied to engineering contracts and contract documents, including specifications. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

320. Fluid Mechanics Laboratory (1) I II Open-channel and closed conduit studies of basic flow phenomena, with emphasis on continuity, conservation of momentum, and exchange of energy; measurement and analysis of turbulence; calibration of flow-measuring devices. One 3-hr. lab. weekly. P, 214; CR 321; A.M.E. 232.


330. Structural Engineering I (3) I II S Analytical and graphical analysis of statically determinate structures, including beams, frames and trusses; introduction to computer methods. P, 217, S.I.E. 170R and 170L.
331. **Structural Engineering II** (3) I II S Deflection of beams, frames and trusses; analysis of statically indeterminate structures with and without computer programs; approximate analysis of indeterminate structures. P. 302, 330, A.M.E. 232.

336. **Structural Design in Steel** (3) I II CDT Structural design in steel and other metals, including design of tension, compression and flexural members; design of welded, riveted and bolted connections; introduction to plastic design. P. 330, CR 331.

337. **Structural Design in Concrete** (3) I II S Introduction to reinforced concrete design. P. 330, 380.

340. **Soil Engineering** (4) I II Physical and mechanical properties of soils, shear strength, consolidation, settlement, lateral earth pressures, and bearing capacity. 3R, 3L. P. 217, Chem. 103b.

342a-432b. **Advanced Structural Engineering Design** (3-3) GC Advanced problems in the analysis and design of concrete, steel, and wood structures; yield line and plastic design methods, lateral and vertical load analysis of bridges and multistory buildings; introduction to seismic design; use of structural computer programs. 432a : P. 336. 432b : P. 337.

352. **Hydrology** (3) GC I Elementary treatment of major topics in hydrology, including rainfall, evaporation, groundwater, and runoff. Field trips. P. 321. (Identical with Hydr. 423)

380. **Materials Laboratory** (2) I II Mechanical properties of concrete, concrete aggregates, steel, and other metals as engineering materials. 1R, 3L. P. 217, Chem. 103b.

394. **Practicum**

a. **Junior Field Trip** (1) II Students are urged to take this trip in the jr. yr. Fee, not to exceed $40, determined and collected when trip is arranged.

402. **Introduction to Finite Element Methods** (3) GC I II Theory and formulation procedures: energy and residual; one-dimensional problems: stress analysis in axial structures, steady and transient fluid and heat flow, consolidation, wave-propagation, beam-column; two-dimensional problems: field and plane/axisymmetric; use of computer codes for solution to typical problems. P. 302. (Identical with E.M. 402)

423. **Hydrology** (3) GC I Elementary treatment of major topics in hydrology, including rainfall, evaporation, groundwater, and runoff. Field trips. P. 321. (Identical with Hydr. 423)

424. **Hydraulic Engineering Design** (3) GC II Hydraulic criteria for design of bridges, stilling basins, gates, open-channel distribution and collection systems; sediment-transport effects; pipe networks and pumping systems. P. 322.

432a-432b. **Advanced Structural Engineering Design** (3-3) GC Advanced problems in the analysis and design of concrete, steel, and wood structures; yield line and plastic design methods, lateral and vertical load analysis of bridges and multistory buildings; introduction to seismic design; use of structural computer programs. 432a : P. 336. 432b : P. 337.

440. **Foundation Engineering** (3) GC II Site and subsurface investigations, design of footings and pile foundations; design of foundations on collapsing and swelling soils; computer methods. P. 340.

441. **Stability in Soil Engineering** (3) GC I Shear strength of soil; total vs. effective stress analysis; slope stability analysis methods including sliding block, circular and generalized surfaces; computer applications; earth pressure theories; flexible and rigid retaining structures; tunnels in soft ground; reinforced earth. P. 340.

452. **Engineering Surveys** (3) GC I CDT Solar and Polaris observations; mineral, public, and private land surveys; route surveying, curves, and earthwork; triangulation, photogrammetry, and modern engineering surveys. 2R, 3L. P. 151.

454. **Photogrammetry** (3) GC II Reading, interpretations, and geometric characteristics of aerial photographs; stereoscopic principles and their application in the production of planimetric and topographic maps. 2R, 3L. Field trips. P. 151, Math. 125a.

455. **Surface Irrigation** (3) GC II (Identical with A.En. 455)

456. **Boundary Surveys and Legal Principles** (3) GC II Boundary control; property descriptions; public land surveys; writing and interpretation of deeds; subdivision standards; legal aspects; rights, duties and liabilities of land surveyors. Field trip.

463. Traffic Engineering (3) GC I Methods for the efficient and safe operation of transport facilities through analysis of capacity, safety, speed, parking, and volume data. P, 360.

464. Airport Planning and Design (3) GC II Location, analysis and design of airports and airport facilities, including aircraft characteristics, site selection, configuration, capacity, access and terminals. Field trips. P, 360.

465. Urban Systems Modeling (3) GC II Use of systems analysis in contemporary planning, including consideration of social, environmental and physical constraints; study of general and special purpose manual and computer-based simulation and gaming as an engineering and planning tool.

468. Urban Transportation Planning (3) GC II CDT Transportation planning in relation to urban development; techniques and procedures for developing long-range regional plans. P, 360 or consult department before enrolling. (Identical with Ping. 468)

471. Water Quality Control (3) GC II Aspects of water quality maintenance; physical, chemical and biological factors in water and wastewater treatment and natural purification. 2R, 3L. Degree credit available for nonmajors only. P, Chem. 103b. (Identical with Hydr. 471 and Ws.M. 471)


479. Environmental Air Pollution (3) GC I Air pollution sources and pollutant control, with special consideration of the meteorological, urban, rural, industrial, and health aspects.

481. Construction Methods (3) GC II Introduction to estimating; construction planning and methods; selected topics of fundamental importance in construction, including the Critical Path Method and PERT. 2R, 3L. P, 336 or 337, 380 or CR.

486. Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487. Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

507. Drainage of Irrigated Lands (3) I (Identical with A.En. 507)


526. Water Quality Management (3) II (Identical with W.R.A. 526)

532. Advanced Strength of Materials (3) II Advanced problems in the analysis of deformable solids including curved beams, nonprismatic beams, torsion of thin-walled members, beam on elastic foundation, inelastic deformation.

536. Advanced Computer Graphics in Engineering (3) I (Identical with A.M.E. 536)

537. Prestressed Concrete Structures (3) II Behavior, analysis, and design of statically determinate and indeterminate prestressed concrete structures. P, 337.

544. Soil Stabilization (3) II Purpose of soil stabilization; stabilization using mechanical means, cement, asphalt, lime, salt and resins; factors governing stabilization techniques; special application. P, 340.

547. Seepage and Earth Dams (3) I Principles of flow in porous media; analytical and approximate solutions of confined and unconfined flow; seepage erosion piping and filter design; earth and rock fill dam construction and design; stability analyses. P, 340.

548. Numerical Methods in Geotechnical Engineering (3) I Brief statements and applications of numerical methods based on closed-form solutions, finite difference, finite element and boundary element methods for problems involving soil structure interaction such as piles, retaining walls, group piles, underground works; seepage; and consolidation. P, 340, 402.

560. Ground-Water Management (3) II (Identical with W.R.A. 560)

561. Structural Design of Flexible Pavements (3) I Analysis of loads, stresses, material characteristics, and environmental factor for the theoretical and practical design, construction and maintenance of pavements. P, 340, 361.
562. **Structural Design of Rigid Pavements (3)** II Analysis of loads, stresses, material characteristics, and environmental factors for the theoretical and practical design, construction and maintenance of these pavements. P, 340, 361.


565. **Quick Response Transportation Planning Methods (3)** I 1985-86 Quick response transportation tools for subarea, problem and policy analysis, and strategic planning in the urban setting. (Identical with Ping. 565)

566. **Highway Geometric Design (3)** II 1986-87 Study of geometric elements of streets and highways, with emphasis on analysis and design for safety. P, 463.


574. **Solid and Hazardous Waste Management (3)** II Engineering, legal, planning, and management aspects of solid and hazardous wastes; overview of waste generation, collection, transport, processing, recovery, and disposal; emphasis on municipal wastes.

575. **Microbiology of Environmental Engineering (3)** I Microbiological concepts and their application to natural and engineered systems for upgrading water and wastewater quality. 2R, 4L. P, 370.

576. **Chemistry of Environmental Engineering (3)** I Chemistry of natural waters and water and wastewater treatment processes. Chemical thermodynamics, equilibria and kinetics are applied to environmental systems. Lab. emphasizes analytical methods. 2R, 3L. P, 370.

596. **Seminar**
   a. **Sanitary and Environmental Engineering (1 to 3)** II
   b. **Geomechanics/Mechanics (1)** II (Identical with E.M. 596b)


621. **Sediment Transportation (2)** I Erosion, transportation and deposition of sediments by flowing water; sediment properties and their measurement; bed load and suspended load movement; river behavior and control. P, 321.


623. **Flow through Hydraulic Structures (3)** II 1986-87 Subcritical and supercritical flow through culverts, bridges, spillways, stilling basins, transitions, bends; hydrologic effects on inflow; pumps and turbines. P, 322.

624. **Planning and Design of Multipurpose Water Resources Projects (3)** II Design of water resource systems for surface water supply, flood control, hydropower and navigation, either as single purpose or as multipurpose projects; brief review of environmental, economic and legal aspects. Field trips. P, 321, 423.

637. **Soil-Structure Interaction (3)** I 1985-86 Explanation of soil-structure interaction, closed form and numerical solutions, beams, axially and laterally loaded piles and walls, wave equation for piles, group piles, slabs on deformable media. P, 640 or 641 or consult department before enrolling.

640. **Advanced Soil Mechanics (3)** I Site investigation and in situ testing; shear strength of sands and clays; interpretation of laboratory test results; consolidation theory: one-dimensional infinitesimal and finite strain; slope stability. P, 340.


642. **Engineering Characteristics of Soil (3)** II Advanced theories of mechanical and physical aspects of soil. Lab testing including index parameters, compaction, consolidation, shear strength; introduction to critical state and plasticity aspects. 1R, 6L. P, 640.


647. Seepage and Earth Dams (3) I Principles governing the flow of water through soils and their application in the design of earth dams; methods of earth dam design, including earthquake design; theory of wells and groundwater flow. P, 340.

648. Constitutive Laws for Engineering Materials (3) [Rpt./1] II 1985-86 Statement of axioms of continuum mechanics strain, stress and nonlinear behavior, hyperelasticity. Laboratory testing including hypoelasticity, rate type models, plasticity review, hardening, volume change and dilatancy, softening, inherent and induced anisotropy, laboratory testing and implementation. P, E.M. 505, E.M. 603, or consult department before enrolling. (Identical with E.M. 648)


650. Advanced Water and Wastewater Analysis (3) II Advanced chemical, physical and microbiological analyses as related to water and wastewater quality and advanced treatment process design. 1R, 6L. P, 371.

651. Advances in Water and Waste Reclamation and Reuse (3) II Theory, application, and evaluation of currently developing techniques in water and waste reclamation and reuse. P, 875.

652. Wastewater Treatment (3) I Administration, financing, design, construction, and operation of wastewater disposal systems. P, 371.


Engineering Mechanics

In addition to the courses listed below, the faculty of the Department of Civil Engineering and Engineering Mechanics is prepared to offer temporary courses in the following areas, subject to faculty availability and student interest: analytical mechanics, plates and shells, structural dynamics and earthquake engineering, experimental mechanics, and fluid mechanics.

Credit for these courses is offered in both civil engineering and engineering mechanics.

402. Introduction to Finite Element Methods (3) GC I II (Identical with C.E. 402)

505. Continuum Mechanics (4) I Analysis of deformation, principal stresses and strains, velocity fields, and rate of deformation; constitutive and field equations; elementary elasticity.

539. Advanced Structural Mechanics (3) II (Identical with A.M.E. 539)

596. Seminar
b. Geomechanics/Mechanics (1). I. II. (Identical with C.E. 596, which is home.)

603. Elasticity Theory and Application (3) I General three-dimensional equations of elasticity; problems in plane stress, plane strain, extension, torsion; energy and residual (Galerkin) methods; applications to rings, beams, plates, torsion and other problems. P, C.E. 217, 302 or S.I.E. 270.

604. Plasticity Theory and Application (3) II Yield conditions and flow rules for perfectly plastic and strain hardening materials; application to various elastoplastic problems such as bars, cylinders and plates; effect of volume change behavior, isotropic and anisotropic hardening plasticity with expanding/contracting yield surfaces.


635. Matrix Methods in Structural Mechanics (3) I Formulation of the force and displacement methods; the finite element method, with application to bar, beam, plate, and shell structures; organization and development of computer programs; linear and nonlinear systems. P, C.E. 331 or A.M.E. 436.


648. Constitutive Laws for Engineering Materials (3) [Rpt./1] II (Identical with C.E. 648)

CLASSICS

Professors David Soren, Head, Norman Austin, Garnet D. Percy (Emeritus)
Associate Professors Richard C. Jensen, Jon D. Solomon, Thomas D. Worthen
Assistant Professor Charles T. Chamberlain
Lecturers Robert A. Burns, Donna E. Swaim

The cultural environment of Greece and Rome is the subject matter taught in the Classics Department. Courses are given in the language, literature (in the original and in translation), art and archaeology and in the development and heritage of these civilizations.

The department offers a degree of Bachelor of Arts with majors in Greek, Latin, and classics and a degree of Master of Arts with a major in classics with concentrations in ancient Greek, Latin, or classical archaeology. Programs leading to a Bachelor of Arts in Education and a Master of Education with a teaching major in Latin are also available. In addition, a number of the department's courses may be used toward a supporting minor in other graduate programs. Requirements for the B.A. are as follows:

The major in Greek: 34 units, including 102a-102b, 202a-202b, 250a-250b, and nine units of 402.

The major in Latin: 34 units, including 101a-101b, 201a-201b, 250a-250b, and nine units of 401.

The major in classics: 34 units, including 101a-101b or 102a-102b, 201a-201b or 202a-202b, six units in ancient history, and at least twelve upper-division credits in classics.

The program of study should be planned in consultation with an adviser.

The supporting minor should be chosen in consultation with the major adviser.

The teaching minor: 25 units in Latin, including 101a-101b, 201a-201b, and nine units of 401.

For information on the graduate degrees, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.

101a-101b. Elementary Latin (4-4) The Latin language presented as far as possible from the point of view of its influence on English.

102a-102b. Elementary Classical Greek (4-4) Introduction to ancient Greek for students of the Bible and of the Hellenic authors.

103a-103b. Elementary Modern Greek (4-4) Development of skills in conversation, composition, and reading, with emphasis upon audiovisual practice.

115. The Study of English Words (3) I Vocabulary building through the systematic study of English words derived from Latin and Greek.

120. Introduction to the Greek Bible (3) S Grammar, syntax and vocabulary of Koine Greek, textual criticism of the Bible, concentration on the New Testament. Open to nonmajors only.

126. Mythology (3) I II The myths, legends, and folktales of the Greeks and other peoples of antiquity. (Identical with Reli. 126)

201a-201b. Intermediate Latin (4-4) Reading and discussion of selected passages from Virgil's Aeneid or other texts; grammar, some composition. P, 101b or two yrs. of h.s. Latin.

202a-202b. Intermediate Greek (4-4) Selections from classical Greek chosen in accordance with the student's needs and interest. P, 102b.

203a-203b. Intermediate Modern Greek (4-4) Pronunciation, grammar, and vocabulary of modern Greek; development of skills in conversation, composition, and reading; emphasis on aural-oral skills. P, 103b.

204. Ancient History: Greek History (3) I (Identical with Hist. 204)

205. Ancient History: Roman History (3) II (Identical with Hist. 205)

229. Art History of the Cinema (3) I Survey of major artistic movements, including academicism, expressionism, cubism, and surrealism, and their influence on film in Germany, Italy, America, and France. (Identical with Art 229, Dram. 229)
240a-240b. Introduction to Classical Art and Archaeology (3-3) 1985-86 An archaeological history of Greece and Italy through the study of major excavations and monuments, with emphasis on cultural developments and relationships. 240a is not prerequisite to 240b. (Identical with Anth. 240a-240b)

250a-250b. Classical Literature in Translation (3-3) Historical survey of the major authors and works of ancient Greece and Rome. 250a: From Homer to the New Testament. 250b: Roman literature of the Republican period, and the Silver Age, to the end of the pagan period. 250a is not prerequisite to 250b.

260. Ancient Philosophy (3) I (Identical with Phil. 260)

310. Classical Art (3) (Identical with Art. 310)

345. Ancient Cosmology (3) I Investigation of ancient Greek concepts of the universe, with emphasis on theories regarding nature, matter, and the soul.


347. Love in Classical Literature (3) II Love as a theme in Greek and Roman literature of various genres: lyric, tragedy, comedy, philosophy, satire, and romance.

401. Latin Reading Course (3) [Rpt.] GC I II Extensive readings in one of the following: epic, lyric, drama, history, oratory, satire, epistles, novel, philosophical, technical or medieval literature. P, 201b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

402. Greek Reading Course (3) [Rpt.] GC I II Extensive readings in major Greek authors including Homer, Plato, and the historians and dramatists. P, 202b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

403a-403b. History of Greece (3-3) GC (Identical with Hist. 403a-403b)

404a-404b. History of Rome (3-3) GC (Identical with Hist. 404a-404b)

409. Greek Composition (3) GC II Analysis of Greek prose style and practice in composing Greek prose. P, 102, 202 or consult department before enrolling.

410. Latin Composition (3) GC I Analysis of Latin prose style, review of Latin grammar, practice in composing Latin prose. P, 101 and 201 or consult department before enrolling.

411. Roman Art and Architecture (3) GC (Identical with Art. 411)

412. Topics in Greek Philosophy (3) [Rpt./1] GC Extensive readings in Greek in one of the following areas of Greek philosophy: the pre-Socratics, Plato's ethics and epistemology, Aristotle's Nicomachaen Ethics.

413. Augustan Literature (3) GC II Survey of the major writers of the Augustan Age, the period from about 30 B.C. to 14 A.D., with the exception of the Elgiac poets. P, 101 or 201 or consult department before enrolling.

414. Medieval Latin (3) GC Survey of Latin literature during the thousand years between the end of the classical period and the beginning of the Renaissance. P, 101 and 201 or consult department before enrolling.

415. Latin Love Elegy (3) GC Intensive reading of selections from Ovid, Tibullus and Propertius.

417a-417b. Sanskrit Grammar and Texts (3-3) GC 1986-87 (Identical with Or.S. 417a-417b)

443. The Archaeology of Neolithic and Bronze Age Greece (3) GC History, art and culture of Neolithic and Bronze Age Greece through the study of archaeological excavations. P, six units or CR in clas., hist. or anth. (Identical with Anth. 443)

454. Greek and Roman Sculpture (3) GC A survey of the development of classical sculpture from the eight century B.C. to circa 300 A.D. P, 240a-240b.

456. Greek and Roman Painting (3) GC Greek vase painting from the Dipylon vases of the Geometric period in Athens to the Orientalizing animal styles of Corinth and the Black and Red figured attic style. Also, survey of ancient Roman painting and mosaics. P, 240a-240b

457. Greek Architecture (3) GC A survey of the architecture and architects of Greece from the Neolithic to Roman periods including such sites as Nea Nikomedia, Aegina, Lerna, Tiryns, Mycenae, Athens and Corinth. P, 240a-240b

470. Greek Philosophy (3) GC [Rpt.] (Identical with Phil. 470)

488. History of Byzantium (3) GC II (Identical with Hist. 488)

511. Greek Lyric Poetry (3) Intensive study in Greek of the early Greek Lyric writers from Archilochus to Bacchylides, including Pindar. P, 103 and 202 or consult department before enrolling.

512. Topics in Greek Drama (3) Close Reading in Greek of either (1) tragedy - 1 play each by Aeschylus, Sophocles and Euripides or (2) comedy - 2 plays of Aristophanes, 1 of Menander. P, 103 and 202 or consult department before enrolling.

513. Roman Drama (3) Representative plays of Plautus, Terence and Seneca, read in Latin. P, 101 and 201 or consult department before enrolling.

514. Homer (3) Close reading of selections from the Iliad and Odyssey in Greek and an introduction to the critical secondary literature. P, 103 and 202 or consult department before enrolling.

515. Cicero (3) The life of Cicero illustrated by means of close reading of selected works in Latin (pro Caelio, selections from the Philippics, the Verrine Orations) as well as selections from his letters. P, 101 and 201 or consult department before enrolling.

553. Introduction to Graduate Study in Classical Archaeology (3) An historographic survey of classical archaeology with discussion of Heinrich Schliemann, Luigi Palma de Cesnola, Charles Follin McKim and others. P, 240a or 240b.

554. Topics in Greek and Roman Architecture and Urbanism (3) Research papers on an aspect of ancient architecture which involves not only monuments themselves but attempts to consider a building in its physical and cultural setting. P, 240a or 240b.

555. Topics in Greek and Roman Archaeology: (3) Research papers and oral presentations on different aspects of Greek and Roman archaeology; preparation in writing scholarly articles for refereed journals. P, 240a or 240b.

556. Greek and Roman Provincial Archaeology (3) Survey of classical archaeology in ancient Tunisia, Cyprus, Portugal and Turkey. P, 240a or 240b.

595. Colloquium
   f. Advanced Studies in Ancient History (3) II (Identical with Hist. 595f, which is home)

596 Seminar
   a. Ancient Greek Literature (3) Open to graduate majors only.
   b. Latin Literature (3) Open to graduate majors only.
   c. Aegean, Roman and Mediterranean Provincial Archaeology (3) Open to graduate majors only.

**CLINICAL ENGINEERING**
(See College of Engineering)

**CLOTHING, TEXTILES AND INTERIOR DESIGN**
(See Family and Consumer Resources)

**COMPUTER ENGINEERING**
(See Electrical and Computer Engineering)

**COMPUTER SCIENCE**

Professors Ralph E. Griswold, Webb C. Miller
Associate Professors David R. Hanson, Head, Gregory R. Andrews, Peter J. Downey, Christopher W. Fraser
Assistant Professors Timothy A. Budd, Eugene W. Myers, Richard D. Schlichting

The Department of Computer Science offers courses in programming languages and systems, theory of computation, computer architecture, program development, and numerical software. The department's programs prepare graduate students for the design and development of computer systems and applications, and for industrial or academic research in computing.

The department offers graduate programs leading to the Master of Science and Doctor of Philosophy with a major in computer science. For admission and degree requirements, consult the Graduate Catalog.
The teaching minor: Eighteen units, including 115, 227, 237, 327, 342, and one 400-level course.

111. Introduction to Computing (3) I II (Identical with M.I.S. 111)


121. Business Programming (3) I II (Identical with M.I.S. 121)

122. Scientific Programming (3) I II Design and construction of computer programs using the FORTRAN programming language; the concept of algorithm; problem solving techniques and their realization in the FORTRAN language. P, 111 or 115, and Math. 123. (Identical with Math. 122 and M.I.S. 122)

123. Nonnumerical Programming (3) II The SNOBOL4 programming language; character and string data, pattern matching, pointers and structures, programming techniques and applications. P, 115. (Identical with M.I.S. 123)

227. Program Design and Development (3) I II Programming using a high-level language such as Pascal. Several medium-sized projects will be required, with emphasis on program design using stepwise development. P, 115.

237. Introduction to Assembly Language Programming (3) I II Introduction to digital computers; elementary hardware concepts; machine operations and instructions; assembly language concepts; programming in assembly language. P, 115 or 122.

301. Program and Data Structures (3) III (Identical with M.I.S. 301)

327. Comparative Programming Languages (3) I II Introduction to several major high-level programming languages and their characteristics. Programming projects are required in at least four languages. P, 227 or M.I.S. 301. (Identical with M.I.S. 327)

331. Data Management Systems (3) I II (Identical with M.I.S. 331)

342. Data Structures (3) I II Mathematical preliminaries; fundamental data structures and associated algorithms, implementations and applications: stacks, queues, trees, graphs, sorting, and searching. P, 227 or CR 327; Math. 243 or 362. (Identical with M.I.S. 342)

402. Mathematical Logic (3) GC II 1985-86 (Identical with Math. 402)

421. Simulation Modeling and Analysis (3) (Identical with M.I.S. 421)

422. Mathematical Programming and Applications (3) GC (Identical with M.I.S. 422)

430. Software Tools (3) GC I II Techniques for the design and implementation of programs that assist in programming: filters; file managers; editors; text processors. P, 327, 342.

440. Numerical Software (3) GC II Floating-point arithmetic; design and analysis of numerical algorithms; implementation issues; testing and performance measurement; software tools. P, a programming and a linear algebra course.

443. Theory of Graphs and Networks (3) GC II 1985-86 (Identical with Math. 443)

452. Principles of Operating Systems (3) GC II Concepts of modern operating systems; concurrent processes; process synchronization and communication; resource allocation; kernels; deadlock; memory management; file systems; protection mechanisms. P, 237, CR 430.

453. Translators and Systems Software (3) GC I Design and implementation of translation-oriented systems programs: macroprocessors; preprocessors; assemblers; loaders; linkers; introduction to compilers and operating systems. P, 237, 430.

472. Continuous-System Simulation (3) GC I (Identical with E.C.E. 472)

473. Theory of Computation (3) GC I II Mathematical preliminaries: finite automata, regular expressions, applications; context-free grammars, pushdown automata, Turing machines, undecidability. P, knowledge of a programming language; Math. 243 or 215. (Identical with Math. 473)

474. Digital Logic Design (3) GC I II (Identical with E.C.E. 474)

475a-475b. Mathematical Principles of Numerical Analysis (3-3) GC (Identical with Math. 475a-475b)

476. Computer Architecture (3) GC I II Functional overview of computer systems; interconnection of basic components; input/output; interrupts; virtual addressing; stack architecture; microprogramming; microprocessors. P, 237. (Identical with E.C.E. 476)
478. Computational Methods of Algebra (3) GC II (Identical with Math. 478)
479. Game Theory and Mathematical Programming (3) GC II 1985-86 (Identical with Math. 479)

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

520. Principles of Programming Languages (3) II Global semantics of algorithmic languages, including scope of declarations, data types, retention, block structure, binding time, subroutines, coroutines, extensibility; implementation issues. P, 430.

521a-521b. Advanced Systems Modeling and Simulation (3-3) (Identical with M.I.S. 521a-521b)


541a-541b. Computer-Aided Information Systems Analysis and Design (3-3) (Identical with M.I.S. 541a-541b)

545. Analysis of Algorithms (3) I Time, space complexity; recurrences; algorithm design techniques; lower bounds; graph, matrix, set algorithms; sorting; fast Fourier transform; arithmetic complexity; intractable problems. P, 342, 473, Math. 362.

550. String and List Processing (3) I Data representation, pattern matching, structures; applications in symbolic mathematics, text analysis, document formatting, cryptography, etc. P, 327, 342.

552. Principles of Parallel Programming (3) I Fundamental concepts and applications of parallel programs; program verification; synchronization mechanisms in programming languages; distributed processing concepts; case studies of languages; access control and information flow. P, 452.

555. Principles of Compilation (3) II Finite automata and lexical analysis; context-free grammars; parsers; parser generators; code generation; graph-theoretic approaches to optimization. P, 453, 473.

560. Formal Language Theory (3) II Basic concepts of languages and their representations; types of grammars and their relation to programming languages and automata; ambiguity and decidability questions for languages. P, 473.

571. Digital Systems Design (3) I (Identical with E.C.E. 571)

573. Microprocessors, Minicomputers and Real-Time Distributed Processing (3) II (Identical with E.C.E. 573)

575a-575b. Numerical Analysis (3-3) (Identical with Math. 575a-575b)

620. Advanced Topics in Programming Languages (1 to 3) [Rpt./12 units] I Design, implementation, and compilation of programming languages; specific topics to be determined by current literature and faculty and student interest.

630. Advanced Topics in Software Systems (1 to 3) [Rpt./12 units] I Problems in design and development of large systems of programs; specific topics to be determined by current literature and faculty and student interest.

645. Advanced Topics in Algorithm Analysis (1 to 3) [Rpt./12 units] II Design and analysis of algorithms; specific topics to be determined by current literature and faculty and student interest.

652. Advanced Topics in Operating Systems (1 to 3) [Rpt./12 units] II Operating system design, development, analysis, and performance; specific topics to be determined by current literature and faculty and student interest.

660. Advanced Topics in Theory of Computation (1 to 3) [Rpt./12 units] I Specific topics to be determined by current literature and faculty and student interest.

674. Sequential Circuits and Automata (3) I (Identical with E.C.E. 674)

CONSUMER STUDIES
(See Family and Consumer Resources)

CORRECTIONAL ADMINISTRATION
(See Management and Policy)
COUNSELING AND GUIDANCE

Professors O. C. Christensen, Roger J. Daldrup, Bill W. Hillman
Associate Professors Richard L. Erickson, Head, Harley D. Christiansen, Philip J. Lauver, Elizabeth B. Yost
Assistant Professor Betty J. Newton

The department offers professional preparation in counseling and guidance, with concentrations in elementary and secondary school counseling, classroom guidance, community program and agency counseling, career education, and student personnel work in higher education.

The Master of Arts, Master of Education, Doctor of Philosophy, and Doctor of Education degrees with a major in counseling and guidance are available through the department. For admission and degree requirements, please see the Graduate Catalog.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

297. Workshop
   a. Self and the World of Work (1) I II
   b. Student Executive Training in Higher Education (2) II
   c. Student Assistant in College Residence Halls (1) I

401. Basic Skills in Counseling (3) GC I Selected counseling skills and their applications to non-counseling settings. Designed for nonmajors needing basic skills in counseling as an adjunct to other primary occupational functions.

403. Principles of Adlerian Psychology (3) GC I II Techniques for the study of human behavior; implications for improving adult-child relationships, with emphasis on Adlerian principles.

445. Nonpharmacological Issues of Medicines (3) GC I (Identical with Ph.Pr. 445)

489. Clinical Pharmacotherapy of Mental Disorders (3) GC I (Identical with Ph.Pr. 489)

521. Techniques of Interviewing (3) GC I II Types and functions, process, and application of the interview in various settings.

531. Career Education (3) I Concepts and goals, elements and systems of career education, with emphasis on development of materials and teaching strategies for implementing objectives in the elementary and secondary classroom. Open to nonmajors. (Identical with Elem. 531 and S.Ed. 531)

549. Counseling and Guidance Laboratory (1 to 3) [Rpt.] I II Supervised observation and participation in selected counseling and guidance activities: campus, public school, and community settings.

557. Methods in Marital Therapy (3) II 1986-87 (Identical with C.D.F.R. 557)

567. Law for Teachers and Student Personnel Workers (3) II (Identical with Ed.F.A. 567)

570. Counseling the Adult (3) I Adult crisis, midlife changes and developmental patterns; counseling techniques and intervention strategies.

571. Counseling Women (3) II Examination of the counseling needs of contemporary women and current types of intervention designed to meet these needs. (Identical with W.S. 571)

581. Human Relations Training (3) GC I II Interdisciplinary human relations training lab. for assessment and development of communication and interpersonal skills. Applications in the home, business, educational and community settings. (Identical with Ed.F.A. 581)

597. Workshop
   b. Classroom Group Guidance (3) I S
   c. Self-Management Techniques (3) S
   j. Anger, Depression and Guilt (3) S
   k. Family Systems and Psychodrama (3) S.

601. Foundations of Counseling (3) I II Relationship and contributions of various fields to the work of the counselor at all levels, in current and historical perspective; derivation of principles and objectives; integrated lab. experience in selected settings. Open to majors only.
602. Foundations of Student Personnel Work in Higher Education (3) I (Identical with H.Ed. 602)
607. The College Student (3) I (Identical with H.Ed. 607)
617. Student Personnel Services in Higher Education (3) II (Identical with H.Ed. 617)
622. Appraisal of the Individual (3) I II Methods of appraising and reporting individual behavior, with emphasis on nonpsychometric data. Open to majors only.
623. Testing in Counseling (3) I II Evaluation and selection of psychological tests for guidance; use of psychometric data in counseling. Open to majors only.
631. Career Counseling (3) I II Theories of vocational development; types, sources, and use of occupational and educational information in career counseling and decision making. P, 601 or CR.
644. The Counseling Process (3) I II Introduction to theories of counseling; collation and interpretation of counseling data; the counseling process; study of cases. P, 601, 622.
645. Theories of Counseling (3) II Rationale, development, and research underlying major counseling theories. P, 631, 644.
647. Premarriage and Marriage Counseling (3) I II Contemporary issues, concepts, and procedures in premarriage and marriage counseling. P, 581, 622.
648. Procedures in Family Counseling (1 to 3) I II Theory and process in family counseling; problem solving techniques applied to parent-child conflict; lab. experience. P, 403.
682. Group Techniques (3) I II Group techniques and underlying theories; applications in schools and agencies; interpersonal relationship of group and individual approaches in counseling and related programs. P, 622, 601 or CR.
683. Group Counseling (3) I Theory and process in group counseling; applications in school, college, and community settings; lab. experience. P, 644.
693. Internship
   a. Counseling (1 to 9) [Rpt.] I II
   b. Student Personnel Services (1 to 9) [Rpt.] I II
   c. Career Guidance (1 to 9) [Rpt.] I II
694. Practicum
   P, 24 units of counseling courses. Supervised practice is offered on the basis of need and demand in the following areas:
   a. Elementary School Counseling (1 to 9) [Rpt.] I II
   b. Secondary School Counseling (1 to 9) [Rpt.] I II
   c. Higher Education Counseling (1 to 9) [Rpt.] I II
   d. Agency Counseling (1 to 9) [Rpt.] I II
   e. Family Counseling (1 to 9) [Rpt.] I II
   f. Group Counseling (1 to 9) [Rpt.] I II
   g. Marriage Counseling (1 to 9) [Rpt.] I II
   h. Career Counseling (1 to 9) [Rpt.] I II
795. Colloquium
   b. Professional Practice (1 to 3) [Rpt.] I II
   c. Counselor Education and Supervision (1 to 3) [Rpt.] I II
   d. Counseling Theory (Theory varies) (1 to 3) [Rpt.] I II
   f. Career Development (1 to 3) I II

CREATIVE WRITING
(See English)

CRIMINAL JUSTICE ADMINISTRATION
(See Management and Policy)
DANCE

Committee on Dance

Professor John M. Wilson
Associate Professor Isa Bergsohn, Chairperson
Assistant Professors Nina Janik, Mary K. Wolff
Lecturer George Zoritch

The Committee on Dance, a division of the Faculty of Fine Arts, provides studies in the art, the teaching, and the analysis of dance. The dance curriculum offers four years of technique in ballet and modern dance, choreography and ample performing experience, leading to the Bachelor of Fine Arts degree with a major in dance.

A concentration in dance is offered by the Department of Drama as an option within their Master of Arts degree with a major in drama. For information consult the Graduate Catalog or the Department of Drama.

The major: Dance majors must audition for placement in dance technique courses. For information regarding the placement session, please contact the Committee on Dance.

In addition to the general education requirements, as described under the Bachelor of Fine Arts, in the Faculty of Fine Arts section of this catalog, the following courses must be taken: 175, 143a, 209, 240a-240b, 241a-241b, 245a-245b, 259a-259b, 340a-340b, 341a-341b, 440a-440b, 441a-441b; any three of 343a or 343b or 343c or 343d; 246, 247a-247b, 270, 346; 496d; 394a-394b, 445, Mus. 107, 108. Twenty units of combined electives from drama, art, music, and r.t.v. are also required. Thirty units in dance classes, including four units in ballet technique, four units in modern technique, and 394a-394b, must be taken in residence. Minimum units required for the degree with the major in dance—125.

Honors: The Committee participates in the Honors Program.

112. Ballet (1) I II S
   a. Beginning Ballet
   c. Intermediate Ballet

143. Improvisation (1) I II
   a. Beginning Improvisation

152. Modern Dance (1) I II S
   a. Beginning Modern Dance
   c. Intermediate Modern Dance

175. Theatre Dance (1) I II S (Identical with Mus. 175)

209. Percussion for Dance Students (2) I (Identical with Mus. 209)

240a-240b. Ballet Technique I (2-II)

241a-241b. Modern Dance Technique I (2-II)

244a-244b-244c-244d. Jazz Dance Technique (1-1-1-1) Janik

245a-245b. Basic Choreography (2-II) Study of the elements of time, space, and energy; basic concepts of phrasing and structure leading to dance composition. 4S. P, 143c. Bergsohn/Wolff


247a-247b. Production in Dance (3-3) Theory and practical training in dance production; lighting, sound, costuming, and promotion. IR, 4S. Wolff

259a-259b. History of Dance (3-3) 259a: Origins of dance as human expression in ritual, social, and theatrical context. 259b: History of dance as theater art within the western world from 1581 to the present. 259a is not prerequisite to 259b. Wolff/Bergsohn

270. Human Movement in the Arts (3) II 1986-87 Anatomical and biomechanical foundations of human movement from the viewpoint of the performing and visual arts. Historical development and stylistic treatment of the human figure in action through slide transparencies, demonstration of dance training and choreography. Wilson
339. Ballet Pointe Preparation (1) [Rpt./1] I II Strength, stretch and placement techniques in preparation for ballet pointe; analysis of foot and shoe-fitting; barre and centre basics. 2S. P, 112c or audition.

341a-341b. Modern Dance Technique II (2-2) P, 241b.
343a-343b-343c-343d. Dance Repertory (2-2-2-2) a and b sections 1986-87; c and d sections 1985-86. Study of performance skills from classical, modern, contemporary and folk repertory. 6L. Enrollment by audition only.


349. Practicum
a. Dance Project (1) I II 3L.
   b. Production Project (1) I II 3L. P, 247a-247b, 445.

441a-441b. Modern Dance Technique III (2-2) P, 341b.
445. Advanced Choreography (2) GC I Movement qualities, motif development, and geometric principles applied to group composition. 4S. P, 245b.

496. Proseminar
d. Dance-Related Art Forms (1 to 3) GC II 1986-87 (Identical with Dram. 496d) Bergsohn

540a-540b. Advanced Ballet (2-2) [Rpt./1] P, 440a-440b.
541a-541b. Professional Level Modern Dance Technique (2-2) [Rpt./1] P, 441a-441b.
545. Literary Resources for Choreography (3) II 1986-87 Studies in primary world literature, in drama, and in psychology of personages as sources for choreographic themes; presentation of motifs and scenario. 6S. P, 445 or 594. Wilson (Identical with Dram. 545)

697. Workshop
a. Concert Production and Choreography (2 to 4) [Rpt./4 units] I II 4-8S. P, 445, 594.

DIEETICS

(See Nutrition and Food Science)

DISTRIBUTIVE EDUCATION

(See Business and Career Education)

DRAMA

Professors Robert C. Burroughs, Head, Irene F. Comer (Emerita), J. Michael Gillette, Robert A. Keyworth (Emeritus), Peter R. Marroney (Emeritus)
Associate Professors Harold W. Dixon, Rosemary Gipson, Peggy Kellner, William A. Lang, Peter Lehman, Jeffrey L. Warburton
Assistant Professors Richard T. Hanson, Dianne J. Winslow

The Department of Drama offers the following degrees: Bachelor of Fine Arts with a major in drama production with options available in acting/directing, design/technical production, and theatre specialist; Bachelor of Fine Arts with a major in drama education; Bachelor of Arts in Drama with a major in dramatic theory; Master of Arts and Master of Fine Arts.

The department participates with the School of Music and the Committee on Dance in providing course work for the musical theatre option. Also, in cooperation with the Department of Radio-Television, course work is offered for the cinema option. Both options are available within the Bachelor of Fine Arts, major in general fine arts studies. For additional information concerning these options, see the Faculty of Fine Arts section of this catalog.
Drama core curriculum: Undergraduates in the department with a major in drama production or in drama education are required to take the same curricular core. In addition to the general education units described under the Bachelor of Fine Arts in the Faculty of Fine Arts section of this catalog, the following lower division requirements must be met: 105, 106, 111, 112, 113, 115, 116, 117, 118, 120, 140a-140b, 149, 151, 220, 221, 222, 223, 224, 225 and 245.

The requirements for the various programs are listed below.

Bachelor of Fine Arts (major in dramatic theory): The Bachelor of Fine Arts in Drama is designed for the theatre generalist and provides an appropriate basis for advanced study of theatre history, theatre criticism, and playwriting at the graduate level. In addition to the general education units required, as described under the Bachelor of Arts in the Faculty of Fine Arts section of this catalog, the following requirements must be met: 105, 111, 112, 113, 116, 117, 118, 140a-140b, 149, 245, 440a-440b, 460a, or 460b, and six units of dramatic literature.

Acting/directing option: admission is by interview and audition at the completion of the drama core curriculum at the end of the sophomore year. The following requirements must be met: 250, 251, 305, 306, 430, 440a-440b, 449, 451, 452, 455, 475, 4 units from 497; 6 units of drama literature; 4 units selected from Ex.S.S. 132a, 132c, 132d, Dnc. 112a, 112c, 143a, 152a, 152c, 175; one course selected from Sp.H. 260 or 367 or Sp.C. 467; and one course from Mus. 103 or 111a or 205 or Musi. 180v. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option — 125.

Design/technical production option: admission is by portfolio review and interview at the completion of the drama core curriculum. The following requirements must be met: 415, 416, 420, 421, 423, 424, 425, 427, 429, 440a-440b, four units selected from 497a, 497b, 497c, 497d, or 497e, and 6 units of dramatic literature. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option — 125.

Theatre specialist option: admission is by interview with supporting documents and completion of the drama core curriculum. Upper-division course work must be planned at the beginning of the undertaking of a declared specialty with an academic advisor. This option offers the student the opportunity to design a specific curriculum in consultation with a departmental faculty advisor. The course of study may not substantially parallel that offered in any other departmentally administered degree program. The following requirements must be met: 440a-440b, 18 units of drama courses, and 6 units of dramatic literature. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this option — 125.

Bachelor of Fine Arts (major in drama education): Students may be admitted upon completion of drama core curriculum and an interview. This major is designed for students preparing for a teaching position in the junior and senior high schools. The student must complete the following drama courses: 250, 251, 410, 455, and 456; and the following education courses: Ed.P. 311, S.Ed. 225, 329, 330, 338t, 435, 493a, and 494b. A teaching minor is not required, but those students anticipating employment in areas where a teaching minor might be advantageous should consult with their advisor. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this major — 125.

Bachelor of Arts in Drama (major in dramatic theory): The Bachelor of Arts in Drama is designed for the theatre generalist and provides an appropriate basis for advanced study of theatre history, theatre criticism, and playwriting at the graduate level. In addition to the general education units required, as described under the Bachelor of Arts in the Faculty of Fine Arts section of this catalog, the following requirements must be met: 105, 111, 112, 113, 116, 117, 118, 140a-140b, 149, 245, 440a-440b, 460a or 460b, and 6 units of dramatic literature. A twenty-unit minor is also required. (See the Faculty of Fine Arts section for details.) If the minor is in a field other than the fine arts, it is recommended that additional general electives be taken in fine arts. At least 18 units in the major must be taken in residence. Minimum total units required for a degree with this major — 125.

Teaching minor: twenty units, including 6 units of acting, 6 units of theatre history, and 6 units of technical theatre.
100. Acting for General College Students (3) I II S The craft of acting with emphasis on body, voice and mind. Theoretical background and practical experience, including in-class performances of selected scenes. Open to non-majors only.

101. Theatre Appreciation (3) I II An introduction to the art used in producing the play: directing, acting, technical production. Open to non-majors only.

105. Voice and Movement for the Actor I (1) [Rpt./1] I Beginning voice and movement skills for the actor including the Linklater approach, phonetics, physical isolation and awareness exercises. 2S. Open to drama majors/minors and general fine arts studies majors only.

106. Voice and Movement for the Actor II (1) [Rpt./1] II Continued voice and movement skills for the actor with a new focus on stage dialects and physicalization of character. 2S. Open to drama majors/minors and general fine arts studies majors only. P, 105.

108. Introduction to Film Studies (3) I An introduction to the language of film. Selected films will be viewed and analyzed to enhance the students' understanding and awareness of film as an art form and communicative medium.

109. Survey of Film History (3) II A survey of the history of motion pictures. Films will be chosen from a variety of nations and time periods to illustrate the diversity of film styles. 2R, 3L. P, 108.

111. Stagecraft (2) I II Basic principles of the scenic process: construction and use of materials.

112. Stagecraft Laboratory (1) [Rpt./2] I II S Scenic and property shop techniques and practices. P, CR 111 and 113 for majors.

113. Stagecraft Crew (1) [Rpt./2] I II S Crew work on building theatrical sets or properties for department productions. P, CR 111 and 112 for majors.

115. Makeup (1) I II History and essentials of makeup; straight, character, and special types; effects of light on makeup; opportunity for experience in production. 2S.

116. Stage Costume (2) I II Trends of historic dress analyzed in relation to social and economic background; design and execution of costumes; and the organization and care of departmental wardrobes.

117. Stage Costume Laboratory (1) [Rpt./3 units] I II S Costume construction techniques and shop practices. P, CR 116 and 118 for majors.

118. Stage Costume Crew (1) [Rpt./3 units] I II S Crew work involved with costume construction, wardrobe maintenance and storage. P, CR 116 and 117 for majors.

120. Basic Theatre Graphics (2) I II Practical graphic skills essential to theatrical productions. 4S.

140a-140b. History of the Theatre and Drama in Western Civilization (3-3) Origins and development of the arts of theatre from primitive ritual to modern times; integrated study of plays, theatre architecture, dramatic styles, and theories of significant periods. 140a is not prerequisite to 140b.

149. Acting I (3) I Fundamental techniques of acting, with emphasis on the actor's approach to characterization and the performer's relationship to all parts of the play's production. 2R, 2S. Open to drama majors and minors only.

151. Acting II (3) II Intensive study of text analysis and the actor's approach to characterization as it pertains to modern realism. 2R, 2S. P, 105, 149.

170. Introduction to Motion Picture Technique (3) [Rpt./1] I II S Silent motion picture production techniques. Individual and/or team projects to include completion of 3 to 5 short super 8 silent films. University provides camera, editing and projection equipment; student provides film and pays all processing and lab. charges.

194. Practicum a. Performance (1 to 2) [Rpt./4 units] I II S

200. Principles of Lighting Design (2) I Function and qualities of light; typical applications in theatre, dance, television, motion pictures, architecture and interior design.

205. Musical Theatre (2) [Rpt./1] I S American musical theatre: its origins, development and influences. Practical applications. 1R, 2S.

220. Stage Lighting (2) Studies in stage lighting equipment, procedures, and design techniques.

221. Stage Lighting Laboratory (1) [Rpt./2] I II S Stage lighting techniques and shop practices. P, CR 220 and 222 for majors.

222. Stage Lighting Crew (1) [Rpt./2] I II S Crew work on theatrical stage lighting productions. P, CR 220 and 221 for majors.
223. **Scene Design (2)** I II Basic principles of scenic design.

224. **Scene Design Laboratory (1)** [Rpt./J units] I II S Scene painting techniques and shop practices. P, CR 223 and 225 for majors.

225. **Scene Design Crew (1)** [Rpt./J units] I II S Crew work involved with painting and decorating sets for department productions. P, CR 223 and 224 for majors.

229. **Art History of the Cinema (3)** I (Identical with Clas. 229)

245. **Principles of Dramatic Structure (3)** I Interpretation of structural elements of major dramatic forms and styles in relation to stage presentation and film; reading and analysis of representative plays.

250. **Acting III (3)** I Intensive work in expanding the versatility of the actor's instrument. Improvisation, class exercises and scene work. 2R, 2S. P, 106, 151.

251. **Acting IV (3)** II Non-realistic styles, including expressionism, absurdism and the contemporary avant-garde; work with select exercises in both representational and presentational modes. Analytical skills, scene performance and critique. 2R, 2S. P, 250.

304. **Musical Theatre II (3)** I Intensive text and score analysis in relation to the process of characterization for the actor, singer, dancer in musical theatre. Individual and group performance. Open to majors only. 2L, 2S. P, 205 and audition.

305. **Voice and Movement for the Actor III (1)** [Rpt./J] I Intermediate voice and movement skills for the actor including standard stage speech and period manners and movement; emphasis on Shakespearean style. 2S. Open to majors only. P, 205 and audition.

306. **Voice and Movement for the Actor IV (1)** [Rpt./J] II Continued intermediate voice and movement skills for the actor including individualized attention to special voice problems and period manners and movement. Emphasis on Commedia dell'arte, Moliere and English Restoration styles. 2S. Open to majors only. P, 305.

338t. **Teaching of Theatre Arts (3)** II Carries credit in ed. only. (Identical with S.Ed. 338t)

404. **Musical Theatre III (3)** GC II Intensive scene study and exploration of the major historical styles and genres of the American musical theatre. 2R, 2S. Open to majors only. P, 304 and audition.

410. **Creative Drama (3)** GC I Principles and procedures of improvisations, role-playing, creative playwriting techniques, and program development in creative dramatics applicable to the elementary and secondary school levels. P, twelve units of dram. or ed.

412. **Theatre for Children (3)** GC II Principles and techniques of selecting plays, playwriting, directing, designing and producing theatre for children. 2R, 3L. P, twelve units of dram. or ed.


421. **Lighting and Sound Technology (3)** GC II Applied theory and techniques associated with sound system and visual effects in the theatre. 2R, 3L.

423. **Scene Painting (3)** GC I Techniques and methods of scenic painting.


425. **Advanced Stagecraft (3)** GC I Advanced studies in scenic construction methods and techniques. P, 111.

427. **Advanced Stage Costume Construction (3)** GC II Advanced techniques in costume construction, including period pattern design, cutting and draping techniques. P, 116.


430. **Stage Management (2)** GC I Principles and techniques of stage management, practical applications, problems and analysis of stage managing. P, 111, 151.

431. **Theatre Publicity and Box Office (2)** GC I Publicity, press releases, sales, advertising, display techniques, subscription procedures. P, twelve units of drama.

432. **Theatre Management (2)** GC II Amateur, educational and professional theatre organization and management; theatrical contracts, professional unions and representative organizations. P, twelve units of drama.
436. Shakespeare through Performance (3) GC I (Identical with Sp.C. 436)


449. Acting V (3) GC I Intensive study of classical acting styles with emphasis on Shakespeare. Individual and group performance. 2R, 2S, P, 251 and audition.


452. Acting VII (3) GC I Rpt./1 Audition material, techniques and research into problems of a professional career in the theatre, television, motion pictures and related fields. 2R, 2S, P, 305, 449.


455. Directing I (3) GC I Basic techniques of stage directing including play analysis, director-actor communication and technical problems of movement, composition, picturization and blocking. 2R, 2S.

456. Directing II (3) GC II Techniques of stage direction with the study of factors leading to a completed production; special attention given to director-designer communication and the production process. Direction of one-act plays. 2R, 2S, P, 455.

460a-460b. Writing for Stage and Screen I (2-2) GC Preparation and analysis of brief scripts for stage and motion pictures; staged readings and lab. productions. Writing-Emphasis course for Cinema Option (General Fine Arts Studies major). P, Satisfaction of the upper-division writing proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

475. Screen Acting Techniques (3) GC II Principles and techniques of various performance methods involved in acting for television and motion pictures; basic problems faced by the professional actor seeking employment in these media; on camera experience with directed exercises and dramatic scenes. 2R, 3L. (Identical with R.T.V. 475)

496. Proseminar
   a. Portfolio (1 to 2) GC I II
   b. Cinema Production and Practices (1) GC II
   c. Advanced Topics in Film Studies (3) [Rpt./3] GC I II P, 109 or consult department before enrolling.
   d. Dance Related Art Forms (2 to 3) GC II (Identical with Dnc. 496d, which is home).

497. Workshop
   a. Technical Production (1 to 6) [Rpt./20 units] GC I II S
   b. Costume Production (1 to 6) [Rpt./20 units] GC I II S
   c. Lighting/Sound (1 to 6) [Rpt./20 units] GC I II S
   d. Production Design (1 to 6) [Rpt./20 units] GC I II S
   e. Scenic Design (1 to 6) [Rpt./20 units] GC I II S
   f. Performance (1 to 6) [Rpt./20 units] GC I II S
   g. Cinema Production (1 to 6) [Rpt./20 units] GC I II S

545. Literary Resources for Choreography (3) II 1986-87 (Identical with Dnc. 545)

560a-560b. Writing for Stage and Screen II (3-3) Preparation and analysis of full-length scripts for stage and motion pictures. Production possible for selected scripts.

600. Introduction to Graduate Study of Drama (2) I Methods and materials for research in theatre and drama; introduction to the bibliography of these fields; organization and form of thesis.

605. Advanced Voice and Movement for the Actor I (4) [Rpt./1] I Advanced study and exercise in voice and movement for the actor: relaxation, breathing, physical and vocal freedom, resonance, articulation and improvisation including the Linklater Approach, I.P.A., and Neutral Mask. 2R, 4S.

606. Advanced Voice and Movement for the Actor II (4) [Rpt./1] II Continued advanced study and exercise in voice and movement for the actor: standard stage speech, stage dialects, period customs, manners and movement. 2R, 4S, P, 605.

640. Dramatic Criticism: Tragedy (3) I Comparative analysis of tragedy and theories of tragedy from antiquity to the present for stage and screen; writing of critical papers.

641. Dramatic Criticism: Comedy (3) II Comparative analysis of comedy and comic theory from antiquity to the present for stage and screen; writing of critical papers.
642a-642b. **Studies in Theatre History** (3-3) Concentrated study in theatre history, with major emphasis on the physical theatre, standard scholarly works, and source materials. 642a: Beginnings to circa 1660. 642b: Circa 1660 to 1975. 642a is not prerequisite to 642b.

644. **History of the American Theatre** (3) II Studies in the American theatre and drama. Directed and individual projects will be assigned.

650. **Experimental Theatre I** (3) I Post-Stanislavsky experimental theatre techniques and theories of the first half of the twentieth century. Rehearsal and performance of select projects.

651. **Experimental Theatre II** (3) II Theories and techniques of avant-garde theatre. Rehearsal and performance of select projects.

655. **Advanced Directing I** (3) I Techniques of analyzing and staging classical texts for a contemporary audience; use of directorial style and the adaptation of directorial philosophies with an emphasis on the staging of Shakespeare. 2R, 2S, P, 456.

656. **Advanced Directing II** (3) II Techniques of analyzing and staging classical texts for a contemporary audience; use of directorial style and the adaptation of directorial philosophies with an emphasis on staging the plays of Moliere, the English Restoration, and similar historical texts. 2R, 2S, P, 655.

696. **Seminar**
   a. Contemporary Trends (1 to 3) I II
   b. Special Topics in Acting (1 to 3) I II
   c. Special Topics in Directing (1 to 3) I II
   d. Musical Theatre Production (1 to 3) I II
   e. Directing the Full-Length Motion Picture (1 to 3) I II
   f. Film Editing (1 to 3) I II
   g. Documentary and Educational Films (1 to 3) I II
   h. Theatrical Design (1 to 3) I II
   i. Period Design Style (1 to 3) I II

**EARLY CHILDHOOD EDUCATION**

*(See Elementary Education; Family and Consumer Resources)*

**ECOLOGY AND EVOLUTIONARY BIOLOGY**


Associate Professors Russell Davis, Robert S. Mellor, Richard E. Michod, Stephen M. Russell, Oscar G. Ward

Assistant Professor Astrid Kodric-Brown, D. Lawrence Venable, David J. A. Vleck

Lecturer C. William Gaddis

The Department of Ecology and Evolutionary Biology provides general and professional education for those intending to pursue graduate study or for those planning a career in fields where training in basic and applied organismic, evolutionary and environmental biology is necessary or desirable. Courses in population, community and physiological ecology, behavior, population theory, biogeography, natural history, population genetics, systematics, and evolution are offered. Through such courses the department offers undergraduate and graduate students unusual opportunities to explore ecological and evolutionary phenomena. In addition to excellent instructional facilities on campus, the department uses the Marine Biology Station at Puerto Penasco, Sonora, Mexico; the Coronado Ranch in the Chiricahua Mountains; the Southwestern Research Station at Portal, Arizona; the Boyce-Thompson Arboretum at Superior, Arizona and the Research Ranch at Elgin, Arizona. It also operates the research vessel, LA SIRENA, for marine biological teaching and research in the Gulf of California, and curates excellent regional collections of plants and animals.

The department offers the Bachelor of Science, Master of Science, and Doctor of Philosophy degrees with a major in general biology and the Bachelor of Arts and Bachelor of Science degrees with a major in ecology and evolutionary biology. The department also
DEPARTMENTS AND COURSES OF INSTRUCTION

offers advanced degrees, the Master of Science and Doctor of Philosophy, with majors in ecology and evolutionary biology, and botany.

The Bachelor of Science with a major in general biology provides a broad background covering aspects of molecular, cellular, organismic, physiological, ecological, and evolutionary biology. The requirements are: 102, 103, 104, 320; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b, 180a-180b; eight units of math., including Math. 125a and either 160 or 263.

Majors must complete three or four upper-division units in three of the following four areas: (1) cell-molecular, (2) ecology, (3) physiology, and (4) systematics-morphology. From six to nine units of additional upper-division elective credit must also be taken for a minimum of 35 units in the major. No more than four of these elective units may be taken as 399 or 499 (independent study). Programs resulting in the equivalent of majors in botany, physiology and zoology may be pursued. Other areas of emphasis are genetics, invertebrate zoology, marine biology, predentistry, premedicine and other appropriate preprofessional programs. The biology program has a structured minor in chemistrymath.

The B.S. with a major in ecology and evolutionary biology is designed primarily for students who plan to pursue graduate study in ecology and evolutionary biology or a related science. The requirements for the major are 102, 103, 104, 320, 434, and 435; in addition, Chem. 103a-103b, 104a-104b; Phys. 102a-102b, or 103a-103b and 180a-180b, or 110, 116, and 121; Math. 125a-125b and 223 which courses constitute the minor; at least nine additional units of upper-division courses listed by the department (chosen with the approval of a major adviser); six to ten additional units of math. or physical science. (Exception: Only four additional units of physical science required if Phys. 121 option is taken.) Students interested in doing graduate or professional work in biological sciences are strongly advised to include a course in plant or animal physiology (450 or 468R and 468L), an additional eight units of organic chem. or bioc. and a course in m.c.b. in their programs.

The B.A. with major in ecology and evolutionary biology is designed for students with interests in natural history and the biological environmental sciences who may not wish to continue with graduate study. The requirements for the major are 102, 103, 104, 470 or 472, and any one of 480, 482, 483, 484, 485; in addition, Chem. 103a-103b, 104a-104b; Phys. 102a-102b; Math. 117e, 118, and one course from the following: Math. 119, 123, 125a, 263 which courses constitute the minor. With assistance of a major adviser, the student must select eleven or twelve additional units listed by the department for a total of 32 units in the major.

The teaching major: The same as the biology major.

The teaching minor: 102, 103, 104; seven units of electives selected in consultation with a biological sciences adviser. Note: 103 has a prerequisite of Chem. 103a.

Honors: The department participates in the Honors Program.

101a-101b. General Biology (4-4) Important biological principles and problems related to the origin, nature, and population ecology of man. Not designed for bio. majors. 3R, 3L. Field trips.

102. Fundamentals of Ecology and Evolution (4) I II Ecological and evolutionary concepts and principles, including Darwinian evolution; genetic mechanisms of evolution; adaptation; speciation; physiological, population, and community ecology; ecosystems; behavior. 3R, 3L. P, high school chemistry, intermediate algebra. (Identical with M.C.B. 102, Micr. 102)

103. Biology of Cells (4) I II (Identical with M.C.B. 103)

104. Organismic Biology (5) I II Structure, function, development, and economic value of flowering plants; structure, function, and development of animals; brief survey of the plant and animal kingdoms. 3R, 6L. (Identical with M.C.B. 104, Micr. 104)

105. Introductory Botany (3) I Structure, function, and development of flowering plants and an overview of the plant kingdom. 3R.

106. Environmental Biology (4) I Principles of ecology applied as background for understanding the interactions between the human species and natural ecosystems. Nonmajors orientation. 3R, 3L Field trip.

120. Plants and Society (3) I Lecture-demonstration course on the interrelationships between plants and man; discussion of plants as a source of food, fiber, drugs and other products; plants for esthetic value, survival and energy.

123. Introduction to Organic Evolution (2) I Study of the origin and maintenance of the diversity of life.
130. Natural History of the Southwest (3) I Elementary biology of the common plants and animals of the Southwest; identification, distribution, ecology. 2R, 2L. Field trips.

150. Fundamentals of Marine Biology (3) II Survey of the marine environment and its biotic communities, with emphasis on the natural history of marine organisms. 2R, 3L. Weekend field trip.

159aR-159bR. Human Anatomy and Physiology (3-3) Correlated structure and function of the human body. Primarily for majors in nurs., phrm., and ex.s.s.; not designed for bio. majors.

159aL-159bL. Human Anatomy and Physiology Laboratory (1-1) III CR 159aR-159bR.

260. Elementary Plant Physiology (4) II Functions, nutrition, metabolism, and development of higher plants. 3R, 3L. P, 104 or P.I.S. 100; Chem. 101b, 102b.


320. General Genetics for Majors (4) II Inheritance in plants and animals, with emphasis on lab. experimentation. 3R, 3L. P, 104, Chem. 103b, 104b. (Identical with M.C.B. 320)

321. General Genetics (4) I II Inheritance in plants and animals, with emphasis on lab. experimentation. 3R, 3L. Open to nonmajors only.


402. History of Biology (3) GC II (Identical with Hist. 402)

403R. Biology of Animal Parasites (3) GC I (Identical with V.Sc. 403R)

412. Plants Useful to Man (2) GC S Lecture-demonstration course for teachers and others wishing information on the uses of plants: foods and food plants, medicinal plants, plants and industry, plants in textiles and other manufacturers.

413. The Plant Kingdom (3) GC S Designed for public school teachers and others wishing to become familiar with the major plant groups in our environment; collecting and growing plants. Field trip.

414. Plants of the Desert (2) GC S Designed for teachers and others wishing to become familiar with common native and cultivated plants; identification, ecology, and uses.

418a-418b. Scientific Illustration-Photography (2 to 4 - 2 to 4) [Rpt.] GC Individual basic training in the execution of thesis drawings and graphic art techniques. Consult dept. before enrolling. (Identical with Anth. 418a-418b)

421. Philosophy of the Biological Sciences (3) GC I 1985-86 (Identical with Phil. 421)

428L. Advanced Microbial Genetics Laboratory (2) GC I (Identical with M.C.B. 428L)

431. Environmental Physiology (3) GC II 1985-86 Analysis and synthesis of recent studies of the physiological responses of animals to their environments. P, 468R.

433. Advanced Scientific Illustration (4) [Rpt./1] GC S Individualized advanced work in scientific illustration; lecture demonstrations on a variety of techniques. Field trips. P, 418a. (Identical with Anth. 433)


435. Evolution (3) GC I A balanced survey of the present-day concepts of the process and products of evolution, with emphasis on contrasting models and their consequences; recent techniques for the elucidation of phylogenetic pathways. P, 102, 320; Math. 125a, CR Math. 125b.

436. Plant Ecology (4) GC II Dynamic processes giving rise to ecological patterns in plant populations and communities. 2R, 6L. Field trips. P, 102 and a basic botany course.

437. Floras of North America (2) GC II Analysis of the ranges of naturally-occurring plant taxa and communities of North America, both past and present. Two-day field trip.

438. Biogeography (3) GC II The role of historical events and ecological processes in determining the past and present geographic distribution of plants and animals. P, 102 or Geos. 225. (Identical with Geos. 438)

440R. Oceanography (2) GC II Introduction to the physical, chemical, geological, and biological dimensions of the oceans, with emphasis on their importance as biological environments. P, six units of a physical sci.
DEPARTMENTS AND COURSES OF INSTRUCTION

440L. **Oceanography Laboratory** (2) GC II Field and lab. investigations of the Gulf of California, with emphasis on research techniques important to biological oceanography. Weekend field trips. P, 440R or CR.

441. **Limnology** (4) GC I (Identical with W.F.Sc. 441)

442. **Marine Ecology** (6) GC S A field introduction to basic concepts in marine ecology with emphasis on the behavior and ecology of invertebrates and fishes and the factors affecting the diversity and community structure of marine communities. The entire course is conducted at selected sites in the Gulf of California. Consult instructor before enrolling.

450. **Developmental Plant Anatomy** (4) GC II 1986-87 Origin, development, and maturation of vascular plants. 3R, 3L. P, 101b or 104.

458. **Comparative Vertebrate Anatomy** (4) GC I (Identical with V.Sc. 458)

459. **Comparative Vertebrate Histology** (4) GC II (Identical with V.Sc. 459)

460. **Plant Physiology** (4) GC I II (Identical with M.C.B. 460)

464aR-464bR. **Human Physiology** (3-3) GC Basic principles and concepts of physiology applied to humans. P, 104 or 159b; Chem. 241b, 243b. (Identical with M.C.B. 464aR-464bR and Tox. 464aR-464bR)


468R. **Comparative Physiology** (3) GC I The responses of physiological systems to the environment; energy exchanges, respiration, thermal and osmotic regulation, locomotion, behavioral regulation, and integration of responses. P, 102, 104.

468L. **Comparative Physiology Laboratory** (1) GC I Physiological measurement techniques in laboratory and field studies. P, CR 468R.

470. **Plant Diversity and Evolution** (3) GC I Survey of the plant kingdom, with emphasis on comparative structure and evolution of major plant divisions. 2R, 3L. Field trips. P, four units of bio. or pl.s.

472. **Systematic Botany** (4) GC II Evolutionary relationships of orders and families of spermatophytes; systems of classification; collection and identification of local flora. 2R, 6L.

473. **Legumes, Grasses, and Composites** (2) GC I 1986-87 Identification and classification of the three largest flowering plant families of the Southwest. 6L.

475. **Freshwater Algae** (3) GC II 1985-86 Systematics, ecology, and evolution of planktonic and benthic species; field techniques and lab. culture. 2R, 3L. Field trips. P, four units of bio. or pl.s.

476. **Marine Algae** (4) GC II 1986-87 Systematics, ecology, and evolution of marine algae; field collection in marine environments and lab. culture. 2R, 6L. Field trips. P, four units of bio. or pl.s.

477. **Aquatic Plants** (3) GC I Identification, ecology and economic importance of freshwater aquatic plants, as related to fisheries, wildlife management, limnology, plant ecology and aquatic biology. 2R, 3L. Field trips. P, four units of bio. or pl.s.

480. **Invertebrate Zoology** (4) GC I Comparative morphology, physiology, and ecology of invertebrates. 2R, 6L. Field trips. P, 104.

482. **Ichthyology** (4) GC I Ecology, evolution and systematics of fishes, with field and lab. emphasis on Gulf of California and Arizona fishes. 2R, 6L. Weekend field trips. P, 104. (Identical with W.F.Sc. 482)

483. **Herpetology** (4) GC II Systematics, ecology, and evolution of the amphibians and reptiles. 2R, 6L or field work. P, 104.


485. **Mammalogy** (4) GC I Systematics, ecology, and evolution of mammals. 2R, 6L or field work. P, 104. (Identical with W.F.Sc. 485)

487. **Animal Behavior** (3) GC I Concepts and principles of the evolution, development, causation and function of behavior, with emphasis on the adaptiveness of behavior; discussion and films. P, eight units of bio. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
ECONOMICS

488. Sociobiology (2) [Rpt.] GC I Selected topics in animal behavior; survey of recent literature, with emphasis on sociobiological theory. P, 487 or CR.

489. Parasitology (4) GC S Etiology, distribution, symptomatology, pathology, epidemiology, diagnosis, and control of parasites of man and domestic animals, with emphasis on the evolution of parasitism and host-parasite relationships. P, sixteen units of bio. (Identical with V.Sc. 489)


523. Cytogenetics (3) II Investigation into the structure and function of chromosomes and their role in heredity and evolution. 2R, 3L. P, 320.

524. Theoretical Population Genetics (3) I Mathematical theory of modern population genetics developed from first principles, with emphasis on evolutionary implications and the historical development of ideas. P, 320, Math. 223. (Identical with Anth. 524)

525. Speciation (2) [Rpt.] II Mechanisms of evolution in the formation of races and species of animals and plants. P, 320.


540. Advanced Studies in Marine Biology (2) [Rpt.] I Analysis and discussion of current advances in the marine biological sciences.

542. Marine Ecological Research (4) I Distribution and abundance of marine organisms in relation to physical, chemical, and biotic factors of their environments; emphasis on directed, original research problems and preparation of manuscripts for publication. 2R, 3L. Weekend field trips. P, 102.

547. Ecology of Wildlife Reproduction (2) GC II (Identical with W.F.Sc. 547)

580. Selected Studies in Malacology (2 to 4) [Rpt.] II Recent advances in malacology. 2R, 6L. Field trips. P, 480.

584. Selected Studies of Birds (2) [Rpt.] I Recent advances in ornithology. 1R, 3L or field trip. P, 484. (Identical with W.F.Sc. 584)


596. Seminar
   a. Evolutionary Ecology (1 to 2) [Rpt./5] I.
   b. Population Biology (1) [Rpt./6] I II Open to majors only.
   c. Macroevolution (2) [Rpt./4] II.

610a-610b. Research in Ecology and Evolution (2-2) Introduction to the research currently being pursued by faculty and staff in the dept. 6L. 610a : Three-day field trip. Open to majors only.

620. Applications and Techniques of Human Genetics (3) I (Identical with Gene. 620)

670. Recent Advances in Genetics (2) I (Identical with Gene. 670)

ECONOMICS

Professors Edward E. Zajac, Head, Gerald O. Bierwag, Phillip J. Bryson, John E. Buehler, James C. Cox, Helmut J. Frank (Emeritus), Bernard P. Herber, Jimmye S. Hillman (Agricultural Economics), Reka P. Hoff (Law), Philip G. Hudson (Emeritus), Robert H. Marshall, Leahmae McCoy (Emerita), Ronald L. Oaxaca, Kenneth R. Smith, Vernon L. Smith, Lester D. Taylor, Donald A. Wells

Associate Professors Michael K. Block (Management and Policy), Jon B. Christianson (Management and Policy), David A. Conn, John Z. Drabicki, Donald G. Heckerman, R. Mark Isaac, Gary D. Libecap, James C. McBrearty,
The study of economics is designed for those who wish to concentrate in economic analysis to prepare for careers in business, government, teaching, or private research and consulting.

A Bachelor of Arts with a major in economics is available through the College of Arts and Sciences; the degrees of Bachelor of Science in Business Administration with a major in business economics, Master of Arts and Doctor of Philosophy with a major in economics are also offered. The department participates in the Master of Business Administration and the Master of Public Administration degrees as well. Two undergraduate minors are offered: a teaching minor and a general minor for nonbusiness students. The department offers a structured honors program open to nonmajors as well as majors in economics. The program is normally entered in the junior year and consists of four courses: 332H, 361H, 422H, and an elective senior-level course such as 406H, 441H, 460H, 461H, or 481H. Additional information can be obtained by contacting the department.

The major in economics consists of a minimum of thirty units, including 201a-201b or 210, 330, 361, 439 (or M.A.P. 275 and 375, or Math. 461), 332 and twelve additional upper-division units of which at least six units must be selected from 401, 405, 406, 421, 422, 441, 460, 461, 481, 482 and 484. In addition, students contemplating graduate study in economics should take, at a minimum, Math. 125a-125b, Econ. 401 and 422; additional courses in computer science, statistics and mathematics are recommended.

The major in business economics: See the College of Business and Public Administration section of this catalog.

The teaching minor: 24 units, including 201a-201b, 300 or 361, 330, three additional upper-division units in econ. and nine additional upper-division units in another soc. sci.

The nonbusiness minor consists of a minimum of twenty units in econ., including 201a-201b or 210, 300, 330 and other electives needed to meet minor requirements of the student's college.

Honors: The department participates in the Honors Program.

201a-201b. Principles of Economics (3-3) GRD 201a : Nature of economics, price theory for the product market, factor prices, international economics. 201b : Introduction to the theory of national income and employment, money and banking, economic growth and stabilization. P, 1 1/2 units of high school algebra or Math. 116. Both 201a and 201b are offered each semester.

210. Survey of Economic Theory (3) I II Introduction to current economic theory. Not open to students with credit in 201a-201b. P, six units of calc.

217. Resource and Environmental Economics (3) I (Identical with A.Ec. 217)

300.* Microeconomic Analysis for Business Decisions (3) I II GRD Examination of industrial structure; theory of prices under varying market conditions; applications to business problems. Not open to students with credit in 361. P, 201b or 210.

303.* History of Economic Thought (3) I The origins and evolution of contemporary economic doctrines; classical, socialist, Keynesian and neoclassical thought in past and present social contexts. P, 201b or 210.


308.* Economic History of Europe (3) I Europe's economic origins and development; process of industrialization; economic underpinnings of modern Europe. P, 201b or 210.

313.* Economics of Futures Markets (3) I II (Identical with A.Ec. 313)

330.* Money and Banking (3) I II GRD Nature of money and credit; commercial banking; Federal Reserve System; monetary theories; domestic and international monetary policies. P, 201b or 210.

332.* Aggregate Economic Analysis (3) I II Analysis of output, employment, interest rates, and the price level; the effects on these of changes in monetary and fiscal variables. P, 330.

339.* Economic Statistics (3) I II (Identical with A.Ec. 339)

382. *Labor and Public Policy (3) I Economic and legal analysis of the issues and problems arising out of executive, legislative, and judicial efforts to define the rights, duties, and responsibilities of labor and management in the field of industrial relations. P, 201b.


401. *Studies in Microeconomics (3) GC II Studies in microeconomics, such as the economics of imperfect information and uncertainty, externalities and public goods, and imperfect competition. P, 361, Math. 125b.


406. *Introduction to Experimental Economics (3) GC II Lab. experimental studies of economic behavior; applications to monopoly, bilateral bargaining, and competitive markets under various exchange rules; speculation, voting processes, public goods. 2R, 3L. P, 210 or 300 or 361.

409. *Economic Anthropology (3) GC II (Identical with Anth. 409)


412. *Agricultural Economic Development in Latin America (3) GC II (Identical with A.Ec. 412)

421. *Introduction to Mathematical Economics (3) GC I Comparative statics, stability, classical optimization, the Kuhn-Tucker theory, calculus of variations, linear algebra, and game theory, and the application of these techniques in economic analysis. P, six upper-division units in econ.; Math. 125b.

422. *Introduction to Econometrics (3) GC II Statistical methods in estimating and testing economic models; single and simultaneous equation estimation, identification, forecasting, and problems caused by violating classical regression model assumptions. P, 439 or M.A.P. 375.


436. *Economics of Fiscal Federalism (3) GC II Study of the economics of intergovernmental fiscal relationships in a federal system inclusive of allocational, distributional, and aggregate economic effects. P, 435.

441. *International Trade Theory (3) GC II General equilibrium analysis of product and input markets of international trade, tariffs, commercial policy, and growth and the welfare aspects of each. P, 300 or 361.

442. *International Economics (3) GC I Financial aspects of international trade relations and commercial policy. P, 300 or 330.


461. *Economics of Regulated Industries (3) GC II Economic analysis of the regulated sector of the American economy, including communications, transportation and energy industries; impact of existing and alternative public policies. P, 300 or 361.

476. *Natural Resource Economics (3) GC II (Identical with A.Ec. 476)

481. *Economics of Wage Determination (3) GC I Applications of economic theory and empirical methods to labor supply and demand, investment in human capital, minimum wages, union effects on relative wages, and labor market discrimination. P, 300 or 361.

482. *Labor and the Economy (3) GC II Macro aspects of labor economics: unemployment — causes and cures; unemployment and inflation; distribution of income. P, 300 or 361.

483. *Urban Economics (3) GC II Problems of metropolitan areas; evaluation of alternative solutions. P, 201b or 210. (Identical with Bl.S. 483)

484. *Regional Economics (3) GC I Location theory, regional growth, techniques of regional analysis. P, 300 or 361.
DEPARTMENTS AND COURSES OF INSTRUCTION

487. * Health Economics (3) GC II A study of pricing, allocation, and distribution in the health-care industry, with particular emphasis on the economic effects of current governmental policy. P, 201b.

497. * Workshop
   a. Economics Education Workshop (2) GC S Consult instructor before enrolling.
   b. Summer Institute on the American Economy (3) GC S Consult instructor before enrolling.
   c. Economic Issues for Teachers (3) GC S Consult instructor before enrolling.

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

500a-500b. Micro-Macroeconomics (3-3) 500a: Theory of price and its application. P, Math. 117a. 500b: Theory of income, employment, interest rates and the price level. Both 500a and 500b are offered each semester. Advanced degree credit available for nonmajors only. Open only to students admitted to a BPA graduate program.


503. Development of Economic Theory (3) II Development of economic thought from ancient times to the present. P, 300 or 361.

504. Production Economics (3) I (Identical with A.Ec. 504)

511. Microeconomic Theory and Behavior (3) I Microeconomic theory with an emphasis on the use of experimental laboratory and field methods for testing the behavioral implications of the theory. P, Math. 125a, 125b, Econ. 520.

512. International Agricultural Economic Development (3) II (Identical with A.Ec. 512)

513. Agricultural Price and Marketing Analysis (3) II (Identical with A.Ec. 513)

514. Cost-Benefit Analysis (3) II (Identical with A.Ec. 514)


520. Theory of Quantitative Methods in Economics (3) II Introduction to the basic concepts of statistics and their application to the analysis of economic data. P, 421.

522a-522b. Econometrics (3-3) 522a: Least squares estimation, statistical inference in the linear regression model. P, 520. 522b: Simultaneous equation estimation, identification, forecasting with econometric models; Bayesian econometrics.

534. Public Finance (3) I II The study of public fiscal economics, with emphasis on relevant topics for public administration and urban planning grad. students: public goods, tax and nontax revenues, intergovernmental issues, benefit-cost analysis. P, 500a.

553. Business and Economic Forecasting (3) II Forecasting techniques used in business; assembly, interpretation and use of economic data; analysis of business conditions; examination of related environmental factors; construction of actual industry sales forecasts. P, 500b, M.A.P. 552. Advanced degree credit available for nonmajors only.

560. Theory and Institutions in Industrial Organization (3) I II S Major issues in the field of industrial organization. Theoretical issues presented with complementary material dealing with specific American industries. P, 500a.

576a-576b. Advanced Natural Resource Economics (3-3) (Identical with A.Ec. 576a-576b)

597. Workshop

696. Seminar
   a. Experimental Economics (1 to 3) I II 2R, 3L. P, 501b.
   b. Mathematical Economics (1 to 3) I II P, 421, 501b, 502b.
   c. Advanced Microeconomic Theory (1 to 3) I II P, 501b.
   e. Advanced Econometrics (1 to 3) I II P, 522b.
   f. Monetary Economics I (1 to 3) P, 502b.
   g. Monetary Economics II (1 to 3) I II P, 598f.
   h. Labor Economics I (1 to 3) I II P, 501a; or 361 and 421.
   i. Labor Economics II (1 to 3) II P, 501a; or 361 and 421.
   j. Public Sector Economics I (1 to 3) I P, 501a; or 361 and Math. 123.
   k. Public Sector Economics II (1 to 3) II P, 501a; or 361 and Math. 123.
EDUCATIONAL FOUNDATIONS AND ADMINISTRATION

I. International Trade and Finance I (1 to 3) II P, 421; 361 or 501a.

m. International Trade and Finance II (1 to 3) II P, 300, 330, or 361.

n. Economic Growth and Development I (1 to 3) II P, 501a, 502a.

o. Economic Growth and Development II (1 to 3) II P, 501a, 502a.

p. Industrial Organizations I (1 to 3) I P, 501a; or 361 and Math. 123.

q. Industrial Organizations II (1 to 3) II P, 501a; or 361 and Math. 123.

r. Regional and Urban Economics I (1 to 3) I P, 501a; or 361 and Math. 123.

s. Regional and Urban Economics II (1 to 3) II P, 501a; or 361 and Math. 123.

t. Natural Resources and Environmental Economics (3) I P, 501a; or 361 and Math. 123.

u. Economics of Regulated Industries (1 to 3) II P, 501a; or 361 and Math. 123.

EDUCATION OFFICE MANAGEMENT

(See Business and Career Education)

EDUCATIONAL FOUNDATIONS AND ADMINISTRATION


Associate Professors Kenneth F. Gose, Jr. (Acting Head), Lee A. Droegemueller, Stanley Pogrow, Donal M. Sacken, Macario Saldate IV (Director, Mexican American Studies and Research Center)

Assistant Professors Arminda Fuentevilla (Director, Bilingual Programs), Marcello Medina, Jr.

The department offers programs leading to the Master of Arts and Master of Education degrees with majors in bilingual/bicultural education, educational administration, and foundations of education. The Educational Specialist degree is offered with a major in educational administration. The Doctor of Education and Doctor of Philosophy degrees are offered with majors in educational administration and foundations of education. A doctoral program in educational foundations or administration emphasizing bilingual/bicultural education is offered. Students seeking institutional recommendation for Arizona administrative certification must enroll in a graduate degree program. For admission and degree requirements, please see the Graduate Catalog.

The department offers a teaching minor in bilingual/bicultural education for prospective secondary teachers. The minor (18 to 24 units, depending upon major) must include 325, 408, 427, Span. 473, and S.Ed. 338). Spanish Proficiency Test required for Arizona State endorsement in bilingual education.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

226. Introduction to Education and Careers (3) II The educational system in the United States, including higher education and a review of careers in education in addition to the classroom teacher.

325. Foundations of Bilingual Education (3) I Introduction to the theory and practice of bilingual education. (Identical with Elem. 325 and M.A.S. 325)

350. Social Foundations of Education (3) I II Introduction to the cultural and social influences on educational theory and practice.

401. Environmental Education (3) GC I II (Identical with Geos. 401)

403. Study of Exceptional Children (3) GC I II (Identical with Spec. 403)

408. English as a Second Language in Bilingual Education (3) GC I II (Identical with Engl. 408)

411. Public Administration and the Mexican American (3) GC I Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with M.A.P. 411)

429. Pedagogical Linguistics: Applied Linguistics for Language Teachers (3) GC II (Identical with Or.S. 429)

437. Issues in Indian Education (3) GC II An interdisciplinary approach to give school administrators, teachers, students, and laymen insight into the governmental, anthropological, public school, and Indian points of view relating to Indian education. (Identical with A.In.S. 437)

465. Educational Program Management (3) GC I Program planning, management, and evaluation for educationally related positions. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

476. Philosophical Foundations of Education (3) GC II Introduction to philosophy as general educational theory; logic for teachers, major philosophic thinkers, value theory and epistemology.


488. Microcomputer Application in Education (3) GC I II S The microcomputer as the object and medium of instruction and as a management tool in the school setting; special emphasis on advanced programming techniques, Disk Basic, and Disk operating systems. P, 487. (Identical with B.C.Ed. 488, Ed.P. 488, Elem. 488, Li.S. 488, Rdn. 488, Rhb. 488, S.Ed. 488, Spec. 488)

489. Anthropology and Education (3) GC I II The application of anthropological theory and methodology to education. (Identical with Anth. 489)

508. Bilingual Reading (3) I (Identical with Rdn. 508)

540. Issues in Educating Mexican American Children (3) I S The application of social science theory and methodology to the issues of educating American children of Mexican heritage; examination of the research and related literature concerning the goals of education in a pluralistic society, cross-cultural education, and bilingualism.

567. Law for Teachers and Student Personnel Workers (3) I Law in the school and university setting; nature of the legal process; forces behind law and education; law and education as social processes and institutions; legal rights and responsibilities. (Identical with Coun. 567, Elem. 567, S.Ed. 567)

581. Human Relations Training (3) GC II (Identical with Coun. 581)

601. Current Problems in Education (3) I II The problems found in current educational literature, research studies, and school reports.

603. Introduction to Educational Research (3) I II Research techniques in education, interpretation of data and the reporting of results.

604. Educational Administration in Anthropological Perspective (3) I The application of anthropological field techniques and theory to specific educational problems associated with school administration. (Identical with Anth. 604)

605. Social/Cultural Perspectives of School Administration (3) II The use of social science theory and methodology in analyzing school administration problems and solutions.

606. Comparative Education (3) I II Emphasis on comparative education methodology; analysis of selected national education systems, with focus on sociocultural foundations; curriculum and instruction; administration; teacher education; contemporary trends and issues; implications for education in the United States.

607. Pragmatic Philosophies of Education (3) I Intensive analysis of modern philosophies and their relationships to American educational thought; the emergence of the "pragmatic" curriculum.

610. Philosophy of Education (3) I II Analysis of values and conflicts in American culture as these direct educational policy; critical examination of contending philosophies in the light of democratic ideals.

611. History of Western Education (3) I II The historical development of western educational thought from its origins to the present.

612. History of Education in the United States (3) I II The development of American educational thought from its colonial origin to the present.
614. **State School Systems and School Law** (3) II Legal provisions for the government of state school systems; legal basis of local, state and federal relations in education; legal principles relating to pupils, teachers, and school administrators. P, nine grad. units in ed.

615. **Public Relations for Teachers and Administrators** (3) I Nature of the school community: interagency relationships, influence and use of media, public opinion polls, public relations programs.

616. **General School Administration** (3) I Organization structures and purposes through which societal demands for education are met; administrative competencies and skills. (Identical with Spec. 616)

619. **Design of Instructional Media** (3) II (Identical with S.Ed. 619)

620. **Education and the Culturally Diverse** (3) I II Issues in the education of the culturally, socially, and economically diverse.

625. **Educating the Bilingual Learner** (3) I Analysis of theories and practices affecting bilingual learners; historical, social, and cultural influences; relationship of theory to the characteristics and needs of the bilingual learner. (Identical with M.A.S. 625)

647. **The Principalship** (3) I S Functions and activities of building-level administrators, with emphasis on instruction, staff development, student services, evaluation, and operational services. (Identical with Elem. 647 and S.Ed. 647)

648. **The Superintendency** (3) II S Functions and responsibilities of the chief school executive and central office staff, with emphasis on external and internal system relationships in policy formation and decision-making. (Identical with Elem. 648 and S.Ed. 648)

664. **Theory and Behavior in School Administration** (3) II Theory in administration: patterns of theory classifications; relationship of theory to administrative function and organizational dynamics. P, nine grad. units in ed.f.a. (Identical with Spec. 664)

670. **Personnel Administration in Education** (3) I Composition of school staffs and the functions of various personnel; patterns and practices in school personnel management; issues, trends, and prospects in personnel management. P, fifteen grad. units in ed. or CR.

671. **School Finance** (3) I Historical background of the financing of education in the United States; economics and principles; sources and distribution of funds for education; budgeting, accounting, and reports. (Identical with Spec. 671)

672. **School Business Management** (3) I The general management of school business; administration and accounting of school funds; administration of equipment and supplies; other business operations. P, nine grad. units in school admin.

673. **Planning and Maintenance of School Facilities** (3) II Problems in the planning, construction, and maintenance of school facilities; visitation and evaluation of school facilities.

675. **The Law and American Education** (3) I The analysis of educational questions as influenced by legal principles and the case law; effect of legal provisions upon administrative and other educational decisions and upon social policy. (Identical with H.Ed. 675 and Spec. 675)

676. **Supervision of the Instructional Program** (3) II Purposes of instructional supervision: organization, techniques and skills for supervisory competency.

677. **Higher Education and the Law** (3) II (Identical with H.Ed. 677)

680. **Administrative Leadership** (3) I Explores the leadership process in education, including the use of power and authority in relation to existing social, organizational, and behavioral theories. P, fifteen grad. units in ed.f.a.

681. **Educational Program Evaluation Principles and Techniques** (1 to 3) [Rpt./1] I (Identical with Ed. P. 681)

683. **Curriculum Development and Supervision in Reading** (3) I II (Identical with Rdng. 683)

684. **Administration of Bilingual Education Programs** (3) S Dynamics of the administration of educational programs for the bilingual learner including socio-political realities, mandated federal and state funded educational programs and effective community participation. (Identical with M.A.S. 684)
DEPARTMENTS AND COURSES OF INSTRUCTION

695. Colloquium
   a. Theory into Practice (1 to 4) I II
   b. The Administrator and the Organization (1 to 4) I II
   c. The Politics of Decision Making (1 to 4) I II
   f. Computer Applications in Educational Administration (1 to 4) I II
   p. Evaluation (1 to 3) III (Identical with Ed.P. 695p, which is home)
   r. Bilingualism in the United States (3) [Rpt./3] S (Identical with M.A.S. 695r, which is home.)

697. Workshop
   a. Collective Negotiations (1 to 3) I II (Identical with H.Ed. 697a)
   c. Educational Evaluation (1 to 3) [Rpt./1] I II
   d. Leadership and the Mexican-American Educator (1 to 3) [Rpt./1] I II
   n. Problems and Processes in Teacher Appraisal (1 to 3) I II (Identical with S.Ed. 697n)

794. Practicum
   b. Bilingual Education (3) [Rpt./2] P. 15 grad. units incl. 540, 625. Open only to students majoring or concentrating in bilingual ed. (Identical with Elem. 794b and S.Ed. 794b)

796. Seminar
   a. Educational Administration (1) [Rpt./2] I II Open to majors only.
   b. Bilingual Education (3) I

EDUCATIONAL PSYCHOLOGY

Associate Professors Sarah M. Dinham, Joseph D. Gullo, Rosemary A. Rosser

Educational psychology includes the study of psychological processes as applied in educational settings, human learning and development, measurement, research, and statistics in education.

The department offers programs leading to the degrees of Master of Education, Master of Arts, Educational Specialist, and Doctor of Philosophy with a major in educational psychology. Specialist and doctoral programs are available leading to certification as a school psychologist. For admission and degree requirements, please see the Graduate Catalog.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

301. Child Development (3) I II Human growth and development from conception through early adolescence; integration of behavioral principles into the elementary school setting.

302. Adolescent Development (3) I II Concepts of human development from early adolescence through young adulthood; consideration of major influences on physical, cognitive, and social development with emphasis within the school environment.

310. Learning in the Schools (3) I II Psychological principles applied to learning and instructional design in the educational setting, emphasizing learning and instructional variables and their applications.

311. Learning and Development in the Secondary School (3) I II S Psychological and developmental principles relevant to learning in the secondary school setting. Credit is allowed for this course or 310, but not for both. Open to secondary education majors only.

340. Statistics and Measurement for Research in Education (3) I II Basic concepts essential to the comprehension of research in education, including measurement principles and descriptive statistics.

400. Development Throughout Life (3) I II Life span development within the context of physical, intellectual, social, emotional, and moral development; emphasis on the dynamics of personal growth.

414. Mental Health in Education (3) GC I II The principles of mental health, with emphasis on effective personal adjustment in educational settings.

458. Psychological Measurement in Education (3) I II Psychometric methods as applied to the assessment of achievement, mental ability, and attitudes.
487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)
488. Microcomputer Application in Education (3) GCI II S (Identical with Ed.F.A. 488)
500. Life Span Development (3) II Dynamics of development, social integration and roles across
the life span. Special emphasis on cognitive, emotional, and personality development with
concentration on the antecedent events to adult life experiences. (Identical with C.D.F.R. 500)
501. Advanced Child Development (3) I II Aspects of growth and development which influence
behavior of the school age child; emphasis on current research findings. P, 301.
502. Advanced Adolescent Development (3) II Major developmental issues within the adolescent
years; emphasis on the importance and design of adolescent research. (Identical with C.D.F.R.
502)
510. Learning Theory in Education (3) II Major theories of learning and motivation; emphasis on
relationships between theory and practice in the schools.
512. Individual Differences (3) II Psychological, social, and biological factors producing human
517. Classroom Application of Behavior Modification Techniques (3) II Application of behavior
principles and techniques to promote learning and social development of school related behavior.
2R, 3L. P, 510 or CR.
530. School Psychology (3) I Roles of the school psychologist; implementing programs in the public
schools; and legal and ethical issues in school psychology. 2R, 3L.
540. Statistical Methods in Education (3) I II Descriptive, correlational, and inferential procedures
for presenting and analyzing school and research data. For students in all fields.
547. Theories of Human and Family Development (3) I (Identical with C.D.F.R. 547)
558. Educational Tests and Measurements (3) I Theoretical and practical application of psycho-
metric techniques to test construction, analysis, and interpretation of test results. P, 540 or CR.
559. Testing of Minorities (3) II Current theoretical, social, and practical issues in the use of norm-
referenced tests with individuals from minority cultures.
593. Internship
   a. Research and Evaluation (1 to 6) I II
   b. College Teaching (1 to 6) I II
   c. Learning and Development (1 to 6) I II
595. Colloquium
   a. Technology in Instruction (1 to 3) I II
   b. Creativity (1 to 3) I II
   c. Preadolescent Development (1 to 3) I II
597. Workshop
   a. Development of Values (1 to 3) I II
600. Theories of Human Development (3) I History and analysis of psychological theories of human
development and a comprehensive overview of major theoretical systems. P, 500 or 501.
610. Psychological Theory in Educational Practice (3) I Major theories of psychological thought;
strategies for utilizing such theories in educationally relevant research. P, 510.
612. Cognitive Development (3) II Cognitive theory and research as they bear upon developmental
and educational processes. P, 500 or 501.
614. Design of Instruction (3) II Historical and theoretical bases for developing instructional design;
615. Adult Learning and Development (3) I (Identical with H.Ed. 615)
618. Research on Teaching (3) II To acquaint educational researchers with the models, paradigms,
strategies, and empirical research that are the basis for understanding how classroom teaching
and learning are related. P, 510, 540, 558.
619. Design of Instructional Media (3) II (Identical with S.Ed. 619)
638. Behavioral Consultation in Educational Settings (3) I II Principles and techniques of conduct-
ing behavioral consultation in educational settings to promote learning and development of chil-
dren and youth. 2R, 3L. P, 517.
640. Advanced Statistical Methods in Education (3) II Inferential procedures for analyzing educa-
tional data; includes nonparametric methods and introduction to multivariate and causal pro-
646. **Multidimensional Methods in Educational Research** (3) II Provides an understanding of and facility with research application of multivariate correlational techniques, such as multiple regression, discriminant function, canonical correlation, and factory analysis. P, 640.

655. **Evaluating Standardized Tests** (3) I Technical standards for evaluating standardized tests and manuals with emphasis on the contemporary state of the field. P, 540, and 558 or CR.

658. **Theory of Measurement** (3) II Advanced topics in theoretical and practical issues in psychometrics. P, 558; 640 or CR.

661. **Computer Applications in Educational Research** (3) II The practical applications of computers to statistical data analysis. P, 640.


671. **Theories of Intellectual Assessment** (3) I II Various theories and models of human ability and their implications for intellectual assessment. P, 558 or CR.

672a-672b. **Field Experience in Intellectual Assessment in Education** (1-2) Supervised field experience in the administration, scoring and interpretation of various intellectual assessment devices. 672a : Wechsler Adult Intelligence Scale. 672b : Intellectual assessment techniques. 1R, 3L. Open to majors and minors only. Credit allowed for 672a or 672b, but not for both. P, 671 or CR.

673. **Individual Assessment Techniques in the Schools** (3) II Techniques for assessing personality and social behavior; practice in implementing programs derived from assessment techniques. 2R, 3L. Open to majors and minors only. P, 672b.

674. **Psychoeducational Assessment in the Schools** (3) I Psychoeducational assessment techniques; practice in prescribing remedial programs. 2R, 3L. Open to majors and minors only. P, 671, 672b.

681. **Educational Program Evaluation Principles and Techniques** (1 to 3) [Rpt./1] I Development and current viewpoints, political context, illustrative cases, technical skills for determining merit or making decisions about educational and social programs. P, 540, 558, Ed.F.A. 303. (Identical with Ed.F.A. 681)

693. **Internship**
   a. Research and Evaluation (1 to 6) [Rpt./12 units] I II
   b. College Teaching (1 to 6) [Rpt./12 units] I II
   c. Learning and Development (1 to 6) [Rpt./12 units] I II
   d. School Psychology (1 to 6) [Rpt./12 units] I II

694. **Practicum**
   a. Research and Evaluation (3) [Rpt./1] I II
   b. Learning and Development (3) [Rpt./1] I II
   c. School Psychology (3) [Rpt./1] I II

695. **Colloquium**
   a. Cognition (1 to 3) I II
   b. Cross-Cultural Perspectives (1 to 3) I II
   c. Human Development (1 to 3) I II
   d. Instructional Technology (1 to 3) I II
   e. Learning and Development (1 to 3) I II
   g. Motivation for Learning (1 to 3) I II
   h. Personality and Adjustment (1 to 3) I II
   j. School Psychology (1 to 3) I II
   p. Evaluation (1 to 3) I II (Identical with Ed.F.A. 695p)

696. **Seminar**
   a. Research Design and Techniques (1 to 3) [Rpt./2] I II

**ELECTRICAL AND COMPUTER ENGINEERING**

The Department of Electrical and Computer Engineering in the College of Engineering offers the degrees of Bachelor of Science in Electrical Engineering and in Computer Engineering, and Master of Science and Doctor of Philosophy with a major in electrical engineering.

Both undergraduate curricula have the goal of educating immediately productive engineers who are also qualified to pursue further education as necessary to keep pace with these rapidly changing areas. The electrical engineering program prepares students for careers in such areas as electronics, power, communications, control, electromagnetics, and instrumentation. The computer engineering program prepares students for careers in the dynamic and rapidly expanding field of computer technology. (See the College of Engineering section of this catalog for specific undergraduate program requirements.)

For information regarding the clinical engineering option, please see the College of Engineering section of this catalog. For graduate admission and degree requirements, consult the Graduate Catalog.

101. Introduction to Electrical Engineering (3)

107. Elements of Electrical Engineering (3)

108. Elements of Electronics (3)

221. Elementary Circuits and Electronics (3)

271a-271b. Digital Systems and Microprocessors (3-3)

301. Electrical Engineering Laboratory (3)

321a-321b. Electric Circuits (3-3)

351a-351b. Electronics (3-3)

371. Engineering Software Design (3)

372. Computer System Hardware (3)

381. Electric and Magnetic Fields (3)
DEPARTMENTS AND COURSES OF INSTRUCTION

411. Electronic Instrumentation (1 to 3) GC II Individualized instructional units in specific areas: light, temperature, psychometry, reference electrodes, gas analysis, basic electric circuits, signal processing. P, college phys.

415. Medical Instrumentation (3) GC I Basic concepts of instrumentation and measurement; principles of transducers, operational amplifiers and instrument systems, with emphasis on biomedical measurements; lab. experiments with transducers and medical equipment. 2R, 3L. P, sr. engr.

417. Clinical Engineering (3) GC II Activities and responsibilities of clinical engineers; hospital facilities, medical equipment specifications and control, safety, management, health care, and developing and selling new ideas. Field trips. P, 208 or 351 b. (Identical with A.M.E. 417)

418. Physiology for Engineers (4) GC I (Identical with Psio. 418)

419. Physiology Laboratory (2) GC I (Identical with Psio. 419)


426. Modern Filtering and Signal-Processing Techniques (3) GC II Operational amplifier circuits; basic active RC filter design; nonlinear wave shaping; analog switches; A/D and D/A conversion. P, 321b.

428. Digital Signal Processing (3) GC I Discrete-time systems and difference equations; time and frequency analysis, Z-transforms; sampling and data reconstruction; modern design of digital filters. P, 305, 321b, Math. 322.

431. Principles of Communication Systems (3) GC I II Signal analysis techniques associated with modulation and demodulation in systems such as AM, FM, and PCM, with special emphasis on digital communication. P, 321b, 351b.


434. Electrical, Magnetic and Optical Properties of Materials (3) GC I 1986-87 (Identical with M.S.E. 434)

436. Introduction to Coding Techniques (3) GC II Error-correcting codes used in modern digital communications systems, with emphasis on hardware implementations and performance on real channels.

441. Automatic Control (3) GC I II Linear control system representation, analysis, stability and design. P, 305, 321b.

442. Digital Control Systems (3) GC II Modeling, analysis, and design of digital control systems; A/D and D/A conversions, Z-transforms, time and frequency domain representations, stability, microprocessor-based designs. P, 441.

452. Solid-State Device Design (3) GC II Properties of semiconductors, impurity behavior, solid-state effects; the operation of p-n junctions, transistors, photocells, tunnel diodes, surface devices. P, 381.

455. Elementary Digital Circuit Design (3) GC II Emphasis on first-order analysis and design; integrated bipolar digital and MOS logic circuits. P, 351b.

457. Integrated Circuit Technology Laboratory (3) GC I II Theory of and experiments in diffusion, oxidation, etc.; fabrication of an integrated circuit. (Identical with M.S.E. 457)

458. Solid-State Circuits (3) GC I Intermediate level circuitry and devices, with applications ranging from DC to the microwave and optical regions; consideration of discrete and integrated circuits. P, 321b, 351b.

459a-459b. Laser Engineering (3-3) GC I 459a: Introduction to lasers, laser radiation and laser applications. 459b: Quantum elements plus fusion, weapons, holography and space communications P, 351a, 381.

461. Energy Conversion (4) GC I Principles and operating characteristics of rotating machinery and electromagnetic transducers, single-phase and polyphase transformer operation, laboratory demonstrations and tests of transformers and rotating machinery. P, 321b, 381.


465. Current Problems in Energy and Power (1 to 4) [Rpt./1] GC II (Identical with N.E.E. 465)
467. Solar Energy Engineering (3) GC I (Identical with N.E.E. 467)
472. Continuous-System Simulation (3) GC I Interdisciplinary introduction to continuous-system simulation, mainly digital; modeling, state equations, languages, sensitivity and optimization. P, 305. (Identical with C.Sc. 472)
474. Digital Logic Design (3) GC I II Truth-functional calculus, Boolean algebra, map tabular minimization, coding, synthesis of sequential circuits, selected lab. exercises. 3R, 3L. P, 271b or C.Sc. 476. (Identical with C.Sc. 474)
475. Microcomputer-Based Design (3) GC I II Design of microprocessor-based real-time test and control systems, use of development systems and emulators. 2R, 3L. P, 372.
476. Computer Architecture (3) GC I (Identical with C.Sc. 476)
477. Environmental Impact of Energy-Related Systems (3) GC II (Identical with C.E. 477)
478. Data Communications Networks (3) GC I Characteristics of ISO Open Systems Interconnection Reference Model; design of broad band and baseband network interfaces; features of network, transport, session, and presentation layers; Ethernet and IEEE 802 interface. P, 371, 372 or equivalent.
481. Microwave Measurements (3) GC II Measurement techniques and applications of devices used in microwave research. 2R, 3L. P, 381.
482a-482b. Electromagnetic Applications (3-3) GC Special functions, boundary value problems, potential theory, transmission lines and in wave guides, resonant cavities, power flow in propagating waves, antennas and radiation. P, 381 or Phys. 415a.
494. Practicum
495. Colloquium
497. Workshop
501. Linear Systems Theory (3) I Techniques for the analysis of continuous and discrete-time linear systems; state variable representation, time domain and frequency domain methods; Laplace, Fourier, Z-transforms.
502. Analytical Methods in Electrical Engineering (3) I Electrical engineering phenomena in terms of partial differential equations; solutions by Green's functions, eigen function expansions, and transform methods; the special functions, including Bessel and Legendre functions; application to practical analysis problems.
503. Introduction to Statistical Communication Theory, Random Processes, and Noise (3) I Probability, random variables, stochastic processes, and their relation to communications systems analysis; correlation functions and spectra, impulse noise and other simple random wave forms, noisy networks.
504. Optimal Control of Dynamic Systems (3) II 1985-86 (Identical with A.M.E. 504)
505. Modern Control Theory (3) II 1986-87 (Identical with A.M.E. 505)
515. Advanced Medical Instrumentation (3) II Concepts and design of transducers, instrumentation and measurement systems, with emphasis on biomedical technology; research project on lab. computer. 2R, 3L.
521. Network Synthesis (3) I Synthesis of active and passive low-, high-, and band-pass network functions, time and frequency domain approximation, use of optimization techniques, properties of distributed elements.
522. Active RC Filters (3) II Modern techniques for realizing active RC filters, using lumped and distributed elements and operational amplifier gain blocks; determination of sensitivity.
531. Image Processing Laboratory (3) I Introduction to hardware and software used in image processing: image sampling and display systems, principles and applications; image processing software for image enhancement and information extraction; applied problems in natural resources, remote sensing. 3R, 3L. (Identical with Opti. 531)
533. Image Processing: Devices, Systems and Applications (3) II 1985-86 (Identical with Opti. 533)
534. Advanced Electronic, Magnetic and Optical Materials (3) II 1986-87 (Identical with M.S.E. 534)

539. Algebraic Coding Theory (3) II 1985-86 (Identical with Math. 539)


545. Decentralized Control and Large-Scale Systems (3) II Introduction to large-scale systems, definitions and special problems, modeling and model reduction, structural properties, decentralization of control and information, hierarchical and multi-level controllers. P, 501.


552. Linear Circuit Design (3) I Design of discrete and integrated solid-state circuits for small-signal applications; flow graph analysis; DC operational and wide-band amplifier design; power amplifier design.

553. Active Linear Circuit Design (3) II I.F. and R.F. band-pass amplifier design using solid-state devices; stagger-tuned I.F. amplifier and UHF band-pass amplifier design methods; fundamental concepts of design engineering, P, 552.

555. Layout Engineering for Integrated Circuits (3) I Development of layout ground rules; circuit design and layout methods for low sensitivity to parameter variations; use of SPICE and UAMASK programs for circuit simulation and layout. P, 457 or 458.

556. General Physical Electronics (3) I Fundamentals of plasma, solid-state and optical electronics. Specific topics include lasers, thermoelectricity, solid-state and plasma devices.

558. Advanced Integrated Circuits Laboratory (3) II All phases of design and fabrication of a modern integrated circuit are considered and applied in the fabrication from concept to final test. 1R, 6L. P, 457, consult dept. before enrolling.

567. Advanced Solar Engineering (3) II (Identical with N.E.E. 567)

569. Energy Use: Analysis and Management (3) I (Identical with N.E.E. 569)

571. Digital Systems Design (3) I II Computer organization, memory systems, AHPL, control unit design, microprogramming, input-output, computer arithmetic, features of large computers, time sharing. P, computer programming. (Identical with C.Sc. 571)


577. Computer Aided Engineering for Integrated Circuits (3) I II Industrial CAD systems for integrated circuits; programs for process and device simulation; terminal models of bipolar and MOS devices, automated circuit analysis, methods, programs, use of computer graphics. P, 452, 455.

581. Electromagnetic Field Theory (3) I Development and application of electromagnetic field theory in advanced studies; topics chosen to apply to many electrical engineering subdivisions.

583. Remote Sensing Instrumentation and Techniques (3) II Development of instrumentation, measurement and signal processing techniques required for electromagnetic remote sensing applications with emphasis on atmospheric remote sensing. P, 482a or other introductory electromagnetic course.

584. Antenna Theory (3) II 1985-86 Electromagnetic radiation and diffraction; dipoles, slots, open wave guides, and horns; apertures, reflectors, and arrays; mechanical and electronic scanning; applications to practical radar and communications problems. P, 581.

589. Atmospheric Electricity (3) II 1986-87 (Identical with Atmo. 589)

636. Information Theory and Coding (3) II 1986-87 Definition of a measure of information and study of its properties; introduction to channel capacity and error-free communications over noisy
channels; encoding and decoding systems, with emphasis on error correcting and error detecting codes for noisy binary channels. P, 503. (Identical with Math. 636)

639. Methods of Communication and Detection Theory and Signal Extraction (3) II 1985-86 Communication, detection and measurement as statistical decision problems; principles of communication in the presence of noise; discussion of AM, FM, and PCM; matched filter and correlation detection; coherent detection, phase-locked loops. P, 503.

652. Analysis and Design of Semiconductor Junction Devices (3) II 1985-86 Analysis of physical phenomena in semiconductors, including carrier transport, injection, and lifetime, with emphasis on how these phenomena affect design and operation of junction devices. P, 556.


674. Sequential Circuits and Automata (3) I Analysis and synthesis of sequential circuits, partitioning and state assignment, linear sequential circuits, iterative networks, fault test generation and design automation. P, 474. (Identical with C.Sc. 674)


685. Inertial Confinement Controlled Fusion (3) I (Identical with N.E.E. 685)

687. Magnetic Confinement Controlled Fusion (3) II (Identical with N.E.E. 687)


693. Internship c. Clinical Engineering (2 to 3) I II P, enrollment in clinical engr. option.

ELEMENTARY EDUCATION

Professors Edward D. Brown, Head, Joseph Fillerup, Kenneth Goodman, Yetta Goodman, Bill J. Ranniger

Associate Professors Ruth A. Beeker, Vivian E. Cox, Willis Horak, Carol Larson

Assistant Professors Richard Lopez, Alice Paul, Guadalupe Romero

The department sponsors undergraduate programs leading to professional careers in teaching preschool, kindergarten, and all elementary school grade levels. Course work is designed to accommodate students wishing to attain proficiency in alternative programs, such as bilingual education, early childhood education, and Indian education, in addition to general elementary education.

The department offers the Bachelor of Arts in Education, as well as advanced programs leading to the Master of Education, Master of Arts, Master of Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees.

The major for prospective elementary teachers must include Ed.F.A. 350; Ed.P. 301, 310; Elem. 322, 323, 324, 326, 327, 395a, 493a, Li.S. 480, Rdnng. 304, 494.

The major for prospective early childhood teachers must include Ed.F.A. 350; Ed.P. 301, 310; 323, 324, 326, 395a, 376, 377, 379, 493a; Li.S. 480, Rdnng. 304, 494.

The major for prospective bilingual education teachers must include Ed.F.A. 325, 350, 427; Ed.P. 301, 310; Elem. 322, 323, 324, 327, 394, 395a, 493a; Rdnng. 406, 494a.

Elementary education majors must select a subject matter minor. A list of acceptable minors is available in the Department office.

Honors: The department participates in the Honors Program.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

304. Decoding Skills in the Elementary School (2) I II (Identical with Rdnng. 304)

322. Teaching Language Arts in the Elementary School (3) I II The teaching of language arts in the elementary school, with special emphasis on current approaches and organization of methods and materials. P, Ed.P. 301, 310, or CR. Writing-Emphasis Course. P, Satisfaction of the upper-
DEPARTMENTS AND COURSES OF INSTRUCTION

274

division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

323. Teaching Reading in the Elementary School (3) I II The teaching of reading in the elementary school, with special emphasis on current approaches and organization of methods and materials. Other aspects of communicative arts are also included. P, Ed.P. 301, 310, or CR.

324. Teaching Science in the Elementary School (3) I II Basic course in methods of elementary school science instruction, with special emphasis on the skills and structure of science in relation to the processes of inquiry. P, Ed.P. 301, 310, or CR.

325. Foundations of Bilingual Education (3) I (Identical with Ed.F.A. 325)


327. Teaching Social Studies in the Elementary School (3) I II Methods and materials for teaching elementary school social studies. P, Ed.P. 301, 310, or CR.


377. Early Childhood Education (3) I II Curriculum practices in the primary grades. P, Ed.P. 301, 310, or CR.

379. Kindergarten Education (3) I II Growth and learning of 4 to 6 year-old children, and study of programs for children of these ages in creative arts, music, science, mathematics, social studies, and language arts; evaluation of and reporting pupil growth to parents. P, Ed.P. 301, 310, or CR.


403. Study of Exceptional Children (3) GC I II (Identical with Spec. 403)

408. English as a Second Language in Bilingual Education (3) GC I II (Identical with Engl. 408)

417. Media in Instruction (3) GC I II S (Identical with S.Ed. 417)

427. Bilingual/Bicultural Education Curriculum Development (3) GC II (Identical with Ed.F.A. 427)

487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)

488. Microcomputer Application in Education (3) GC I II S (Identical with Ed.F.A. 488)


494. Practicum a. Elementary School Reading (1) I II (Identical with Rdng. 494a, which is home) c. Reading in School Settings (3) I II (Identical with Rdng. 494c, which is home)

497. Workshop g. Creative Arts for Native Americans (3) GC I II j. Elementary Techniques of Mexican Folk Crafts (2) S Offered in Guadalajara only.

526. Methods and Materials in Bilingual Education (3) I II Evaluation and study of methods and materials used in bilingual education programs. (Identical with S.Ed. 526 and Spec. 526)

531. Career Education (3) I (Identical with Coun. 531)

534. Learning Through Play (3) I II S Play theories as they relate to early childhood development, parenting, and curriculum design.

561. History of Children's Literature (3) II (Identical with Li.S. 561)

567. Law for Teachers and Student Personnel Workers (Identical with Ed.F.A. 567)

595. Colloquium c. Language Experiences in Learning (3) II S P, 322. (Identical with S.Ed. 595c)

597. Workshop a. Evaluating the Elementary School (1 to 3) I II S P, Ed.P. 301 or 310. c. Elementary School Science (1 to 3) [Rpt./1] I II S P, Ed.P. 301, 310. e. Newspaper in the Classroom (1 to 3) I II S P, Ed.P. 301 or 310. (Identical with S.Ed. 597e) f. Investigating the Environment (1 to 13) I II S Field trips. (Identical with S.Ed. 597f)
n. Miscue Analysis in Teacher Education (2 to 3) II 1986-87
r. Curriculum for Self Development (3) S (Identical with S.Ed. 597r, which is home)
w. Southern Arizona Writing Project (3-9) [Rpt./12 units] I II S (Identical with S.Ed. 597w, which is home)

613. Teaching of ESL (3) I (Identical with Engl. 613)
616. Coordination of Instructional Media Programs (3) II (Identical with S.Ed. 616)
617. Preparation of Instructional Materials (3) I (Identical with S.Ed. 617)
619. Design of Instructional Media (3) II (Identical with S.Ed. 619)

620. Science Curriculum in the Elementary School (3) I II Trends in the science curriculum of the elementary school, with emphasis on selection of content, concepts and activities, methods of teaching, needed equipment, and community resources. Primarily for in-service, public-school personnel. P, twelve units of elem.

621. Trends and Issues in Early Childhood Education (3) I II S 1986-87 Trends and issues in contemporary early educational programs with emphasis on changing needs in the home, school and society.

623. Constructing the Elementary School Curriculum (3) I II The elementary school curriculum and its relationships; basic theories and techniques of curriculum construction discussed, evaluated and applied. P, twelve units of elem.


625. Developing the Language Arts Curriculum in the Elementary School (3) I II Trends in the language arts curriculum of the elementary school, with emphasis on linguistic theory and its application to the instructional program. P, twelve units of elem.

626. Social Studies Curriculum in the Elementary School (3) I II Trends in the social studies curriculum of the elementary school, with emphasis on selection of content, grade placement of concepts and activities, methods of teaching, needed equipment, and community resources. Primarily for in-service, public-school personnel. P, twelve units of elem.


629. Investigations in Elementary Education (3) I II Critical study and evaluation of the investigations and experimental evidence basic to the aims and instructional practices of the elementary school.

631. Curricular Studies in School Mathematics (3) II 1986-87 (Identical with S.Ed. 631)

632. Math Diagnosis and Remediation (3) II Techniques for identifying mathematical learning difficulties and strengths; strategies for designing systematic instruction for correcting identified difficulties. 3R, 1L. P, 326.

633. Language Acquisition and Development (3) I Study of the development of language in young children, and exploration of instructional techniques to maximize that development.

634. Day Care Education (3) I History, types, goals, environments, planning for adults, standards and licensing requirements, understanding public responsibility of comprehensive child care. Field trips.

635. Applied Linguistics in Education (3) I The application to curriculum, teaching and learning of concepts from linguistics, psycholinguistics and sociolinguistics.

636. Research Methodology in Educational Linguistics (3) II Applied research methodology using insights from linguistics, psycholinguistics, sociolinguistics and information theory; cognitive and linguistic development in school and life. P, 633 or 635.

637. Application of Miscue Analysis (3) II 1985-86 Study of miscue analysis to explore the reading process, reading research, and readability, as well as to evaluate readers; applications to reading strategies and curriculum; focus on comprehension. P, 635. Rdng. 633. (Identical with Rdng. 637)

638. Written Language Development (3) I II S Exploration of the emerging writing and reading behavior of children ages 2-10 and the relationship between oral and written language development through current and original student research. P, 633.

639. Research in Language and Literacy (3) [Rpt./9 units] II New concepts and research on the nature and function of written language. P, master's degree or consult department before enrolling.
640. **Applications of Language and Literacy (3)** [Rpt./9 units] II Contemporary research in language development from pre-school to adult as it relates to school language programs.

644. **Parent Education and Involvement (3)** I II Study of models for parent education; exploration of alternative strategies for improving parent/teacher interactions and parent involvement in the learning process.

647. **The Principalship (3)** I S (Identical with Ed.F.A. 647)

648. **The Superintendency (3)** II S (Identical with Ed.F.A. 648)

695. **Colloquium**
   - b. Early Childhood Education (1 to 4) I II

697. **Workshop:**
   - b. Teacher Self-Appraisal (3) I II S (Identical with S.Ed. 697b, which is home)
   - e. Future Studies: Elementary Curriculum (3) I
   - f. Simulation and Gaming in the Classroom (3) I II S (Identical with S.Ed. 697f, which is home)
   - h. Learning Centers in Elementary School Math (3) S
   - n. Problems and Processes in Teacher Appraisal (1 to 3) I II S (Identical with S.Ed. 697n)
   - s. Creating Classroom Alternatives (3) I II (Identical with S.Ed. 697s, which is home):

723. **Curriculum Theory and Evaluation (3)** I 1986-87 Current theoretical issues of curriculum objectives, design, change and evaluation.

794. **Practicum**
   - b. Bilingual Education (3) [Rpt./2] (Identical with Ed.F.A. 794b, which is home)

795. **Colloquium**
   - a. Elementary Education (1 to 4) I II

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**ENERGY ENGINEERING**

*(See Nuclear and Energy Engineering)*

**ENGINEERING MATHEMATICS**

*(See College of Engineering)*

**ENGINEERING MECHANICS**

*(See Civil Engineering and Engineering Mechanics)*

**ENGINEERING PHYSICS**

*(See College of Engineering)*

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**ENGLISH**


Assistant Professors Carl Berkhout, Dhira Mahoney, Patrick O'Donnell, Duane Roen, Alice M. Senob (Emerita), Leslie Marmon Silko, Carolyn Jan Swearingen, Charlotte Thompson, Thomas Willard, Jean Zukowski/Faust, Lynda Zwinger
Lecturers Edward Abbey, Christopher Carroll, Tom J. Collins, Dorothy N. Fuller, Ruth M. B. Gardner, Evelyn J. Kirmse (Emerita), Gloria I. Morton

The Department of English offers courses in composition, language, literature, and creative writing.

Departmental programs lead to the following degrees: Bachelor of Arts with majors in English and creative writing, Bachelor of Arts in Education with teaching majors in English and extended English, Master of Arts, Master of Education, Master of Fine Arts, and Doctor of Philosophy. For further information regarding the graduate programs, please see the Graduate Catalog.

The major in English for the B.A.: 36 units of upper-division English and American literature, including 370a-370b; one proseminar (496); and one course from each of the following periods: (1) Medieval Literature (426, 427); (2) Renaissance Literature (432, 434a, 434b, 444); (3) Restoration and Eighteenth-Century Literature (446, 450a, 450b, 458a); (4) Nineteenth-Century Literature (458b, 460a-460b, 465, 466); (5) American Literature (482, 483, 484a, 486). Majors are also required to take Hum. 250a as part of their college humanities requirement and to fulfill the college language requirement in a single language.

The supporting minor for majors in English: Recommended subjects are classics, drama, philosophy, modern languages, history and theory of art or of music, journalism, speech, anthropology, government, economics, history, linguistics, psychology, sociology; other subjects as may be individually justified.

The major in creative writing: 36 units, including 209, 210, 370a-370b; three units from 261, 265, 267a-267b, 380; six units from 301, 304, 309; six units from 401, 404, 409, 413, Dram. 460a-460b; nine units of upper division (300 level or above) literature courses in the English Department, to include three units from the following: 473a-473b, 475, 484b, 488b.

The minor in creative writing: 24 units, including 209, 210, 370a-370b; three units from 301, 304, 309; three units from 401, 404, 409, 413, Dram. 460a-460b; three units from 261, 265, 267a-267b, 380; three units from 473a-473b, 475, 484b, 488b.

The teaching major in English (for students who are candidates for a teaching certificate in secondary education): 36 units, including 306, 370a-370b, 380, 405, 406, 410, 411, 412, 496, one course in Shakespeare, and one course in American literature. Engl. 107 and 108 may not be used to satisfy the freshman composition requirement.

The teaching minor in English (for students who are candidates for a teaching certificate in secondary education): 21 units, including 306, 370a or 370b, 380, 405, 406, 410, 411, and one course in American literature. Engl. 107 and 108 may not be used to satisfy the freshman composition requirement.

The teaching major in extended English: In place of one of the minor fields listed under “Program for Secondary Education” in the College of Education section of this catalog, a student may combine the English teaching major listed above with additional courses in clas., dram., Engl., ling., jour., rdng., or sp.c. to make a total of fifty units. One course must be in sp.c.

Courses taken to fulfill the University requirement in freshman composition may not be used as part of any English major or minor. Satisfaction of the freshman composition requirement is prerequisite to all other courses in English.

Students may fulfill the English requirement for graduation by completing one of the following sequences: Engl. 100, 101, and 102; 101 and 102; 103 and 104; for ESL students: 106, 107, and 108. Students are placed in Freshman Composition by scores on the American College Test (ACT) or the Scholastic Aptitude Test (SAT) and a written placement essay.

The Center for English as a Second Language: The center offers an intensive, noncredit program for students who are not native speakers of English. Brochures describing the program are available from the Center for English as a Second Language.

Honors: The department participates in the Honors Program.

100. Freshman Composition (3) I II Exposition, review of syntax and usage.
101. Freshman Composition (3) I II Exposition, emphasis on essays.
102. Freshman Composition (3) I II Critical papers on selected subjects.
103. Freshman Composition (3) I II Exposition for superior students.
104. Freshman Composition (3) I II Critical papers for superior students. P, 103.
106. English Composition for Foreign Students (3) I II Exposition, syntax and usage for ESL students.
107. English Composition for Foreign Students (3) I II Exposition, emphasis on essays, for ESL students.
108. English Composition for Foreign Students (3) I II Exposition, critical papers, for ESL students.

*NOTE: All entering foreign students must take a placement examination given at the beginning of each semester and summer session. See "Admission of Foreign Students" in the Admission to the University section.

207. Sophomore Composition (3) I II Exposition and narration.
209. Introduction to Poetry Writing (3) I II Beginning techniques of poetry writing. P, 102.
260. Major British Writers (3) I II Intensive study of selected works by major British writers.
261. Modern Literature (3) I II Readings in modern fiction, drama, and poetry.
265. Major American Writers (3) I II Intensive study of selected works by major American writers.

267a-267b. World Literature (3-3) 267a: Dramatic literature; great plays of the western literary tradition with emphasis on genre, theme and structure. 267b: Narrative literature; great narrative works of western literary tradition with emphasis on form, theme and culture context.
268. Introduction to the Literature of the Americas (3) I Major literary works and movements throughout the English-, Spanish-, Portuguese-, and French-speaking Americas, in translation.

300a-300b. Literature and Film (3-3) Aesthetic relationships between literature and film. 300a: The art of translating literature into film as aesthetic expression. 300b: The artistic medium of the narrative film. 2R, 3L.
306. Advanced Composition (3) I II Study of rhetorical theory; practice in writing exposition and argument. Writing emphasis course for English education majors.*
308. Technical Writing (3) I II Analysis and presentation of scientific and technical information.

311. Major Themes in the Literature of the Americas (3) [Rpt.] I II Works in translation: civilization from wilderness, making of national culture and authentic language, fall of Big House, time warp.

324. Literature of the Southwest (3) I II The last frontier in fact and fiction, the accounts of early travelers, the development of the "Western story," the regional novel; useful bibliography.

331. Introduction to Shakespeare (3) I II A close reading of six to eight Shakespearian plays, including a comedy, a history, a tragedy, and a tragicomedy.
370a-370b. English Literature (3-3) A survey, with emphasis on major writers in their literary and historical contexts. 370a: From Old English to Renaissance literature. 370b: From Restoration to modern literature. 370a is not prerequisite to 370b. Both 370a and 370b are offered each semester.
371a-371b. American Literature (3-3) A survey with emphasis on writers in their literary and historical contexts. 371a: From the Revolutionary Period to 1900. 371b: From 1900 to the present.
380. Literary Analysis (3) I II Introduction to the various modes, techniques, and terminology of practical criticism.
401. **Advanced Nonfiction Writing (1 to 4) [Rpt./2]** GC I II P, 301. Writing emphasis course for creative writing majors.*

402. **Business Report Writing (3)** GC I II Study and development of written reports in business.

403. **Advanced Scientific Writing (3)** GC I II Preparation of professional literature for publication.

404. **Advanced Fiction Writing (1 to 4) [Rpt./2]** GC I II P, 304. Writing emphasis course for creative writing majors.*

405. **History of the English Language (3)** GC I II The evolution of English sounds, inflections, and vocabulary from earliest times to the present, with attention to historical conditions. (Identical with Ger. 405)

406. **Modern Grammar and Usage (3)** GC I II Current American English structure according to major types of grammar and current American English usage, both with reference to standard British English.


408. **English as a Second Language in Bilingual Education (3)** GC I II Methodology for the teaching of English as a component of bilingual education; grammar, phonology, and syntax as they apply to the teaching of language skills. (Identical with Ed.F.A. 408, Elem. 408 and S.Ed. 408)

409. **Advanced Poetry Writing (1 to 4) [Rpt./2]** GC I II P, 309. Writing emphasis course for creative writing majors.*


411. **Teaching of Literature (3)** GC I II Theory and practice of teaching literature, with intensive study of genres and works commonly taught in secondary schools. P, nine units of lit. (Identical with S.Ed. 411)

412. **Teaching of the English Language (3)** GC I II Theory and practice of teaching various aspects of language in the secondary schools. P, 405, 406. (Identical with S.Ed. 412)

413. **Poetry in Forms (1 to 4)** GC II Explores English prosody through discussing and writing of major forms, research paper. Open to creative writing majors only. P, 309

414. **The Nature of Literature (3)** I What literature is and does, as exposed in theories of writing and in self-conscious literary works.

415. **Women Authors (3)** I Analysis of selected writings by women in the context of the authors’ lives and social milieux. (Identical with W.S. 417)

416. **Women in Literature (3)** I Analysis of the representations of women in selected literary texts. (Identical with W.S. 416)

419a-419b. **The Essay in English (3 - 3)** GC 419a: The essay in English. 419b: Other prose forms. P, Freshman Composition; upper division or graduate standing

420. **Contemporary American Usage (3)** GC I II Consideration of the varieties of contemporary American language usage, social and regional, written and oral. P, upper division or graduate standing.

425a-425b. **The Literature of the Caribbean (3-3)** 425a: I 1985-86 Literature of the Spanish-speaking Caribbean; conducted in Span. 425b: I 1986-87 Literature of the English- and French-speaking Caribbean; conducted in Engl. and Fren. 425a is not prerequisite to 425b. (425a is identical with Span. 425a.)


427. **Chaucer (3)** I II *The Canterbury Tales* and other poems, read in Middle English.

431a-431b. **Shakespeare (3-3)** 431a: Twelve comedies, histories and tragedies from the period 1590-1600 (including Hamlet). 431b: Ten comedies, tragedies and tragicomedies from the period 1601-1613. 431a is not prerequisite to 431b.

432. **Renaissance Drama (3)** II Critical and historical study of Marlowe, Jonson, Middleton, Webster, and other contemporaries of Shakespeare.

434a-434b. **Renaissance Literature (3-3)** 434a: Critical and historical survey of major authors, including More, Skelton, Wyatt, Sidney, and Spenser. 434b: Bacon and Hobbes; Ben Jonson and his Tribe; Donne and the Metaphysicals; Milton.
437. Black Literature in the Americas (3) II 1985-86 A study of the literary works written in the western hemisphere which deal with the African experience in the Americas. (Identical with Bl.S. 437)

438. The Indian in the Literature of the Americas (3) GC II 1986-87 Studies of works by and about Indians published throughout the Americas. (Identical with A.In.S. 438)

439. Women in the Literature of the Americas (3) I 1985-86 A comparative study of woman writers throughout the Americas. (Identical with W.S 439)

440. Literary Genres in the Americas (3) I Intensive study of one of the literary genres — the novel, the short story, poetry, the epic, drama — in the literature of the Americas.


444. Milton (3) I Survey of Milton's English poetry, with emphasis on Paradise Lost.

445. Introduction to TESL: An Overview (2) GC I The development of English as a second language with emphasis on current trends, the influence of linguistic theory, and the international role of English.

446. Restoration Drama (3) I Critical and historical study of major plays from Dryden to Sheridan (1660-1780).

449a -449b. Folklore (3 -3) GC 449a: Forms of Verbal Folklore: myth, legend, folktales, riddle, proverb, jokes, folksong, ballad, etc. 449b: Non-verbal Folklore: custom, belief, folk art and craft, food, medicine, dress, festival, and drama. (Identical with A.In.S. 449a-449b and Anth. 449a-449b)

450a -450b. Literature of Restoration and Eighteenth Century (3 -3) 450a: Survey of Restoration and early 18th-century literature (1660-1745). 450b: Poetry, fiction, drama, and essays from 1745 to 1800.

458a-458b. The English Novel (3-3) 458a: Defoe, Richardson, Fielding, Sterne, Smollett, and Austen. 458b: Scott, the Brontes, Dickens, Thackeray, Eliot, Trollope, and Hardy.

460a-460b. Romantic Literature (3-3) 460a: Wordsworth, Coleridge, Keats, and essayists. 460b: Blake, Byron, Shelley, and essayists. 460a is not prerequisite to 460b.

461. Linguistics and the Study of Literature (3) GC II 1986-87 (Identical with Ling. 461)

465. Victorian Literature (3) I Major poetry and nonfictional prose.

466. Themes in Victorian Literature (3) II The impact of science, the sexual revolution, art and ecology, and the Romantic heritage.

468. Literature of the Irish Renaissance (3) II Irish writers of the 19th and early 20th centuries: Yeats, Synge, O'Casey, Lady Gregory, AE, Stephens, and others.

469a-469b. Germanic Folklore: An Introduction to Nonliterary Forms (3-3) GC (Identical with Ger. 469a-469b)

472. Modern Fiction (3) I American, British, and Continental fiction, with particular attention to the development of characteristically modern techniques.

473a-473b. Modern British Literature (3-3) 473a: Development of British fiction from the late 19th century to the present. 473b: Development of British poetry from the turn of the century to the present.

475. Modern Continental Drama (3) I The development of Continental drama from 1875 to the present; Ibsen, Chekhov, Strindberg, Brecht, Pirandello, Giraudoux, Anouilh, Beckett, Ionesco, and other playwrights.


482. American Romanticism (3) II Prose and poetry by Hawthorne, Poe, Emerson, Whitman, Thoreau, and Melville.

483. American Realism (3) I The development of realism and naturalism in American literature; Twain, James, Crane, Dreiser, and other writers.

484a-484b. The American Novel (3-3) 484a: The nineteenth century — Hawthorne, Melville, Twain, and others. 484b: The twentieth century — James, Fitzgerald, Faulkner, and others.
485. Modern British and American Drama (3) II The development of drama in English from 1900 to the present; Shaw, O’Casey, Beckett, Osborne, Pinter, O’Neill, Wilder, Miller, Williams, Albee, and other playwrights.

486. Themes in American Literature (3) [Rpt./2] I II Analysis of such literature themes as the frontier, the American Adam, American humor, self and society.

487. Major American Author (3) I II A consideration of the major works of one author, including such authors as Hawthorne, Melville, James, and Faulkner.


495. Colloquium
Ha. Honors for Juniors (3) II
Hb. Honors for Seniors (3) I II

496. Proseminar
a. Studies in a Literary Period (3) I II
b. Literary Themes (3) I II
c. Literary Genres (3) I II
d. Major Authors (3) [Rpt./9 units] I II S
e. Comparative Literature (3) [Rpt./9 units] I II S
f. Literature and Other Disciplines (3) [Rpt./9 units] I II S

NOTE: Proseminars serve as writing emphasis courses for literature majors.*

515a-515b. History of Criticism (3-3) 515a: Plato through the 19th century. 515b: Modern criticism.

516a-516b. Theories of Linguistic Structure (3-3) 516a: The American tradition in linguistics. 516b: The European tradition in linguistics. 516a is not prerequisite to 516b.

520a-520b. History of the German Language (3-3) (Identical with Ger. 520a-520b)

525. Beowulf (3) II (Identical with Ger. 525)

526. Advanced Studies in Chaucer (3) II


531. Advanced Studies in Shakespeare (3) II

533. Studies in the Renaissance (3) I

534. Advanced Studies in Milton (3) I

541. Studies in the Restoration and Eighteenth Century (3) II


561. History of Children’s Literature (3) II (Identical with Li.S. 561)


591. Preceptorship
a. Methodology of Essay Writing (1) I II Designed for graduate teaching assistants in English.
b. Methodology in Critical Reading and Writing (1) I II Designed for graduate teaching assistants in English.

595. Colloquium
a. Rhetoric of Exposition (1) I II Designed for graduate teaching assistants in English.
b. Rhetoric of Literature and Critical Writing (1) I II Designed for graduate teaching assistants in English.

596. Seminar
a. Medieval Literature (3) [Rpt.] I II
b. Renaissance Literature (3) [Rpt.] I II
c. Restoration and Eighteenth-Century Literature (3) [Rpt.] I II
d. Nineteenth-Century British Literature (3) [Rpt.] I II
e. Twentieth-Century British Literature (3) [Rpt.] I II
DEPARTMENTS AND COURSES OF INSTRUCTION

f. American Literature (3) [Rpt.] I II

g. Comparative Literature (3) [Rpt.] I II

h. Modern Literature (3) [Rpt.] I II Open to creative writing majors only.

i. Germanic Linguistics (3) [Rpt.] I II (Identical with Ger. 596i)

j. Linguistics for ESL (3) [Rpt.] I II

k. Methods and Materials of Literary Research (3) [Rpt.] I II

l. Theories of Criticism (3) [Rpt.] I II

m. Studies in the Oral Tradition (3) [Rpt./9 units] I II (Identical with A.In.S. 596m)

597. Workshop

o. The Teaching of English (3) I II S [Rpt.] (Identical with S.Ed. 597o)

w. Southern Arizona Writing Project (3-9) [Rpt./12 units] I II S (Identical with S.Ed. 597w, which is home)

604. Writing Project in Fiction (1 to 6) [Rpt.] I II For M.F.A. candidates working on the book-length writing project in fiction.

609. Writing Project in Poetry (1 to 6) [Rpt.] I II For M.F.A. candidates working on the book-length writing project in poetry.

612. English Grammar for ESL (3) I Problems analysis of ESL: remedial ESL composition. (Identical with S.Ed. 612)

613. Teaching of ESL (3) I Basic approaches to the teaching of English as a second language, with emphasis on the aural-oral method. P, 612 or CR. (Identical with Elem. 613 and S.Ed. 613)

693. Internship


696. Seminar

b. Linguistics (2 to 4) I II (Identical with Ger. 696b, which is home)

c. Folklore (2 to 4) I II (Identical with Ger. 696c, which is home)

* Writing-Emphasis Courses. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

ENTOMOLOGY

Professors William S. Bowers, Head, Paul D. Gerhardt (Emeritus), Harry H. Graham (Adjunct), Roger T. Huber, Leon Moore, William L. Nutting, Donald M. Tuttle (Emeritus), George W. Ware, Theo F. Watson, Floyd G. Werner

Associate Professors Norbert M. Kauffeld (Adjunct), Dave T. Langston (Adjunct), Robert L. Smith, Gordon D. Waller (Adjunct)

Assistant Professors David N. Byrne, Allen C. Cohen (Adjunct), L. Irene Terry

The Department of Entomology provides basic training for students planning to become professional entomologists or a more general background for those specializing in related fields, such as plant protection. Career opportunities in entomology include teaching, research and technical positions with colleges and universities, experiment stations, governmental agencies, military services and private and industrial organizations.

Undergraduate studies lead to the Bachelor of Science in Agriculture degree under the agriculture, agricultural business, or agricultural sciences curriculum. The department also offers opportunities for study toward the degrees of Master of Science and Doctor of Philosophy. For graduate admission and degree requirements, consult the Graduate Catalog.

Agriculture curriculum: Minimum of sixteen units in ento. selected in consultation with the student's adviser. A pest management specialization may be selected.

Agricultural business curriculum: Minimum of sixteen units in ento., including the following suggested courses selected in consultation with the student's adviser: 201R; Pl.S. 100; Ecol. 104; Chem. 103a-103b, 104a-104b; three units of phys.

Agricultural sciences curriculum: Minimum of sixteen units in ento., including the following suggested courses selected in consultation with the student's adviser: 201R, 404, 407; Ecol. 104, Pl.S. 100; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; three units each of phys., ecol., and gene.

151. Insects and Man (3) I Introduction to the biology, ecology, and management of insects affecting man and his interests. Intended for non-majors. Huber
201R. Fundamentals of Entomology (3) II Insects and other land arthropods, their functional anatomy, perception of the environment, relationship to plants and other animals, and importance to man. Classification to orders and most important families. Werner

201L. Fundamentals of Entomology Laboratory (1) II Classification of insects and other land arthropods to the level of families, with emphasis on recognition; collection. Field trips. P, 151 or CR 201R.

214. The Honey Bee (2) II Biology and social behavior, pollination, ecology, and management. Kaufeld/Waller


402. Introduction to Pesticides and Their Use (2) GC II (Identical with P.I.P. 402)

403R. Biology of Animal Parasites (3) GC I (Identical with V.Sc. 403R)

404. Insect Morphology (4) GC I 1986-87 External and internal anatomy as related to identification, function and phylogeny of insects and other arthropods; modifications in development and habits peculiar to the insects. 2R, 6L. P, three units of ento. or invertebrate zoo. Nutting

407. Insect Physiology (4) GC II 1986-87 Principles of the physiological systems of insects and lab. methods for their study, with emphasis on the functioning of these systems in the environment. 2R, 6L. P, three units of organic or bioc.

410. Introduction to Insect Crop Pests (1) GC I Biology, recognition and control of arthropod pests of Arizona's principal agricultural crops. 1R, 3L. Field trips. P, 151 or 201R. Byrne

412. Cultural Control and Host Plant Resistance (1) GC I Analysis of cultural practices used for insect management in crop systems. Principles of insect-plant relationships pertaining to resistance in crop plants, and the methods used to develop resistant crop varieties. 2R. P, one unit in entomology. Terry.

414. Insect Biometeorology (1) GC I Effects of meteorological factors on insect populations, with emphasis on the development and use of phenological heat unit models for population prediction. 2R. P, one unit in entomology. Huber

416. Biological Control (2) GC II Principles of the biological control of arthropod pests, with emphasis on their application to agricultural entomology. 2R. P, 434 or a course in population ecology. Watson

418. Insect Vectors of Plant Pathogens (1) GC II Examination of the relationships between insect vectors, plant pathogens, and host crops. 2R. P, one unit in entomology. Byrne

420. Urban Entomology (3) GC II 1985-86 Biology of insects, other arthropods and vertebrates, beneficial and pestiferous, that impact humans in the urban ecosystem. Identification of species and management of pests. 2R, 3L. Field trips. Smith

422. Insect Population Sampling (1) GC I Development of sampling methods for both research purposes and pest management decision making. Comparison of the efficiency of sampling methods and programs for sampling data analysis. 1R, 3L. Field trips. P, three units of stat. Terry

424. Biorational In Crop Protection (1) GC I History, current status and methods of use of pheromones and microbial insecticides in crop protection. 2R. P, one unit in entomology. Huber

430. Chemical Control (1) GC I Examination of the history, methods, externalities and benefits of the use of insecticides and acaricides. 2R. P, one unit in entomology. Byrne

432. Horticultural Crops Insect Pest Management (1) GC I Analysis of methods used to manage arthropod pests of fruit, nut, grape, and vegetable crops. 2R. P, 410. Huber

434. Insect Population Dynamics (1) GC II Emphasis on the evaluation of natural regulating mechanisms of agriculturally important insect populations. 2R. P, 422. Huber

436. Field Crops Insect Pest Management (1) GC II Analysis of methods used to manage arthropod pests of field crops, including the biological basis, economics and problems associated with various strategies. Emphasis on Arizona crops. 2R. P, 410. Terry


508. Insecticide Toxicology (3) II 1985-86 Insecticides and related chemicals; their modes of action, detoxication, resistance in arthropods, and environmental distribution and effects. P, three units of organic or bioc. (Identical with Tox. 508)
512. Insect Behavior (3) II 1985-86 The physiological basis of insect behavior, with examples and methods of study of the diverse types of behavior exhibited by insects and other land arthropods. Nutting

516. Applied Insect Taxonomy (4) I 1985-86 Principles and methods in the classification of animals. Practice in developing practical classifications of insects that are of significance to crop protection in local areas. Classification of immature stages of terrestrial insects. 3R, 3L. Field trips. Werner

576. Environmental Toxicology (3) I (Identical with Tox. 576)

696. Seminar a. Entomology (1) [Rpt./6] I II

ENVIRONMENT AND BEHAVIOR

Committee on Environment and Behavior (Graduate)

Professors Robert Bechtel, Chairperson (Psychology), Charles Albanese (Architecture), Warren Anderson (Art), Terry Daniel (Psychology), William Havens (Renewable Natural Resources), Helen Ingram (Political Science), William Ittelson (Psychology), David King (Renewable Natural Resources), Kirby Lockard (Architecture), Thomas F. Saarinen (Geography), Lawrence Wheeler (Psychology), Ervin H. Zube (Renewable Natural Resources)

Associate Professors Dennis Doxtater (Architecture), William Shaw (Renewable Natural Resources)

Assistant Professors Robert Itami (Renewable Natural Resources), Chet Ross (Family and Consumer Resources)

The Committee on Environment and Behavior functions to coordinate and further develop study of the relationship between physical settings and human activities. This multidisciplinary group of teachers and researchers will assist students in the integration of such specialization into their chosen fields. Undergraduate students interested in combining an environment and behavior emphasis into majors such as psychology, architecture, landscape architecture, interior design, geography, renewable natural resources, political science, and water resources administration should consult their department advisers and appropriate members of the Committee on Environment and Behavior.

While the Committee does not offer any degrees at present, it does offer a doctoral minor (see the Graduate Catalog). Environment and behavior may serve as a possible Subject Area III for the undergraduate General Studies major in the College of Arts and Sciences. See an adviser in the College for current status.

Current information on studies in environment and behavior can be obtained from the Chairperson, Committee on Environment and Behavior, Department of Psychology. Courses identified as having content which deals specifically with environment and behavior include: Arch. 287, 429, 474, 497l; Art. 434; Geog. 275, 360, 407, 561, 563; Idis. 596u, L.Ar. 533, 595a; N.R.R. 470; Pol. 481; Psyc. 371, 428, 521a-521b; R.N.R. 595c.

ETHNIC STUDIES

(See American Indian Studies, Black Studies, and Mexican American Studies)

EXERCISE AND SPORT SCIENCES

Professors Charles M. Tipton, Head, Anne E. Atwater, Timothy G. Lohman, Donna Mae Miller, Frederick B. Roby, Mary P. Roby, David H. Strack, Jack H. Wilmore


Assistant Professors Victor A. Convertino, Roger M. Enoka, Roy A. Tatum, Ruth E. Wynn

Lecturers James M. Clemons, Gwen A. Hyatt, Judy A. Sorensen, Ronald A. Sutherland

Instructor Marvin Schierbeek
The Department of Exercise and Sport Sciences is concerned with advancing the body of knowledge in the exercise and sport sciences and preparing professionals for careers in teaching, coaching, research, and applied exercise science. The department participates with the College of Education in programs leading to the Bachelor of Science in Education degree with a teaching major in physical education for the secondary-school level or for K-12 certification. Undergraduate minors are available in athletic coaching and physical education. Exercise and sport sciences may be taken as a major for the Master of Science degree and the Master of Arts degree. For admission and degree requirements for the graduate programs, please see the Graduate Catalog.

The physical education teaching major (secondary emphasis): 276, 279, 285, 286 (one unit), 288, 354 (two units); an additional two units from 260, 354, 357 or professional activities; 370, 371, 373, 374, 377, 380, 381, 388, 394b; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of a minimum of ten courses and fifteen units from the following professional activity courses: 208, 210, 211, 213, 214, 217, 218, 219, 221, 223, 224, 225, 226, 227, 229, 230, 231, 232, 233.

The physical education teaching major (K-12 emphasis): 261, 276, 279, 285, 286 (one unit), 288, 294a, 352, 354 (two units); an additional two units from 260, 354, 357 or professional activities; 358, 370, 371, 373, 374, 377, 380, 381, 388, 394b, 486; Elem. 493a; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of the following professional activity courses: 213, 217, 221, 223, 225, 227, 231, 232; and two additional courses from 208, 210, 211, 214, 218, 219, 224, 226, 229, 230, 233.

The athletic coaching minor (not available to physical education majors): 276, 370, 373, 374, 377, 394a; four units from 385, 386, 408, 485; six units from 286 and 354, to include a minimum of four units in 354.

The physical education teaching minor: 261 or 377; 285, 288, 370, 371, 373, 374, 380, 381; Ecol. 159a-159b. Departmental skills requirement must be satisfied through proficiency examination or completion of a minimum of eight courses and twelve units from the following professional activity courses: 208, 210, 211, 213, 214, 217, 218, 219, 221, 223, 224, 225, 226, 227, 229, 230, 231, 232, 233.

ACTIVITY COURSES

Courses without an “a”, “b”, “c”, or “d” designation are considered to be beginning-level courses.

Students who have completed a beginning-level course, but who do not meet the intermediate prerequisites may repeat the beginning course for credit. Intermediate- and advanced-level courses may be repeated once for credit.

The department offers a free locker for students registered in activity courses. Failure to return the lock will result in a financial encumbrance.

100. Adapted Physical Activities (1) I II
103. Aerobic Dance (1) I II S
    a. Beginning Aerobic Dance
106. Aquatic Sports-Water Polo (1) I II
107. Archery (1) I II
109. Backpacking (1) I II S Two-day field trip.
110. Badminton (1) I II
    a. Beginning Badminton
    c. Intermediate Badminton
114. Basketball (1) I II
    a. Beginning Basketball
    c. Intermediate Basketball
116. Body Dynamics (1) I II S
118. Bowling (1) I II
    a. Beginning Bowling
    c. Intermediate Bowling
123. **Country Swing** (1) I II
125. **Cycling** (1) I II
128. **Diving** (1) I II

132. **Fencing** (1) I II
   a. Beginning Fencing
   c. Intermediate Fencing
   d. Advanced Fencing

135. **Folk Dance** (1) I II
   a. Beginning Folk Dance
   c. Intermediate Folk Dance

137. **Golf** (1) I II S
   a. Beginning Golf
   c. Intermediate Golf
   d. Advanced Golf

138. **Gymnastics** (1) I II
   a. Beginning Gymnastics
   c. Intermediate Gymnastics

140. **Handball** (1) I II
141. **Hiking** (1) I II S Field trips.
145. **Jogging** (1) I II S
146. **Judo** (1) I II S

148. **Karate** (1) I II S
   a. Beginning Karate
   c. Intermediate Karate P, 148a
   d. Advanced Karate P, 148c

150. **Lifesaving** (1) I II S P, 169d.
155. **Orienteering** (1) I II S
157. **Personal Defense** (1) I II S

159. **Racketball** (1) I II S
   a. Beginning Racketball
   c. Intermediate Racketball
   d. Advanced Raquetball P, 159c

164. **Soccer-Speedball-Speed-A-Way** (1) I II
   a. Beginning Soccer-Speedball-Speed-A-Way

165. **Social Dance** (1) I II
166. **Softball** (1) I II
   a. Beginning Softball
   c. Intermediate Softball

169. **Swimming** (1) I II S
   a. Beginning Swimming
   b. Swimming for Beginners with Limited Experience
   c. Intermediate Swimming
   d. Advanced Swimming

170. **Swimming for Fitness** (1) I II S P, 169c.
171. **Synchronized Swimming** (1) I II P, 169b.

173. **Tennis** (1) I II S
   a. Beginning Tennis
   b. Tennis for Beginners with Limited Experience
   c. Intermediate Tennis
   d. Advanced Tennis

176. **Touch Football** (1) I II
178. **Track and Field** (1) I II

179. **Tumbling and Trampoline** (1) I II
   c. Intermediate Tumbling and Trampoline
181. Volleyball (1) I II S
   a. Beginning Volleyball
   c. Intermediate Volleyball
   d. Advanced Volleyball

183. Weight Control (1) I II P, for students who are a minimum of 20% overweight.

184. Weight Training (1) I II S

185. Wrestling (1) I II

187. Yoga for Health and Fitness (1) I II S

189. Foundations of Physical Fitness (2) I II

PROFESSIONAL ACTIVITY COURSES

Open to physical education majors and minors only.

208. Aerobic Dance Fitness (1) I II#

210. Archery (1) I #

211. Badminton (1) I II#

213. Basketball (2) I III#*

214. Fencing (2) II#

217. Folk Dance (1) I II#

218. Football (1) I III#*

219. Golf (1) III#*

221. Women's Gymnastics (2) I#

223. Handball-Racketball (1) I III#

224. Modern Dance (1) I #

225. Soccer-Speedball-Speed-A-Way (2) I III#

226. Social Dance (1) II#

227. Softball (1) I III#*

229. Swimming-Lifesaving (2) I III#*

#Development of knowledge and skill competencies necessary for teaching each activity, with emphasis on
skill progressions, practice opportunities, and error diagnosis and correction.

260. Water Safety Instructor (2) I II American Red Cross Water Safety Instructor Certificate will be
   issued to those students qualifying. P, current advanced lifesaving certificate.

261. Advanced First Aid and Emergency Care (2) I II Instruction in first-aid and emergency care
   procedures. The American Red Cross Advanced First Aid and Emergency Care Certificate will be
   awarded to those students qualifying.

276. Designed Exercise Programs (2) I II Instruction and practice in various types of formal exercise
   programs. Munroe/Simko

279. Motor Development (2) I II Developmental changes in motor patterns of children and adults;
   methods of diagnostic evaluation of motor skill performance and the selection of appropriate
   movement experiences.
285. Principles of Teaching Physical Activities (3) I II General principles and practical experiences related to analysis of movement skills, correction of movement errors, and preinstructional planning applied specifically to teaching physical activities.

286. Sports Officiating (1) I II Guiding principles and standards; rules, mechanics and procedures for officiating sports common to secondary school interscholastic and community club programs. Consult department before enrolling.
   a. Basketball (Men and Women's Rules) II
   b. Baseball-Softball I
   c. Women's Gymnastics I 1985-86
   d. Football II
   e. Soccer I
   f. Volleyball II

288. History of Sport and Physical Education (2) I II Development of physical education from ancient societies through the 20th century; its influence on current practices.

294. Practicum

322. Dynamics of Recreation Group Management (3) I Knowledge, skills and techniques necessary to provide creative and effective leadership in a variety of recreation service delivery systems.

325. Recreation and Special Populations (3) II Disabilities and needs of the handicapped and their implications for the development and management of recreation services and resources.

328. Recreation Delivery Systems (3) I Historical and philosophical perspectives of the recreation profession in the United States; an overview of the settings and agencies in which recreation and park professionals are employed.

351. Elementary School Physical Education (3) I II Purposes and practices of physical education at the elementary school level; instruction in recommended activities; teaching and evaluation techniques; class organization.


354. Theory of Coaching (2) I II Advanced instruction in sports common to secondary school curricula; teaching and coaching principles, advanced techniques, and organizational and practice methods.
   a. Aquatics (2) II 1986-87 P, 169d, 229 or 285 (not required for athletic coaching minor).
   b. Baseball (2) II P, 285 (not required for athletic coaching minor).
   d. Football (2) II P, 218, 285 (not required for athletic coaching minor).
   g. Tennis (2) II 1985-86 P, 230, 285 (not required for athletic coaching minor).
   h. Track and Field/Cross Country (2) II P, 231, 285 (not required for athletic coaching minor).
   i. Volleyball (2) II P, 232, 285 (not required for athletic coaching minor).

357. Methods of Teaching Dance (2) II 1985-86 Instruction and practice in the various methods of teaching dance at the high school level. P, 135a or 217, 224, 285.

358. Dance for Children (2) I 1986-87 Basic methods, materials and activities for teaching dance to children.

370. Kinesiology (3) I II Neuromechanical bases of human movement. P. Ecol. 159a-159b. Enoka

371. Special Physical Education (3) I II Designed to provide the knowledge and experience necessary for the physical education and recreation of persons having various handicaps. Three hours per week of related experiences by arrangement required. P. Ecol. 159a-159b.

373. Exercise Physiology (2) I II Study of various physiological and environmental factors which affect the performance of exercise and sport during acute exercise and the physiological adaptations to chronic exercise. P. Ecol. 159a-159b. Roby/Tipton

374. Exercise Physiology Laboratory (1) I II P, CR 373. Roby

377. Techniques in Prevention and Treatment of Athletic Injuries (3) I II Prevention, treatment, and rehabilitation of athletic injuries; practical experience in application of preventive taping and bandaging. P, Ecol. 159a-159b. Deiforge
380. Scientific Foundations of Motor Learning (3) I II Introductory investigation of the nature of motor skill learning, including topics such as learning theory, neural basis, models of motor skill acquisition and factors which affect motor performance and learning. P, 370, Psyc. 101. Russell

381. Measurement and Evaluation (3) I II Tests and measurements in physical education; data analysis techniques for test evaluation, test construction, and grading; experience with tests of fitness, sport skills, and sociometric measurements. Munroe

383. Governance and Fiscal Aspects of Amateur Athletics (3) I II Examination of the structure, function, and fiscal aspects of organizations which govern amateur athletics in the U.S.A.

385. Principles and Problems of Athletic Coaching (2) II Examination of the duties, ethics and responsibilities of a coach; application of principles from psychology, sociology and other related fields; discussion of typical problems that confront the coach. Baker

386. Administration of Interscholastic Athletics (2) I Role of athletics in secondary education, with emphasis on administrative philosophy, staff relations, business procedures, facilities, and the conduct of athletic events. Baker

388. Administration of Physical Education Programs (3) I II Principles and practices characteristic of programs of physical education; organizational models and theories, curriculum development, contemporary economics, innovations and issues. Baker/Miller

393. Internship
a. Junior Field Work in Recreation (1) [Rpt./1] I II S
b. Fitness Programs (2 to 3) [Rpt./1] I II P, 373, 374, 394d.

394. Practicum
a. Athletic Coaching (3) I II
b. Physical Education Teaching Techniques on the College Level (1) I II
c. Exercise Leader (2) [Rpt./2] I II S 1R, 8L P, 276, Ecol. 159a.
d. Exercise Technician (2) [Rpt./2] I II S 1R, 8L P, 373, 374, 394d.

408. Mechanics of Sports (3) I II (Identical with Phys. 408)

422. Aging and Leisure (3) GC I Investigation of psychological, sociological and physiological characteristics of aging populations; exploration of services for the aging; and analysis of problems and opportunities related to leisure and recreation. Advanced degree credit available for nonmajors only.

425. Administration of Recreation (3) I II Basic administrative functions and practices as they relate to various recreation delivery systems. (Identical with N.R.R. 425)

426. Recreation Programming (3) I II S Principles, policies and procedures utilized in the planning and conducting of recreation programs and services in a variety of recreation delivery systems.


485. Sport in Contemporary Society (3) GC I Study of contemporary sport from the perspectives of its personal, social, cultural, economic and educational dimensions. Miller


493. Internship
a. Senior Recreation Administration Field Work (2) [Rpt./1] I II S P, 328.

496. Proseminar
b. Analysis of Data in Human Motion Studies (1) GC I II Atwater

497. Workshop
a. Sports Injuries (1 to 3) I II
b. Folk Dance (1 to 3) I II

515. Philosophy of Physical Education and Sport (3) I Designed to help the student examine philosophic foundations, to explore the philosophic process, and to analyze, formulate, and apply principles as guides to action. P, twelve upper-division units of ex.s.s. Miller

520. Biomechanics of Human Movement (3) I Analysis of human motion focusing on the mechanical interaction between the human body and the external environment. 2R, 3L. P, 370, Ecol. 159a-159b, twelve upper-division units of ex.s.s. Atwater

525. Motor Learning and Human Performance (3) I Neuropsychological approach to the study of motor skill acquisition and learning variables affecting human potential for physical performance. Fairchild
526. **Neural and Perceptual Foundations of Motor Learning and Performance (3)** I Examines the neural basis of motor behavior and the role and influence of perceptual modalities in motor learning and sports performance; topics include sensory coding, perceptual processing and motor control. *Russell*

527. **Psychological and Social Parameters Affecting Sports Performance (3)** I Examines the effects of motivation, personality, aggression, anxiety and anxiety management techniques, attitudes, competition and social influence processes on sport performance and the influence of physical activity/fitness on psychological well-being. *Williams*

528. **Stress Management for Performance and Health (3)** I Study of practical experiences in stress management strategies for optimizing performance and coping with selected stress-related health disorders. *Williams*


535. **Issues and Trends in Physical Education and Sport (3)** I Designed to aid the student in identifying, analyzing, and evaluating recent developments and basic issues in physical education and sport. *P, twelve upper-division units of ex.s.s. Miller*

536. **Administration of Sports Programs (3)** I Designed to provide a theoretical framework for students pursuing sports management careers and others interested in various functions involved in the conduct of sport programs. *Miller*

545. **Evaluation and Regulation of Body Build and Composition (3)** I Laboratory and field assessment of body fat, lean body mass and somatotype; anthropometry; body build and composition of the athlete; morphology of fat and lean tissue; exercise and dietary regulation of obesity and chronic underweight. *P, 373, 374, Math. 117e. Wilmore*

550. **Advanced Exercise Physiology Laboratory (3)** I Experiments designed to demonstrate basic concepts of physiological responses to exercise with emphasis on development of skills in laboratory instrumentation and techniques of research. *Convertino/Roby/Wilmore*

555. **Cinematographic Techniques for Analyzing Human Movement (3)** I High-speed motion picture photography applied to the study of human motion; techniques of data collection, reduction, analysis and interpretation. *P, 520. Atwater*

565. **Physical Activity and Coronary Heart Disease (3)** I The etiology and pathophysiology of coronary heart disease (CHD); primary and secondary risk factors; diagnosis of CHD; role of exercise in primary and secondary prevention. Field trips. *P, 530. Wilmore.*

570. **Research Design in Exercise and Sport Sciences (3)** I Study of research designs, methodologies and data analysis procedures pertinent to the exercise and sport sciences; emphasis is on the selection of research problems and interpretation of research articles. *Lohman.*

580. **Evaluation of Athletic Injuries (3)** I Advanced study of the etiology, pathology, and clinical signs of common athletic injuries. Emphasis on clinical evaluation of athletic injuries by the athletic trainer. *P, 377; 800 hrs. of clinical experience in athletic training. Delforge*

581. **Therapeutic Modalities (2)** I Advanced study of the role of hydrotherapeutic and electrotherapeutic agents in the rehabilitation of athletic injuries. *P, 580. Delforge*

582. **Anatomical Basis of Sport Injuries (2)** I Comprehensive survey of bones, ligaments, muscles, nerves, and vessels of the trunk and upper and lower extremities, with emphasis on their relationship to sport injuries. 1R, 3L. *P, CR 580. Hillman*

584. **Rehabilitation of Athletic Injuries (3)** I Principles in the planning and implementation of rehabilitation programs for injured athletes with emphasis on application of contemporary therapeutic exercise techniques. *P, 580. Delforge*

585. **Issues in Athletic Training and Sports Medicine (3)** I Current issues and trends in athletic training and sports medicine with emphasis on the professional preparation of athletic trainers and the role of the certified athletic trainer in athletic health care delivery systems. *P, 580 Delforge*
586. **Physical Education and the Law** (3) S Investigation and analysis of legal parameters within which the physical educator and coach operate; negligence theory; common defenses; product liability; insurance; legal implications for program development and methodology. *Baker*

587. **Management of Athletic Injuries** (3) S Principles of injury recognition and initial management of sports injuries for the coach, physical education teacher, and other athlete health care personnel. Credit is allowed for this course or 580, but not for both. *P, 377. Delforge*

588. **Legal Aspects of Sports Administration** (3) II Development of administrative and coaching techniques from the legal perspective. Analysis of personnel procedures, purchase of equipment, athletic associations, certification, transportation, medical procedures, officiating, and the handicapped athlete as influenced by litigation. *P, 586. Baker.*

594. **Practicum**
   b. Exercise Technician/Exercise Prescription (2) I II P, 374, 394

596. **Seminar**
   a. Contemporary Problems in Athletics (3) S *Simko*

795. **Colloquium**
   a. Physiological Adaptations to Training (2) [Rpt./1] I II P, 530.
   b. Environmental Stress and Performance (2) [Rpt./1] I II P, 530.
   c. Cardiovascular Dynamics (2) [Rpt./1] I II P, 530.
   d. Exercise Metabolism (2) [Rpt./1] I II P, 530.

**FAMILY AND CONSUMER RESOURCES**


Associate Professors Ellen Goldsberry (*Adjunct*), Roger M. Kramer, Leanne K. Lamke, Mary H. Marion, Shirley O'Brien (*Adjunct*)

Assistant Professors Kitty L. Abraham, Oscar A. Blazquez, Donna R. Iams, Maureen E. Kelly, Elizabeth L. Kendall, Molly Longstreth, Chester J. Ross, Mari S. Wilhelm

Instructors Patricia Aaron, Patricia Otten

Lecturers Brenda M. Brandt, Patricia L. Wylie

Extension Specialists Bernice Epstein, Norma Redeker, Corinne I. Stinson (*Emerita*), Frank Williams

The School of Family and Consumer Resources strives to research, create, and apply knowledge to improve the well-being of families and individuals and increase understanding of the reciprocal relationships among individuals, families, and their several environments. It deals with social, economic, aesthetic, managerial, health, and ethical aspects of family relations, child development, clothing, and housing.

The school offers the Bachelor of Science in Family and Consumer Resources with majors in child development and family relations (emphasizing family studies, child studies, or a combination of the two); clothing and textiles; consumer studies and home management; early childhood education; general home economics; home economics and journalism; home economics education; home economics extension education; interior design (design track or merchandising track); and merchandising and fashion promotion.

The School of Family and Consumer Resources offers the following advanced degrees: Master of Science with a major in family and consumer resources or home economics education; Master of Education with a major in family and consumer resources; and the Master of Home Economics Education with a major in home economics education.

**Family and Consumer Resources**

129. **Professional Development** (3) I II Knowledge and attitudes generally needed by professionals in family and consumer resources or related fields; exploration of careers and cross specialization concepts.

465. **Women in International Development** (3) GC I 1985-86 (Identical with Anth. 465)

696. **Seminar**
   z. Family and Consumer Resources (1 to 3) [Rpt./1] I II
DEPARTMENTS AND COURSES OF INSTRUCTION

Child Development and Family Relations

Professor Christopherson, Acting Chairperson of the Division

The Division of Child Development and Family Relations focuses on generation and dissemination of basic and applied knowledge concerned with human development and family relations throughout the life span. Students major either in child development and family relations or in early childhood education, and may elect courses in consultation with faculty members to reflect additional emphasis in one of the following areas: child studies, family studies, or a combination of the two. The early childhood education major leads to certification for public school teachers.

The major in child development and family relations: I. C.D.F.R. 117; F.C.R. 129; C.D.F.R. 223; 247; 337; 457; 10-12 units chosen from C.D.F.R. 137, 327, 347, 407, C.S. 416, C.D.F.R. 427, 447, 467, 487, H.E.E. 448, N.F.S. 101; f.c.r. upper division course outside the major; 21 units chosen from anth., educ., c.d.f.r., c.t., i.d., h.e.e., c.s., f.c.r., li.s., ex.s.s., (non-activity course), psyc., m.a.p., soc.; electives 23-28 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). III. Hum. 250a, 250b, 250c (to total 8 units) or 9 units chosen from the humanities courses accepted by the College of Arts and Sciences. IV. Engl. 308; 6 additional units chosen from speech, a language, jour., r.t.v. V. Psyc. 101, Soc. 100, 3 units chosen from econ., anth., soc., psyc., pol., or education. VI. Math. 116; 6-8 units chosen from biological and physical science. VII. 9 additional units from one area III, IV, V, or VI.

The major in early childhood education: In addition to the requirements listed under the College of Education section of this catalog, majors must take F.C.R. 129 and an upper-division f.c.r. course outside the major, plus electives for a total of 130 units.

117. Human Development and Relations (3) I II Behavioral science approach to personal development and interpersonal competence through the life span.

137. Education for Marriage (3) I II Practical study of factors involved in courtship, mate selection, marital adjustment, and parenthood.

223. Child Development (3) I II Growth, development, and socialization of the child within the family setting, from conception to the middle school years; observations of infants and preschoolers. P, Psyc. 101.

243. Sociology of Adult Life (3) I (Identical with Soc. 243)

247. Adolescence (3) I II Growth, development and socialization of the child from the middle school years through adolescence. P, Psyc. 101.

327. Parent Education and Guidance (3) I II Theoretical perspectives and current literature applying to child guidance and parent education; practical considerations of principles and procedures involved in parent study programs. P, 117 or 223.

337. Family Relations (3) I II The modern family and its relationships. Comparative, functional, and institutional factors are examined.

347. Child Development in Group Settings (3 to 6) [Rpt./1] I II Laboratory experience with young children. Supervised experience with 3-5 year-old children in a group setting; interactions, observations, discussions. P, 223.

407. Problems in Child Development (3) GC II 1986-87 Special child-rearing contexts in contemporary society; poverty, minority group membership, social change, and special developmental considerations.

413. Issues in Aging (3) GC II Introductory course in gerontology, with emphasis upon contemporary issues. (Identical with Gero. 413)

417. Advanced Human Development and Relations (3) GC II Behavioral science approaches to interpersonal competence within various societal contexts. P, 117.

427. Problems in Marriage and the Family (3) GC II Identification and analysis of major problem areas in marriage and the family, including economic, sexual, role conflict, emotional disorders, and childrearing.

447. Advanced Child Development (3) GC I In-depth examination of various dimensions of human growth and development. P, 223; 6 units of psyc.

457. Bio-Social Determinants of Socialization (3) GC II Bio-social factors related to socialization and the influence of various subcultures and contexts upon child-rearing practices. P, 223; 6 units of child dev. or soc. or psyc. (Identical with Soc. 457)
467. **Preschool Teaching Theory** (3) GC II 1986-87 Consideration of individual and group needs, guidance, and program planning in preschools. Field trips. P, 347.

487. **Readings In Family Relations** (3) GC II Critical analysis of selected studies and research. P, 137, or 337, or Soc. 321.

500. **Life Span Development** (3) II (Identical with Ed.P. 500)

502. **Advanced Adolescent Development** (3) II (Identical with Ed.P. 502)

507a-507b. **Research Methods In Social Science** (3-3) II 507a: Problem selection, literature review, research design, data analysis, and other related topics, leading to the development of a research prospectus. 507b: Introduction to computer usage in social sci.; critical review of thesis writing by faculty and peers, including literature review, problem formulation, and research design.

517. **Program Development and Evaluation in Micro-level Human Services** (3) I Comprehensive review of human and family intervention projects and the procedures involved in developing, implementing, and evaluating these projects. All-day field trips. P, 507b.

547. **Theories of Human and Family Development** (3) I Analysis and integration of the major theories of individual and family development within a social context; evaluation of theoretical formulations in selected content areas of human relations and individual growth. P, 9 units of child dev., family relations, psyc. or soc. (Identical with Ed.P. 547)

557. **Methods in Marital Therapy** (3) I Theories and principles of counseling for premarital, marital, and group counseling situations. (Identical with Coun. 557 and Rhab. 557)

573. **Family Development** (3) I Internal development of families over the life cycle, with emphasis on family goals, structure and functioning in the context of American society. P, 223, Soc. 100, or Psyc. 101.

607. **Topics in Child Development and Family Relations.** (1 to 3) [Rpt./1] GC I II Variable content: cognitive development, biological theories of development, role theory, middle childhood, and others.

637. **Trends in Human Relations** (3) I Philosophy, content, and resources for understanding, teaching and working in the field of human relations.

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**Clothing, Textiles, and Interior Design**

Professor Hatch, Chairperson of the Division

The Division of Clothing, Textiles, and Interior Design provides instructional programs for clothing and textiles, merchandising and fashion promotion, and interior design. Majors in clothing and textiles and in merchandising and fashion promotion acquire expertise in coordinating complex economic, aesthetic, and sociological factors in dress as they prepare for professional careers. Majors in interior design acquire expertise in the various aspects of the design of the interior environment.

Students are advised to take note of the College of Business and Public Administration's Advanced Standing requirement, which includes a cumulative grade point average of 2.25 or better to establish eligibility for the upper division level business courses. Majors in clothing and textiles, interior design merchandising track, and merchandising and fashion promotion require a number of upper division level business courses as part of the requirements. A student who does not complete the required business courses will not be able to graduate under any of the respective CTID majors.

**The major in clothing and textiles:** I. F.C.R. 129; I.D. 115; C.T. 145; 234; 284R, 284L; 304; 325; 344; 393b (1 unit); 444; 454; 464; 6 units from 393b, 434, 445, 464, 484; f.c.r. upper division course outside the major; Art. 101; 3 units from art or art history; Econ. 201b, 9 units from econ., m.a.p., mktg., m.i.s.; 6 units from Engl., sp.c., jour., education; electives 8-10 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art. 117, 118 and additional 3 units. IV. Sp.C. 102, 112; Engl. 307 or 308. V. Econ. 201a, Soc. 100, Psyc. 101. VI. Chem. 101a, 102a, 102b. VII. 9 units from one area III, IV, V, VI.

**The major in merchandising and fashion promotion:** I. F.C.R. 129; I.D. 115; C.T. 114; 145; 284R, 284L; 304; 325; 393b (1 unit); C.T. 434 or 454; C.T. 444 or 445; C.S. 446; 6 units chosen from C.D.F.R. 117, C.T. 234, 344, 393b, 434, 444, 445, 454, 464, 484, C.S. 416, 466; f.c.r. upper division course outside the major; electives 9-12 units; Acct. 200; Mktg. 361; Mktg. 364, 458; 3 units chosen from Mktg. 410, 450, 452, 453; 9 units from acct., m.a.p.,
DEPARTMENTS AND COURSES OF INSTRUCTION

DEPARTMENTS AND COURSES OF INSTRUCTION

mktg., m.i.s, Art. 101. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s.. (2 units). III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art. 117, 118 and additional 3 units. IV. Sp.C. 102, 112; Engl. 307. V. Econ. 201a, 201b; Soc. 100. VI. Chem. 101a, 102a; and 4 units from Math. 117, statistics, biological and physical sciences. VII. Psyc. 101; 6 additional units.

The major in interior design requires a two-year preprofessional and a two-year professional phase. Prior to entering the professional phase, the student must select one of two tracks of study: design or merchandising. The design track focuses on the relationships between people and their interior environments: residential and contract. It draws from the humanities, behavioral and social sciences, and fine arts for support course work. The merchandising track focuses on the retailing, marketing and business aspects of the interiors profession providing expertise in coordinating complex economic, aesthetic and sociologic factors. An application for admission to the professional phase, design track, must be filed with the program chairman by the last day of classes of the spring semester preceding the intended fall admission. The application shall consist of a portfolio, a completed application form, and a transcript. Applicants will be evaluated on the basis of the following criteria: grade-point average (especially in design and related courses), course work, statement of intent, and creative endeavors. (It is highly unlikely that a student with a grade point average lower than 3.00 in design courses and 2.00 overall will be admitted to the design track.) For application the student must have completed sixty units, including 115, 155, 265a, 265b; Art. 101, 102; and art hist. (6 units) or Hist. 103, 104 (6 units) or Hum. 250a, 250b, 250c (8 units).

The major in interior design (design track): I. F.C.R. 129; I.D. 115; 155; 265a-265b; 335; 355; 365; 375; 393h (1 unit), I.D. 465; 475; 485; 494h; C.T. 284R; C.S. 356; Art. 101; Art. 102; art or I.D. 393h (3 units); Arch. 101; L.Ar. 345; f.c.r. upper division course outside the major; electives 5-14 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. (2 units). III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, Hist. 104 and additional 3 units or Art. 117, 118 and additional 3 units. IV. Sp.C. 102; 6 additional units. V. Econ. 201a; Psyc. 101; Soc. 100. VI. Chem. 101a, 102a; 4-5 additional units. VII. 9 units in behavioral and social science.

The major in interior design (merchandising track): I. F.C.R. 129; I.D. 115; 155; 265a; 335; 355; 375; 393h (1 unit); 485; C.T. 284R; 304; C.S. 356; f.c.r. upper division course outside the major; electives 18-20 units. II. Engl. 101 or 103; Engl. 102 or 104; ex.s.s. 2 units. III. Hum. 250a, 250b, 250c to total 8 units or Hist. 103, 104 and additional 3 units or Art. 117, 118, and additional 3 units. IV. Sp.C. 102; 6 additional units. V. Econ. 201a, 201b; Psyc. 101. VI. Chem. 101a, 102a; Math. 117; 1-2 additional units. VII. Soc. 100; 6 additional units.

Clothing and Textiles

114. Apparel Analysis (2) II Fashion production terms and techniques; comparison and evaluation of apparel, quality, fit and appearance for intended consumer markets.

145. Fashion Concepts and Theory (3) II Theories of consumer's choice and use of clothing and fashions.

234. Apparel Design (3) II Application of intermediate apparel construction and fitting techniques to arrive at aesthetically pleasing and functional garments. 1R, 6L.


284L. Textile Science Laboratory (1) II Lab. analysis of fibers and fabrics. P, 284R or CR.

304. Buying and Merchandising Fashions (3) I Development of merchandising policies and procedures used in retailing. P, 284R.

325. Historical Analysis of Dress and Fashion (3) I Western dress and the development of the fashion system from an historical perspective. P, Hist. 103, Hist. 104 or eight units of Hum. 250a-250b-250c or six units of Art. 117, 118, or 119.

344. Advanced Apparel Design (3) I Experimental problems in advanced techniques of apparel construction, with emphasis on pattern alteration, modification, fitting and couture construction. 1R, 6L, P, 115, 234.

393. Internship

b. Merchandising, Textiles and Clothing (1 to 12) [Rpt./] I II Open to clothing and textiles and to merchandising and fashion promotion majors only.

444. Dimensions of Clothing Behavior (3) GC II Analysis of psychological, social, cultural, historical, economic and aesthetic dimensions of clothing reported in literature. P, 145, Soc. 100, Psych. 101, Econ. 201a.

445. Clothing for Special Needs (3) GC I Clothing and accessories for special needs; based upon research.

454. New Developments in the Textile Field (3) GC I Fabric finishes, new fiber development, textured yarns, knits, and fabric use and care problems. P, 284R.

464. Aspects of Clothing Design (3) GC (Rpt./9 units) II Projects in the analysis and manipulation of design media to produce garments to meet selected needs and populations. 1R, 6L. P, 145, 344.

484. Textile Analysis (3) GC II 1985-86 Physical and chemical testing, dyes, microscopic analysis and use of textile testing equipment for fabric analysis. 1R, 6L. P, 454.

Interior Design

115. Fundamentals of Design (3) I II GRD Elements and principles of design; theory and exploration of design interpretation, historical and contemporary. Open to majors only or consult dept. before enrolling.

155. Social Awareness of Design (3) I II Programming and planning of design to focus on the psychological and sociological needs of individual and group units. P, 115 (for interior design majors).

265a-265b. Presentations (3-3) 265a: I Drafting mechanics, interrelationships of 2-d to 3-d composition; plans, sections, elevations; introduction to model-building skills. 265b: II 2-d and 3-d rendering techniques and technical illustrations; working drawings; model-building techniques. P, 115, Art. 101.

335. Interior Furnishings Industry (3) I Patterns of production and distribution in the interior furnishings industry, the market area, and in merchandising techniques. P, 155.

355. History of Design (3) I Period styles in interiors, classical through the 20th century. P, 6 units of art hist., Hist. 103, 104 or 8 units of Hum. 250a-250b-250c.

365. Housing (3) I Historical aspects of housing, providing housing, housing legislation, current issues and trends. Field trips.


393. Internship
   h. Interior Design (1 to 12) [Rpt./1] I II Open to interior design majors only.


485. Ethics and Practice for Interior Design (3) GC II Readings in the interior fields, with emphasis on individual professionalism. P, 375.

494. Practicum
   h. Interior Design (3) I II S P, 375, 475.

Home Economics Education/Consumer Studies

Associate Professor Rudd, Acting Chairperson of the Division

The Division of Home Economics Education/Consumer Studies provides instructional programs for home economics education, home economics extension education, consumer studies and home management, home economics and journalism, and general home economics. Opportunities for field experiences are provided in all programs.

The major in home economics education prepares students to develop and implement educational programs in home economics and leads to certification for teaching in public schools. Candidates for admission to undergraduate programs in education and home economics education must present evidence of having completed 56 units of work applicable to the B.S. in F.C.R. degree with a minimum grade-point average of 2.2500. Those
who register for H.E.E. 389 and S.Ed. 338g must have a cumulative grade-point average of 2.5 in FCR and NFS course work.

The major in home economics education: I. F.C.R. 129; C.D.F.R. 223; 347; 337; C.T. 145; 234; 284R; 284L; C.S. 116; 316; 416 or 446; I.D. 115; C.S. 346; 356; three courses from N.F.S. 101, 201, 251, 350; f.c.r. upper division course outside the major; H.E.E. 288; 338g; 389; 308; 499 (1 unit); electives recommended H.E.E. 393, 409, B.C.Ed. 485. II. Engl. 101 or 103; Eng. 102 or Eng. 104; ex.s.s. (2 units). III. Two courses in humanities and arts and one course in U.S. history from those listed in the College of Education section of this catalog. IV. Rdng. 435; S.Ed. 494b; 3 unit communications course. V. Psy. 101; Pol. 110 Econ. 210a. VI. Chem. 101a, 102a; 101b, 102b; math - 3 units. VII. Ed.p. 311; Ed.F.A. 350; S.Ed. 340.

The major in home economics extension education prepares students for educational positions in nonformal settings such as the Cooperative Extension Service, business or government or human services.

The major in consumer studies and home management prepares students for careers as consumer affairs specialists in government or business, as consumer educators in adult or nonformal educational programs, and as personal and family financial advisers.

The major in general home economics is for students interested in an emerging and innovative career in the area of family and consumer resources for which there is no formal program. Students should seek aid of an adviser in building an individualized program.

The major in home economics and journalism prepares students to use home economics and communications background for careers in mass media, including newspapers, trade journals, magazines, television, and radio.

356. Social and Economic Aspects of Housing (3) I II GRD Neighborhoods and sites, family requirements, characteristics of a good house, physical, psychological, and social environments, buying new and old houses; equipment and maintenance.

366. Consumer Relations (3) I II Study and application of principles involved in the relationships among consumers, businesses, and government agencies.

416. Management of Family Resources (3) GC I II GRD Resources available to families and the use of these resources to obtain family goals. P, Econ. 100a.

436. Economics of Aging (3) GC II Economic issues as they affect the aging individual, family and society; economic demographics, consumer problems, and retirement financial planning. (Identical with Gero. 436)

446. The Consumer and the Market (3) GC I II GRD Consumer problems in the American economy under existing market conditions. P, Econ. 100a.

466. Family Economics (3) GC I Analysis of the family as a consumer decision-making unit within the larger economic system. P, Econ. 201b.


Home Economics Education

288. Observation/Participation in Home Economics Education and Extension (2) II Functions of home economics educators in school- and community-based programs; characteristics of home economics programs; structuring learning settings to meet student/client needs. 1R, 3L.


338g. Teaching Home Economics (6) I (Identical with S.Ed. 338g)

389. Supervised Teaching in Home Economics (1 to 8) II Teaching vocational home economics under supervision in approved programs in secondary schools in Arizona. Preregistration first semester of jr. yr. P, S.Ed. 338g; CR H.E.E. 308.

409. Occupational Home Economics Programs (3) GC II Purposes and methods of teaching home economics-related occupations, with emphasis on cooperative home economics vocational education. P, S.Ed. 338g; CR H.E.E. 308 and 389 or teaching experience.


448. Extension Program Planning and Evaluation (3) GC II Bases and procedures for program planning, implementation and evaluation in non-formal education programs such as the Cooperative Extension Service. Examination of issues and trends, observation and individual projects. P, A.Ed. 438, and F.C.R. 428 or A.Ed. 439. (Identical with A.Ed. 448)

493. Internship

e. Supervised Work Experience in Home Economics (1 to 6) [Rpt./2] II S Open to h.ec.ed. majors only.

497. Workshop

m. * Human Motivation in Extension Programs (1 to 2) [Rpt./2] (identical with A.Ed. 497m, which is home)

n. * Youth Development through 4-H Programs (1 to 2) [Rpt./2] (identical with A.Ed. 497n, which is home)

c. * Public Relations in Extension (1 to 2) [Rpt./2] GC (Identical with A.Ed. 497r, which is home)

538. Philosophy and Principles of Extension Education (3) I (Identical with A.Ed. 538)

539. Extension Education Methods (3) II (Identical with A.Ed. 539)

597. Workshop

a. * Extension Communication (1 to 2) [Rpt./2] (identical with A.Ed. 597a, which is home)

c. * Extension Credibility and Accountability (1 to 2) [Rpt./2] (identical with A.Ed. 597c, which is home)
DEPARTMENTS AND COURSES OF INSTRUCTION

d. * Extension Supervision and Administration (1 to 3) [Rpt./2] (Identical with A.Ed. 597d, which is home)
g. * Microcomputers-Extension (1 to 2) [Rpt./2] (Identical with A.Ed. 597g, which is home)
h. * Family Development through Home Economic Programs (1 to 2)
i. Principles of Extension Training (1 to 3) I (Identical with A.Ed. 597t, which is home)
j. Evaluation in Extension Education (1 to 3) I (Identical with A.Ed. 597u, which is home)
k. Volunteer Staff Development in Extension (3) I 2R, 3L. (Identical with A.Ed. 597v)
l. Administration of Extension Programs (1 to 3) I (Identical with A.Ed. 597x, which is home)

*Offered only through the Cooperative Extension Service Winter School.

609. Supervision in Vocational Education and Extension (3) I Theory, principles and techniques of supervision in vocational and extension education.

610. Investigation and Studies in Home Economics (3) I Study and analysis of research literature, methods, techniques, and procedures for conducting investigations, selecting and developing plans for research problems.

618. Evaluation in Home Economics Education (3) II Application of theory to the selection and construction of evaluation instruments, their use and interpretation in home economics programs.

628. Curriculum Theory in Home Economics (3) I Theoretical bases and processes of curriculum building in home economics; current issues in home economics education.

For information concerning nutrition and food science, see the Department of Nutrition and Food Science elsewhere in this catalog.

FAMILY ECONOMICS AND HOME MANAGEMENT
(See Family and Consumer Resources)

FAMILY RELATIONS
(See Family and Consumer Resources)

FILM STUDIES
(See College of Arts and Sciences, General Fine Arts Studies, Cinema Option)

FINANCE AND REAL ESTATE

Professors Gerald O. Bierwag, Willard T. Carleton, Nestor R. Roos, James E. Wert
Associate Professors Eric H. Sorensen, Head, Erich K. Bleck, John T. Emery
Assistant Professors Edward H. Robbins, John D. Schatzberg, Howard S. Stern, Gerry Suchanek
Lecturers Thomas C. Moses, Sanders K. Solot, Robert Ash Wallace

Majors in finance are prepared for corporate financial management, investment portfolio management, brokerage, and investment and commercial banking. Those who concentrate in real estate are exposed to the practical aspects of appraising, marketing and managing real property in addition to the economics of land uses.

Undergraduate majors in finance and real estate are offered through the Bachelor of Science in Business Administration (see the College of Business and Public Administration section of the catalog). Nonbusiness students interested in a minor in one of these areas should contact the department head for information. A Master of Science with a major in finance is available, and the department participates in the Master of Business Administration and the Doctor of Philosophy degrees with a major in business administration.

201. Personal Finance (3) II Principles of personal money management and financial planning for the individual and family, including analysis of home buying, credit purchases, insurance, savings, and investments. Not open to B.P.A. students.
221. The Stock Market (3) I II Analysis of the markets for securities of both public and private issuers: brokers, dealers, investment bankers, organized and over-the-counter markets; the mechanics of trading, and the investment risks and merits of all classes of securities. Open only to nonmajors.

251. Risk and Insurance (3) I II Theory of risk; essentials of risk management, with emphasis on insurance, including analyses of coverages purchased by business firms and families. Designed for those seeking a general knowledge of insurance.

261. Real Estate Principles (3) I II Survey of the business aspects of real estate.


313.* Economics of Futures Markets (3) II (Identical with A.Ec. 313)

361.* Real Estate Finance (3) I II Real estate risks and financing; kinds, sources, costs, and uses of funds; the secondary market and related governmental activities. P, 261.

362.* Real Estate Appraisals (3) I II Factors influencing real property values; application of three approaches in determining the value of residential, commercial, and industrial properties. P, 261.


421.* Investments (3) GC I II Operation and analysis of the stock, bond, and commodity markets; theory and practice in construction and management of investment alternatives. P, 311.

422.* Securities Analysis (3) GC I II Current practices and techniques of evaluating common stocks, bonds, stock options and warrants. P, 421.

431.* Financial Intermediaries (3) GC I II Financial markets and institutions; effects of economic conditions and government policy on financial institutions, the flow of funds, and interest rates; term structure of interest rates; financial institution management. P, 311, Econ. 330.

453.* Risk Management (3) GC I II Analysis of a logical and systematic approach to uncertainty regarding loss; the identification, analysis, and evaluation of risk and the selection of the most advantageous method of treating it. P, Acct. 210, Econ. 201b.

455.* Safety Management (3) GC I Definition of functional requirements of a safety program, management's responsibilities, relationship to insurance; the effect on business of the Occupational Safety and Health Act of 1970 and similar state laws.

461.* Real Estate Law (3) GC I II Principal areas of the law of real estate. P, 261.

463.* Real Estate Investment and Taxation (3) GC II Professional management and use of real estate for income production; tax influences. P, 361, 362, Acct. 320.

465.* Advanced Real Estate Appraisal (3) GC II Valuation of income-producing property; the capitalization process, discounted cash flow, concepts of investment analysis. P, 361, 362.


486.* Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487.* Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

* Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

511. Business Finance (3) I II Integration of the basic principles and theory of business finance, with emphasis on analytical financial management of the firm. Students with credit in 412 should take 512. Open only to students admitted to a BPA graduate program. P, Acct. 550.

512. Advanced Corporation Finance (3) II Financial theory applied to capital structure; investment decisions; corporate valuation; and corporate financial policies. P, 412 or 511.

513. Theory of Finance (3) I Theoretical models pertaining to financial decisions. P, 412 or 511.

521. Portfolio Management (3) I Portfolio theory and applications; equity markets, fixed income, and option markets; risk analysis and investment strategies. P, 421.

522. Advanced Securities Analysis (3) II Examination of securities risk, return, and price behavior in competitive markets. P, 421 or 521.

532. Financial Futures and Options (3) II Design and trading of interest rate futures and options. Examination of their use in hedging, speculating, arbitraging, and their regulation. P, 421 or 521.

555. Advanced Safety Management (3) II Relating safety management to modern motivation theories; coordinating control of environment and behavior; interaction of unions, business, government, and other societal institutions. P, 455.

556. Safety Law (3) II History of law; tort and contract law; court procedure and trial; administrative law; worker’s compensation, O.S.H.A., and C.P.S.C. law and cases; safety professional’s responsibilities.

557. Safety and Institutional Policy (3) S Occupational safety problems; society’s organization of safety; early legislation; successes and failures of early safety efforts; consumerism; institutions bearing on safety problems. P, 555.

561. Advanced Subjects in Real Estate (3) I Syndication, feasibility studies, tax-free exchanges, and advanced appraising. P, 361.


696. Seminar
   a. Investment Analysis (1 to 3) I II
   b. Financial Markets (1 to 3) [Rpt./1] I II
   c. Corporation Finance (1 to 3) [Rpt./1] I II
   d. Capital Budgeting (1 to 3) I II
   e. Research Methods (1 to 3) [Rpt./1] I II

FOOD SCIENCE
(See Nutrition and Food Science)

FOOD SERVICE MANAGEMENT
(See Nutrition and Food Science)

FOUNDATIONS OF EDUCATION
(See Educational Foundations and Administration)

FRENCH AND ITALIAN

Professors Guido Capponi (Emeritus), Frank M. Chambers (Emeritus), Jean-Jacques Demorest, Loyal Gryting (Emeritus), Charles I. Rosenberg
Associate Professors Edward G. Brown, Acting Head, Jonathan Beck, Ingeborg M. Kohn, Henri Servin, Gianni Spera, Ronnie H. Terpening
Lecturers Gerard Agnieray, John L. Gesell, Jean Goetinck, Annamaria Kelly

The Department of French and Italian offers instruction in both languages at the elementary, intermediate, and advanced levels. It also offers courses in the two literatures, the civilizations of France and Italy, as well as courses devoted to the study of areas common to both cultures. The department cooperates with the Arizona Center for Medieval and Renaissance Studies and conducts programs in France and Italy.

The department offers the following degrees: Bachelor of Arts with majors in French and Italian; Bachelor of Arts in Education with a teaching major in French; Master of Arts with major in French (with a concentration available in Francophone literature); Master of Education with a teaching major in French; and Doctor of Philosophy with a major in French. The department also participates in offering the Master of Arts with a major in Romance languages through the Committee on Romance Languages.
Undergraduate majors in French or Italian can expect to attain a command of the idiom and of the culture that prepares them to teach in secondary schools, to undertake professional graduate studies, and to pursue careers in multinational corporations or in the foreign service.

**Writing Emphasis Course:** Because writing in all upper-division courses is in either French or Italian, the requirement will be satisfied through completion of at least one 3-unit course so designated as a Writing Emphasis Course within the minor department. (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

**Honors:** The department participates in the Honors Program.

### French

Unless otherwise indicated, all courses are taught in French.

**The major:** Thirty units (in addition to 101a-101b), including 300a-300b-300c, 375a-375b, and six additional units of literature in the 400 series. No fewer than 22 units must be upper-division coursework. The minor subject will be chosen in consultation with the major adviser.

**The teaching major:** Thirty units (in addition to 101a-101b), including 300a-300b-300c, 375a-375b, 414, and six additional units of literature in the 400 series.

**The teaching minor:** Twenty units (in addition to 101a-101b), including 305a-305b. Students offering 2 yrs. of Fren. as entrance credit must include six units from 300a-300b-300c.

101a-101b. Elementary French (4-4) CDT Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Also see 302a-302b.

101y. Intensive Review and Elementary French (4) I Review at the 101b level for students handicapped by time-lapse between high school Fren. and enrollment in college Fren.; prepares for 201a in the following semester. Admission is by assignment based upon placement test results. P, no more than two yrs. of high school Fren.

105. Training in Reading French for Graduates (3 hrs./week - no credit) I II Summary of basic grammar essential to a reading knowledge of the language, accompanied by readings of increasing difficulty both in the general literature and the chosen field of specialization.

201a-201b. Intermediate French (4-4) CDT P, 101b or two yrs. of high school Fren. Both 201a and 201b are offered each semester.

201y. Intensive Review and Intermediate French (4) I Review at the 201a level for students handicapped by time-lapse between second-year high school Fren. and the first year of college; prepares for 201b in the following semester. Admission is by assignment based upon placement test results.

202a-202b. Accelerated French (6 - 6) S 202a is the equivalent of 101a-101b; 202b is the equivalent of 201a-201b. Credit is allowed for this course or 101a-101b; 201a-201b, but not for both.

282a-282b. French Literature in Translation (3-3) Representative masterpieces of French literature. Will not count toward fulfillment of the language requirement or the major or minor in French.

300a-300b-300c. Types of French Literature (3-3-3) A detailed study of literary texts. 300a: The Middle Ages and the 16th century. 300b: The 17th and 18th centuries. 300c: The 19th and 20th centuries. P, 201b.

302a-302b. Intensive French (4-4) P, knowledge of another language at the 305b level, or permission of instructor. 302a is the equivalent of 101a-101b; 302b is the equivalent of 201a-201b.

305a-305b. Composition and Conversation (3-3) Designed for students who wish to write and speak fluently in everyday idiom; material based upon practical current topics. P, 201b. Both 305a and 305b are offered each semester.

370a-370b. Commercial and Technical French (3 - 3) The basic workings of the French economy and the essential vocabulary and style specific to French business. P, 201b or consult department before enrolling.


375a-375b. Advanced Composition and Conversation (3-3) Practice in formal writing and formal oral communication. P, 305b.
DEPARTMENTS AND COURSES OF INSTRUCTION


403a-403b. Literature of the 16th Century (3-3) GC 1985-86 403a: Early Renaissance, Reformation, Rabelais, the Pleiad. 403b: The Humanists, Montaigne, D'Aubigne, the drama. P, 201b.


414. Teaching of Modern Languages (3) GC II (Identical with S.Ed. 414)

415a-415b. Stylistics (3-3) GC Principles of stylistics, with exercises in literary translation and original writing. P, 375b.

422. Introduction to Romance Philology (3) GC 1 1986-87 (Identical with Span. 422)

430a-430b. French Civilization (3-3) GC Historical, social, economic, literary, and artistic elements in the development of the French nation. P, 201b.


451. Literature of the Fantastique (3) GC II 1986-87 Study of aspects of the supernatural, the unexpected, the unexplainable in French literature; analysis of dominant themes and important authors of the 18th, 19th, and 20th centuries. P, 201b.

452. French Literature of Quebec (3) GC II 1986-87 Comprehensive study of the most significant literary expression in Quebec. P, 201b.


470. Advanced Grammar and Usage (3) GC II Structural analysis of spoken and written French, with emphasis on structural patterns and attention to contrasts with Engl. Grad. students will do additional work in composition and stylistics. P, 201b.

472. French Phonetics (2) GC II 1985-86 Description, analysis, and practice in the larger elements of articulatory phonetics; designed for teaching majors and minors. P, 372.

510. Materials and Methods of Research (2) I 1985-86 Problems and methods of advanced research in French language and literature. Use of specialized library resources and computerized data bases. Style and presentation conventions for preparation of scholarly research.

511. Approaches to French Literature (3) II 1985-86 Methods of criticism and techniques of literary analysis.


557. Rousseau (3) II 1986-87 Rousseau's political thought; his ideas concerning education; The Confessions; the beginning of Romanticism.

558. Realism and Naturalism in the Novel (3) I 1985-86 Flaubert, Zola, Maupassant, etc.

559. Contemporary Theatre (3) II 1986-87 Theatre from 1950 to the present time; Ionesco, Beckett, Genet, Arrabal, Obalda, Tardieu, Dubillard, etc.


579. Problems of Teaching College French (1 to 3) I Emphasis on the problems encountered in teaching lower-division college courses.
696. **Seminar**

- a. Romance Philology (3) I II
- b. Topics in French Literature (3) [Rpt./2] I II
- c. Old French Literature (3) I II
- d. 16th Century (3) I II
- e. 17th Century (3) I II
- f. 18th Century (3) I II
- g. 19th Century (3) I II
- h. 20th Century (3) I II

**Italian**

*The major:* 30 units (in addition to 101a-101b), including 305a-305b, and 405a-405b (for students who require additional fluency); 400a-400b-400c and six additional units of literature courses in the 400 series. No fewer than 20 units must be upper-division course work.

*The minor:* Twenty units (in addition to 101a-101b), including 305a-305b and 405a-405b (for students who require additional fluency); 400a-400b.

Students with teaching minors will be required to complete a course in methodology dealing with teaching foreign languages in high school and/or junior college.

101a-101b. Elementary Italian (4-4) CDT Both 101a and 101b are offered each semester. (The first year of work in a foreign language shall not be counted toward a minor.)

201a-201b. Intermediate Italian (4-4) CDT Both 201a and 201b are offered each semester. P, 101b or two yrs. of high school Ital.

282a-282b. Literature of the Renaissance in Translation (3-3) Representative literary masterpieces of the Italian Renaissance. Does not fulfill the language requirement, the major or the minor in Ital.

302a-302b. Intensive Italian (4-4) P, lang. major or proven lang. proficiency.

305a-305b. Composition and Conversation (3-3) GRD Designed to develop linguistic skills aimed at achieving an FSI rating of 2 plus in listening, comprehension, speaking and writing. P, 201b or consult dept. before enrolling.

400a-400b-400c. Survey of Italian Literature (3-3-3) GC 400a: The Middle Ages and early Renaissance. 400b: The Renaissance, 17th and 18th centuries. 400c: The 19th and 20th centuries. P, 201b or consult dept. before enrolling.

405a-405b. Advanced Composition and Conversation (3-3) GC P, 201b.

406a-406b. The Italian Novel (3-3) GC P, 201b.

420a-420b. Italian Civilization. (3-3) GC Historical, geographical, social, and artistic aspects of the development of the culture of Italy. P, 201b. 420a is not prerequisite to 420b.

422. Introduction to Romance Philology (3) GC I 1986-87 (Identical with Span. 422)

430a-430b. Literature of the Renaissance (3-3) GC P, 201b.

435a-435b. La Divina Commedia (3-3) GC P, 201b.

450. Renaissance Studies (4) S Taught in English. Onsite study of the birth and development of the Italian Renaissance with emphasis of Florence. Offered only in Florence, Italy.

696. **Seminar**

- a. Italian Literature (3) [Rpt.] I II

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**GENERAL BIOLOGY**

*(See Ecology and Evolutionary Biology)*

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**GENETICS**

Committee on Genetics (Graduate)

Professors William P. Bemis (*Emeritus*, Plant Sciences), Harris Bernstein (Microbiology and Immunology), John R. Davis (Pathology), John E. Endrizzi (Plant Sciences), Robert M. Harris (*Emeritus*, Ecology and Evolutionary Biology), William B. Heed (Ecology and Evolutionary Biology), Frank R. H. Katterman (Plant Sciences), Robert G. McDaniel (Plant Sciences), Neil H. Mendelson (Molecular and Cellular Biology), David W. Mount (Molecular and Cellular Biology) Robert T. Ramage
(Plant Sciences), Donald Ray (Animal Sciences), Nobuyoshi Shimizu (Molecular and Cellular Biology)

Associate Professors Oscar G. Ward (Ecology and Evolutionary Biology), Chairperson, Richard E. Michod (Ecology and Evolutionary Biology), Jeffrey Trent (Research, Internal Medicine), Stephen Zegura (Anthropology)

Assistant Professor Sue DeNise (Animal Sciences)

The genetics program is administered by an intercollege committee comprising geneticists from various departments. It offers areas of study in animal and plant genetics, cytogenetics, ecological, human, microbial, molecular, physiological, population and statistical genetics.

Graduate study leading to the Master of Science and Doctor of Philosophy degrees with a major in genetics is provided. For admission and degree requirements, please see the Graduate Catalog.

520. History of Genetics (1) L 1986-87 Experiments and discoveries which have led to the present state of knowledge in the various areas of genetics. P, Ecol. 320 or 321.

595. Colloquium
   a. Genetics (1) [Rpt.] L II

620. Applications and Techniques of Human Genetics (3) L Genetic theory and technique, as applied to man; methods of analysis of genetically determined cytological and biochemical differences in individuals and populations. 2R, 3L. P, Ecol. 320 or 321. (Identical with Ecol. 620) Ward

670. Recent Advances in Genetics (2) L Recent advances in the field of genetics. (Identical with Ecol. 670)

GEOGRAPHY AND REGIONAL DEVELOPMENT

Professors Lay J. Gibson, Head, Terence Burke, Melvin E. Hecht (Emeritus), Lawrence D. Mann, Leland R. Pederson, Richard W. Reeves, Thomas F. Saarinen, Dan Stanislawski (Emeritus), Norman Williams, Jr., Andrew W. Wilson (Emeritus)

Associate Professors D. Robert Altschul, Gordon F. Mulligan

Assistant Professor David A. Plane

Curricula in geography and regional development are designed to contribute to general education, to provide a solid, substantive and methodological grounding in geography for those who plan to teach or pursue graduate work in the field, and to provide preparation for those persons desiring professional training and/or careers in such fields as urban and regional planning and development, resource management, environment affairs, foreign service, and cartography and remote sensing.

The degree of Bachelor of Arts with a major in geography is available through the College of Arts and Sciences and the Bachelor of Arts in Education with a teaching major in geography, through the College of Education. For information on the regional development major, consult the departmental office. In addition, the Master of Arts, Master of Education, and Doctor of Philosophy degrees are offered with a major in geography. The Master of Science with a major in planning is offered through the Graduate College for students wishing professional preparation for careers in planning for urban and rural regions.

The major in geography: 35 units, including 257 in the methods and techniques subfield and at least three units in each of the three subfields of physical geography, human geography, and regional geography. At least 21 units must be at the upper division level. Students may select from five different options:

The general geography option: 3 additional units in each of the four subfields.

The applied geography option: 12 units selected from 330, 381, 457, 481, 483, 485 and six units of either human or physical geography.

The environmental analysis option: 12 units from 305, 330, 360, 362, 461, 463, 464, 483, or 485.

The planning and urban geography option: 18 units from 110, 301, 359, 360, 371, 379, 407, 453, 456 or 457.
The regional development and planning option: 305, 371, and 471; and six units from 360, 379, 414, 453, 456, or 461.

General Studies majors may elect a geography concentration; students may also minor in geography. Concentrations and minors parallel each of the options available to majors.

The supporting minor may be in biological sciences, earth sciences, languages, social sciences, or other fields approved by the departmental adviser.

The teaching major in geography: thirty units, including six units from each of the four subfields of physical geography, human geography, regional geography, and geographical methods and techniques.

The teaching minor in geography: 18 to 24 units, depending upon major and electives, to include at least three units from each of the four subfields of physical geography, human geography, regional geography, and geographical methods and techniques.

For classification of courses by subfields, consult the departmental adviser.

Honors: The department participates in the Honors Program.

Note: 103a-103b and 104a-104b are the only geography courses which may be applied to the Arts and Sciences Group VI requirement.

102a-102b. Human Geography (3-3) Introduction to the main fields of human geography, with emphasis on world patterns of distribution and regional examples. 102a is not prerequisite to 102b. Both 102a and 102b are offered each semester. Pederson/Gibson

103a-103b. Physical Geography (3-3) Treats the atmosphere, biosphere, hydrosphere, and lithosphere as interrelated and geographically variable components of the earth's physical landscapes and the natural environment of man. Both 103a and 103b are offered each semester. 103a is not prerequisite to 103b (Identical with Geos. 103a-103b) Altschul/Reeves

104a-104b. Physical Geography Laboratory (1-1) Field observation and lab. analysis of data and map interpretation. 104a : P, CR 103a. 104b : P, CR 103b. Both 104a and 104b are offered each semester. (Identical with Geos. 104a-104b)

110. Regional Land Use (3) I II Problems of regional environments in relation to the use and development of activities on the land. Emphasis on field study of actual land uses and introduction to the analysis and mapping of these using microcomputers. The relation of land use to taxation, zoning, and real estate transfer and development. (Identical with Ping. 110)

151. World Regional Geography (3) I II Geographic concepts and information organized by conventional region and nation. Appropriate for elementary and secondary teaching. Not open to students with six or more units of credit in 102a-102b, 103a-103b.

171. Introduction to Meteorology and Climatology (3) I II (Identical with Atmo. 171)

207. United States (3) I The changing character of the land and man's occupation of it, with emphasis on eastern regions; regionally organized and historically and problem oriented.

257. Geographical Techniques (3) I II Formulation and solution of geographic problems; models, research design, and methods of gathering, analyzing, and portraying geographic data. 2R, 3L. P, three units of geog. Plane

275. Metropolitan Tucson (3) I Physical and cultural bases of Tucson's geographic patterns, with emphasis on the city's site, situation, settlement patterns and problems of growth and change. Field trips. Saarinen

301. Introduction to Regional Planning (3) I II Introduction to the principles and techniques used for planning in metropolitan and rural regions. Field trips. (Identical with Ping. 301) Mann

305. Economic Geography (3) I II Analysis and modeling of the spatial structure of primary, secondary, and tertiary economic activities; location theory and regionalization in economic systems. Mulligan Writing-Emphasis Course.*

330. Introduction to Remote Sensing (3) I Introduction to remote sensing principles, techniques, and applications, designed principally for those with no background in the field. (Identical with G.En. 330, Geos. 330, S.W.330, and Ws.M. 330) Parton

359. Land Use and Growth Regulation (3) I II Land use analysis and fundamentals of zoning. Current planning, legal, and financial methods to regulate the rate of development, sequence of growth, and eventual size of cities, regions, and states. Practical application of methods. Field trips. (Identical with Ping. 359)

360. Environmental Perception (3) I II Consideration of patterns in human perception in relation to modification of environment and environmental planning. Saarinen Writing-Emphasis Course.*
362. **Man and the Earth Ecosystem** (3) I Concept of the interrelatedness of earth systems; significance of humanly induced ecological modifications through man's tenure on the earth. Field trips. P, 103a or 103b. Reeves

371. **Principles and Practices of Regional Development** (3) I Introduction to basic concepts, objectives, practices and techniques of regional and industrial development as a professional activity, with emphasis on development problems and solutions. Field trips. Gibson Writing-Emphasis Course.*

379. **Urban Growth and Development** (3) I II Economic, financial, political, social, and aesthetic problems arising from growth of the modern city; place of planning and zoning in possible solutions. Field trips. Plane Writing-Emphasis Course.*

381. **Cartography** (3) I Tools and techniques, properties and construction of projections, design and preparation of maps for publication. 2R, 3L. Reeves

401. **Introduction to Water Resources Management** (3) GC II (Identical with W.R.A. 401)

407. **The American Landscape** (3) GC II Origin and character of the visual aspects of places viewed individually and regionally; changes in habitat, vernacular structures, landscaping, townscape, countrysides and special features. Field trips. Writing-Emphasis Course.*

408. **Arizona and the Southwest** (3) GC I II The changing character of the land and man's occupancy of it, with emphasis on Arizona; historically and problem oriented. Field trip. Writing-Emphasis Course.*

411. **Middle America** (3) GC II Land, man, and culture in the major natural and cultural regions of Mexico, Central America, and West Indies. Pederson Writing-Emphasis Course.*

412. **South America** (3) GC I Physical and cultural bases of South America's geographic patterns, with emphasis on human settlement and problems of resource development. Pederson Writing-Emphasis Course.*

413. **Africa** (3) GC II Physical and human bases of regional contrasts, with emphasis on tropical environmental systems and changing patterns of resource utilization. Altschul Writing-Emphasis Course.*

414. **Rural Area Development** (3) GC I (Identical with A.Ec. 414)

453. **Industrial Location Analysis** (3) GC II Geographic distribution of industrial location; location factors and case studies; scale and the modern corporation; geographic inequalities and public policy. (Identical with Ping. 453) Mulligan Writing-Emphasis Course.*

456. **Urban Geography** (3) GC I Analysis and modeling of the spatial organization of cities; concepts of settlement patterns and processes; social and economic interpretations of the modern city. Field trip. (Identical with Ping. 456) Mulligan Writing-Emphasis Course.*

457. **Statistical Techniques in Geography and Planning** (3) GC I Methods of gathering and analyzing data for the solution of geographical, urban, and regional planning problems, with emphasis on quantitative and statistical techniques used in spatial analysis and cartography, on the one hand, and program planning, on the other. (Identical with Ping. 457) Plane/Silvers

459. **Topics in Economic Geography of the Middle East** (3) GC II (Identical with Or.S. 459)

461. **Population and Resources** (3) GC I Estimates of present and potential world population; distribution and methods of conserving important resources. Field trips. (Identical with Ping. 461 and W.R.A. 461) Writing-Emphasis Course.*

463. **Physical Aspects of Arid Lands** (3) GC II Landforms, climate, hydrology, soils, vegetation, and animal life of deserts, with particular emphasis on the interaction of these phenomena in southern Arizona. Field trips. Altschul/Reeves Writing-Emphasis Course.*

464. **The Arid and Semiarid Lands** (3) GC I Past, present and future of settlement and resource utilization in the world's arid lands; spatial interrelationships of environmental, demographic, socioeconomic and political systems. Altschul Writing-Emphasis Course.*

469. **Geography of the Middle East** (3) GC I (Identical with Or.S. 469)

471. **Problems in Regional Development** (3) GC I II Regional inventories and methods of analysis; development problems, policies and strategies; generation, implementation, and evaluation of development of programs; case studies. (Identical with A.Ec. 471 and Ping. 471) Gibson Writing-Emphasis Course.*

481. **Computer Cartography** (3) GC II Introduction to the use of computers for map production, with emphasis on cartographic principles and practical experience with several user-oriented mapping programs. (Identical with Ping. 481) Reeves
483. Geographic Applications of Remote Sensing (3) GC II Use of aircraft and satellite imagery for monitoring and analyzing landforms, soils, vegetation and land use, with the focus on problems of land-use planning, resource management and related topics. 2R, 3L. Field trip. P, two units of remote sensing or equivalent experience. (Identical with Ping. 483) Parton


510. Development of Regional Planning (3) I Survey of the historical development of the planning profession; the evolution of American planning as a response to urbanization. Open to majors only. Credit allowed for this course or 300, but not for both. (Identical with Ping. 510)

511. Metropolitan and Regional Planning (3) I Survey and evaluation of concepts and examples, including metropolitan, economic development, state and national, and environmental plans in the U.S. and abroad. (Identical with Ping. 511) Mann

556. Urban Systems Analysis (3) II Theoretical and applied analysis of urban growth models, gradients of urban influence, residential and facility decisions, and urban transportation. (Identical with Ping. 556) Mulligan

557. Spatial Analysis (3) II Formal analysis and modeling of spatial structures and processes; conceptual evaluation of point patterns, networks, surfaces and interaction. P. 457. (Identical with Ping. 557) Reeves

561. Resource Management (3) I Examination and critical appraisal of social and behavioral science aspects of resource management, with special emphasis on factors affecting decision making. (Identical with Ping. 561) Saarinen

562. Paleoecology and Man (3) I (Identical with Geos. 562)

563. Perception of Environment (3) I II Examination of interdisciplinary research on environmental perception; consideration of social and behavioral variables at all scales of environmental perception and planning. (Identical with Ping. 563) Saarinen

589. History of Geographic Thought (3) I History of geographic philosophy and methodology. P, fifteen units of geog. Pederson

596. Seminar
   a. Economic Geography (3) I II
   b. Cultural Geography (3) I II
   c. Physical Geography (3) I II
   d. Historical Geography (3) I II
   e. Area Study (3) I II
   f. Doctoral Research Seminar (3) [Rpt./3] I II
   u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Idis. 596u, which is home)

605. Planning Theories and Perspectives (3) I A critical examination of normative and methodological assumptions of alternative planning models, with emphasis on developing a perspective on contemporary planning issues. (Identical with Ping. 605). Mann

608. Planning Law (3) II Land-use controls, the law of zoning, exclusionary zoning, restrictive covenants, comprehensive plan, environmental protection, eminent domain, nuisance. (Identical with Ping. 608) Williams

609. Policy Problems in Structure and Change (3) II (Identical with M.A.P. 609)

611. Projects In Regional Planning (1 to 5) [Rpt./5 units] II Lectures, laboratory, and field projects covering various aspects of professional practice. P. 605, 24 units toward a graduate degree in planning. Field trips. (Identical with Ping. 611)

659. Growth Controls (3) II Current legal and planning techniques to regulate the rate of growth, the sequence of growth, and the eventual total size of towns, regions, and states; concentration on case studies. (Identical with Law 659 and Ping. 659)

696. Seminar
   a. Doctoral Research Seminar (3) [Rpt./3] I II

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of the catalog).
DEPARTMENTS AND COURSES OF INSTRUCTION

GEOLOGICAL ENGINEERING
(See Mining and Geological Engineering)

GEOLOGY
(See Geosciences)

GEOSCIENCES

Professors George H. Davis, Head, John W. Anthony (Emeritus), Victor R. Baker, William B. Bull, Robert F. Butler, Clement G. Chase, Peter J. Coney, Paul E. Damon, Jeffrey S. Dean (Laboratory of Tree-Ring Research), William R. Dickinson, Charles W. Ferguson (Laboratory of Tree-Ring Research), Harold C. Fritts (Laboratory of Tree-Ring Research), Laurence M. Gould (Emeritus), John M. Guilbert, C. Vance Haynes (Anthropology), Gerhard O. W. Kremp (Emeritus), Valmore C. LaMarche (Laboratory of Tree-Ring Research), Everett H. Lindsay, Paul S. Martin, Evans B. Mayo (Emeritus), Edgar J. McCullough, Jr., Bartholomew S. Nagy, Denis L. Norton, Joseph F. Schreiber, Jr., Terah L. Smiley (Emeritus), Marvin A. Stokes (Laboratory of Tree-Ring Research), John S. Sumner (Emeritus), Spencer R. Titley, Jame R. Wait (Electrical and Computer Engineering)

Associate Professors Karl W. Flessa, Jibamitra Ganguly, Austin Long, Timothy P. Loomis, H. J. Melosh (Planetary Sciences), P. Jonathan Patchett, Randall M. Richardson, Charles W. Stockton (Laboratory of Tree-Ring Research)

Assistant Professors Owen K. Davis, Christopher J. Eastoe, Joaquin Ruiz, Frank Telewski (Laboratory of Tree-Ring Research), Terry C. Wallace

Geosciences, or those sciences dealing with the study of the Earth, incorporate singularly or collectively the various fields of study that are applicable to an understanding of the formation and development of the chemical, physical, and biological aspects of the Earth. Academic and research pursuits in the geosciences lead toward a professional career in solving or helping to solve the current and projected issues dealing with land use, urban development, the search for energy sources, water, industrial and commercial minerals, and questions concerning earth processes involved in modern geologic studies.

The department offers the following degree programs: Bachelor of Science in Geosciences with concentrations in geochemistry, geology, or geophysics; Bachelor of Arts with a major in geosciences; and a Master of Science and Doctor of Philosophy with a major in geosciences. The degree of Bachelor of Science in Education with a teaching major in earth sciences is available through the College of Education; students in this program are advised during their first two years in the Department of Geosciences.

The B. S. in Geosciences: In addition to the requirements of the College of Arts and Sciences, the following courses constitute the core program: Math. 125a-125b; two additional courses selected from Math. 160 or 263, 215, 223, or 254; C.Sc. 115 or 122 or S.I.E. 272 or Math. 275; Geos. 101a-101b, 102a-102b; field program in geology (Geos. 412, 413) or geophysics (412, 416); Chem. 103a-103b, 104a-104b; Phys. 110, 116, 121, or with the approval of the adviser, 103a-103b and 180a-180b may be substituted; and eight additional units, approved by the adviser, selected from bio., chem., phys., math., or other approved courses. In addition to the core program, students in the geochemistry concentration must take the following courses: 109, 221, 302, 315a-315b, 457, 458; plus geosciences or other approved electives to total 134 units. Students in the geology concentration must take the following courses: 109, 221, 225, 302, 303, or 422, or 435, 315a-315b; plus geosciences or other approved electives to total 134 units. Students in the geophysics concentration must take the following courses: 109, 221, 222, 302, 419, 420; 424 or 432 or 434; Math. 422a; Phys. 410 or E.C.E. 381; plus approved electives to total 134 units.

The major for the B.A.: 101a-101b; 102a-102b, Math. 125a-125b, Chem. 103a-103b, 104a-104b, Phys. 103a-103b, and 180a-180b; further course requirements are flexible but normally should include Geos. 109, 221, 302, 315a-315b, and a field course or suitable equivalent. Approved 200 or higher level courses from geosciences, mathematics, chemistry, physics, biological sciences, computer science, engineering, and anthropology may be
applied toward completion of the degree. The minor may be selected from one or more supporting or complementary areas. Double majors with other departments in the basic or allied sciences are encouraged.

Students in the B.S. in Education (Earth Science Teaching Major) enroll in the College of Arts and Sciences for their first two years and transfer to the College of Education at the beginning of their junior year to complete degree requirements. The necessary general education electives to complete this program must have the approval of the Department of Geosciences. Courses required include: Astr. 110a-110b; Atmo. 171; Geos. 101a-101b; 102a-102b; 12 units of approved earth sciences courses; a minor selected from chem., phys., or math.; 14-20 elective credit hours in science, preferably outside of the designated minor field; an approved biology course of 3-4 units; Freshman Composition; Pol. 110; 20 units of general education electives selected from the humanities and social sciences course listings; and College of Education requirements to total 125 units. At least 40 units of upper division work must be included in the total number of units offered in satisfaction of the requirements for a degree.

The teaching minor: twenty units of approved earth science courses, including Geos. 101a-101b, 102a-102b, Astr. 110a-110b, and Atmo. 171.

Honors: The department participates in the Honors Program.

101a-101b. Introduction to Geology (3-3) 101a: Earth's materials; surface and internal geologic processes; development of plate tectonics model. 101b: Geologic history of the earth with emphasis on North America; modern concepts on the origin of life and evolution.

102a-102b. Introduction to Geology Laboratory (1-1) 102a: Practical experience in rock and mineral identification, topographic and geologic maps, and applied problems in geosciences. Field trips. 102b: An introduction to fossil identification, principles of paleoecology, stratigraphy, and applied problems in geosciences. Field trips. Labs must be taken concurrently with 101a-101b.

103a-103b. Physical Geography (3-3) (Identical with Geog. 103a-103b)

104a-104b. Physical Geography Laboratory (1-1) (Identical with Geog. 104a-104b)

106. Survey of the Solar System (4) I II (Identical with Pty.S. 106)

107. Introduction to Mineralogy and Lithology (4) I GRD Crystallography, crystal chemistry, mineral recognition; genesis and characteristics of rocks and their recognition in hand specimen. 2R, 6L. Not open to geology majors or to students concentrating in geochemistry. P, 101a, 102a; Chem. 103a-103b, 104a-104b.

109. Introduction to Crystallography and Mineralogy (5) II GRD Morphological crystallography; recognition of selected minerals in hand specimen; relation of properties of minerals to their internal structure; mineral genesis. 3R, 6L. P, 101a, 102a; Chem. 103a-103b, 104a-104b.

112. Foundations of Science: Geology (3) I II GRD Current theories on earth processes, the applications of these processes to understanding man's physical environment, and the problems that remain to be solved. 2R, 3L. Field trips. Credit for 112 will not be allowed if a student has credit for 101a, 101b or 151. P, Chem. 112, Phys. 112.

221. Structural Geology (4) I II GRD Description and analysis of geologic structures of deformed origin; stereographic and experimental work in lab.; structure mapping in the field. 3R, 4L. P, 101a, 102a, G. Davis

222. Introduction to Geophysics (3) I GRD Physical principles applied to problems in earth science including seismology, gravity, magnetics, heat flow, plate tectonics. P, Phys. 110, 116. Butler

225. Introduction to Paleontology (4) I GRD Basic principles and concepts; morphology and classification of fossils; their occurrence, distribution, geologic and evolutionary significance. 3R, 2L. Field trips. P, 101b, 102b or Ecol. 101a or 104. Flessa

295. Colloquium.
   a. Frontiers in Geosciences (1) [Rpt./3] I II


303. Economic Mineral Deposits (3) I II GRD Metalliferous and nonmetalliferous deposits; their geologic relations and origins. Field trips. P, 109, 221.
311. Introduction to Planetary Geology (4) 1986-87 (Identical with Pty.S. 311)

315a-315b. Introduction to Petrology (3-3) G.R.D. Classification, distribution, and theory of genesis of rocks; hand specimen description. 2R, 3L. P, 109. Loomis/Ganguly/Schreiber

330. Introduction to Remote Sensing (3) I (Identical with Geog. 330)

400. Methods in Geochronology (3) GC I Concepts, methods and problems in the measurement and calibration of geologic time. Lindsay

401. Environmental Education (3) GC II Nature of ecosystems; relationships of people and their environment; major conservation problems; discussion of proposed solutions; the experiential approach. Field trips, including three days in Sonoran wilderness. (Identical with Ed.F.A. 401)

403. Introduction to the Solar System (3) GC I (Identical with Pty.S. 403)

405. Optical Mineralogy and Petrography (3) II Introduction to optical crystallography and petrography. 1R, 6L. P, 315b; Phys. 121 or 103b and 180b.

407. Photogeology (3) GC II (Identical with G.En. 407)

409. Introductory Vertebrate Paleontology (3) GC I Survey of the vertebrate fossil record, with emphasis on morphological characters relating the major groups of vertebrates. P, 101b, 102b or Ecol. 102. Lindsay

410. Mammalian Phylogeny and Evolution (3) GC II 1986-87 A study of the mammalian fossil record, with emphasis on taxonomy and morphological evolution of selected mammal orders. 2R, 3L. Field trips. P, 409. Lindsay


413. Geology Field Camp II (3) S Field studies in geology, with emphasis on geologic mapping. P, 412. Fee.

414. Sedimentary Geology (3) GC I Sedimentary processes and depositional systems; sedimentary textures and structures; nonmarine, transitional, and marine deposition. 2R, 3L. Field trips. P, 107 or 109. Dickinson


419. Physics of the Earth (3) GC I Introduction to plate tectonics and to the structure and dynamics of the Earth using seismology, heat flow, gravity and magnetics. P, Math. 254, Phys. 121. (Identical with Pty.S. 419) Richardson/Chase

420. Geophysical Exploration: Potential Field Methods (4) GC I Principles of gravity, magnetic, and electrical exploration; acquisition and interpretation of data to define geologic structure and evaluate resources. 3R, 2L. P, Phys. 110, 116, Math. 223 (Identical with G.En. 420) Chase

422. Petroleum Geology (3) GC I Origin, migration, chemistry, and accumulation of petroleum; reservoir mechanics, types of traps; recovery of petroleum; oil shales and tar sands. 2R, 3L. Nagy

424. Paleomagnetism: Principles and Applications (3) GC II Physical basis for remanent magnetism in rocks, techniques of sample collection, measurements, and statistical treatment; review of polarity time scale, apparent polar wander, plate tectonics. P, Phys. 103b or 116. Butler


435. Hydrogeology (3) GC III (Identical with Hydr. 435)


438. Biogeography (3) GC II (Identical with Ecol. 438)

445. Topics in Geodynamics (3) [Rpt./1] GC II Large scale tectonic problems approached through geophysical combined with geological analysis, both in regional tectonic context. P, 20 units of geology, incl. 221, and 3 units geophysics.

450. Geomorphology (4) GC I Concepts of landform development, with emphasis on fluvial processes and environmental applications. 3R, 3L. Field trips. P, 101a, 102a. Bull


457. Principles of Geochemistry I (3) GC I Equilibrium and kinetic chemical processes producing soils, natural waters, and chemical sediments. P, 101a, 102a; Chem. 103b, 104b. (Identical with Hydr. 457) Long

458. Principles of Geochemistry II (3) GC II Nuclear systematics and thermodynamics with applications in high temperature geochemistry. P, 101a, 102a; Chem. 103b, 104b.

462. Introduction to Quaternary Ecology (3) GC I Methods and theories used in reconstructing vegetation and climate. Palynology, packrat middens, dendroclimatology. Field trip. (Identical with Anth. 462)

464a-464b. Introduction to Dendrochronology (3-3) GC Survey of dendrochronological theory and methods. Applications to archaeological, geological, and biological dating problems and paleoenvironmental reconstruction. Emphasis on dating methods, developing free-ring chronologies, and evaluating tree-ring dates from various contexts. 2R, 3L. Field trips. (Identical with Anth. 464a-464b and Ws.M. 464a-464b) Dean

470. Introduction to Paleoecology (3) GC II Paleontologic approaches to the reconstruction of ancient environments, populations and communities. Evolution of communities through geologic time. 2R, 3L. Field trips. P, 225, 302. Flessa

474. Geology and the Urban Environment (3) GC I II Geologic processes that result in loss of life and/or property damage; emphasis on case studies of urban areas in the Southwest. Implications for public policy. 2R, 3L. All-day field trips. (Identical with Ping. 474)

475. Cenozoic Mammalian Faunas (3) GC II 1985-86 Continental Cenozoic stratigraphy and mammalian biochronology of North America and other continents. 2R, 3L. Field trips. P, 409. Lindsay

504. Geology of Arizona (3 to 4) I Systematic coverage of Basin and Range province and Colorado Plateau geology as part of the Southern Cordillera, with emphasis on significant problems. Field trips. Consult dept. before enrolling for three unit option. Damon

506. Analytical Techniques in Geology (4) II Strengths and limitations of methods and analysis of geologic material including XRF, XRD, microprobe, AA theory/experience, INAA, and mass spectrometry theory. 3R, 3L. Open to majors only. P, Chem. 103a-103b, Phys. 110, 116, 121 or 103a-103b and 180a-180b.

507. Applied Multispectral Imagery (3) II (Identical with G.En. 507)

509a-509b. Petrology (3-3) Earth composition; spatial and temporal distribution of rock types; application of physicochemical principles to magmatic and metamorphic processes. P, 405, Chem. 480a or CR. Loomis/Ganguly

512. Petrology of Sandstones (3) I Origin, deposition, and diagenesis of sandstones and other terrigenous sedimentary rocks; classification in hand specimens, detrital grains, and thin sections. 2R, 3L. Field trips. P, 405. Schreiber

514. Late Quaternary Geology (3) I How geologic processes affect environment; how late Pleistocene and Holocene paleoenvironments and geochronology have been inferred from stratigraphic records and geomorphology at key localities and archaeological sites. Field trips. P, 101b, 102b. (Identical with Anth. 514) Haynes

520. Meteorites (3) II 1986-87 (Identical with Pty.S. 520)

521. Detailed Structural Analysis (3) II Geometric, kinematic, and dynamic analysis of deformational structures; stereographic and computer treatment of fabric data; experimental deformation; structural analysis in field; report writing. All day field trips every Friday. P, 412. G. Davis

525. Regional Tectonics (3) I Methods of tectonic regionalization and Integration based on lithotectonic assemblages, tectono-stratigraphic terranes, and regional structural analysis. Discussion of types of orogenic systems, plate regimens and their kinematics, economic aspects regional tectonics. Coney

526. Regional Tectonics of the North American Cordillera (3) II Tectonic evolution of the North American Cordillera viewed through the model of plate and accretionary tectonics. Coney
DEPARTMENTS AND COURSES OF INSTRUCTION

527. Advanced Geochemistry (3) I Isotope and trace element geochemistry applied to problems in the origin of the Earth, magmas and mineral deposits, and the evolution of the crust-mantle system. P, 458. (Identical with Pty.S. 527)

528. Nuclear Geology (3) II 1986-87 Nuclear phenomena applied to the solution of geologic problems, with emphasis on radio isotope dating and isotope petrology. (Identical with Pty.S. 528) Damon

535. Aquifer Mechanics (3) I (Identical with Hydr. 535)

536. Development of Groundwater Resources (3) II (Identical with Hydr. 536)

541. Soil Genesis (3) II (Identical with S.W. 541)

542. Ore Deposit Petrology (3) II 1986-87 Orthomagmatic, porphyry base metal, skarn, and leached capping lithologic-mineralogic studies by petrographic microscope, electron probe, and advanced techniques. 1R, 6L. P, 425 or CR, 546a. Guilbert/Titley

543. Mathematical Theory of Magma-Hydrothermal Systems (3) I Dynamics and chronology of natural systems are reconstructed using mathematical systems and computer models to represent the redistribution of thermal and mechanical energy around magma chambers. Norton

544. Theory of Ore Deposition (3) II Application of physical chemistry and allied laboratory techniques to the problems of hydrothermal ore formation. P, Chem. 480a. Eastoe

545. Geochemical Processes in Magma-Hydrothermal Systems (3) II Migration of chemical components in natural fluid-rock systems are analyzed using the geochemical theory that represents irreversible, equilibrium and advection mass transfer. Norton

546a-546b. Advanced Ore Deposit Geology (4-4) Geology characteristics and origin of ore deposits in igneous, sedimentary, and metamorphic rocks. Labs. include field trips, analytical techniques, problem solving. 2R, 6L. P, 303, 405, Chem. 480a or CR. Titley /Guilbert

554. Evolution of Planetary Surfaces (3) II 1986-87 (Identical with Pty.S. 554)


561. Paleoenvironmental Origins (3) II (Identical with Anth. 561)

562. Paleoclimatology and Man (3) I Changing environments of the last 100,000 years; migration, extinction, and domestication in prehistoric time. 2R, 3L. Field trips. (Identical with Geog. 562) Martin

564. Isotope Hydrology (3) I Theory and application of light stable and cosmogenic isotopes to hydrological and paleoenvironmental problems. Radiometric dating of ground water. (Identical with Hydr. 564) Long

565. Isotope Geology (3) II Theory and application of light stable isotopes to petrological, ore deposition, and geothermal problems. Long


567. Inverse Problems in Geophysics (3) I 1986-87 Linear inverse theory, including generalized and stochastic methods, with application to geophysical problems in seismology, gravity, magnetotellurics and other areas. P, Math. 422b. (Identical with Pty.S. 567) Richardson

568. Advanced Seismology (3) II 1985-86 Computational techniques in seismology. The application of synthetic seismograms to model source processes and complex structure. P, 432; Math. 422b. Wallace

571. Constitution and Evolution of the Terrestrial Planets (3) I 1985-86 (Identical with Pty.S. 571)

579. Introduction to Quaternary Macrofossil Analysis (4) [Rpt./1] II Literature and techniques of identification of plant remains including leaves, seeds, and wood of gymnosperms and angiosperms. 2R, 6L. Field Trips. P, Ecol. 472 O. Davis

581. **Quaternary Palynology** (4) II Theory and application of pollen to geology, biology, archaeology, and paleoecology; definition of information pollen sample record; experience in pollen extraction and identification. 3R, 4L. (Identical with Anth. 581)

584. **Sedimentary Basins** (3) II Sedimentologic, stratigraphic, structural, subsidence, thermal, and diagenetic evolution of sedimentary basins in relation to plate tectonic setting. 2R, 3L. *Dickinson*

585. **Petrology of Carbonate Rocks** (3) II Origin, depositional environments, and diagenesis of carbonate and associated chemical and biochemical sedimentary rocks. 2R, 3L. Field trips. P, 405. *Schreiber*

596. **Seminar**
   a. Petrology-Petrography (1 to 4) I II
   b. Structural Geology (1 to 4) I II
   c. Mineral Deposits (1 to 4) I II
   d. Petroleum Geology (1 to 4) I II
   e. Tectonics (1 to 4) I II
   f. Mineralogy-Crystallography (1 to 4) I II
   g. Vertebrate Paleontology (1 to 4) I II
   h. Paleontology (1 to 4) I II
   i. Paleocology-Paleoenvironments (1 to 4) I II
   j. Geomorphology (1 to 4) I II
   k. Geophysics (1 to 4) I II
   l. Geomathematics (1 to 4) I II
   m. Sedimentology (1 to 4) I II
   n. Stratigraphy (1 to 4) I II
   o. Regional Tectonics (1 to 4) I II
   p. Hydrogeology (1 to 3) [Rpt. /2] I II (Identical with Hydr. 596p, which is home)
   q. General Geochronology (1 to 4) I II
   r. Quaternary Geochronology (1 to 4) I II (Identical with Anth. 596r)
   s. Sedimentary Petrography (1 to 4) I II
   t. Organic Geochemistry (1 to 4) I II
   u. Inorganic Geochemistry (1 to 4) I II
   v. Dendrochronology (1 to 4) I II
   w. Palynology (1 to 4) I II
   x. Paleobotany (1 to 4) I II
   y. History of Earth Sciences (1 to 4) I II
   z. Geophysical Data Handling (1 to 4) I II

650. **Field Studies in Geomorphology** (3) II 1985-86 Application of quantitative methods to field problems. 2R, 3L. Field trips (includes spring break field trip). P, 450. *Bull*

651. **Tectonic and Climatic Geomorphology** (3) II 1986-87 Effects of tectonic movements and climatic changes on geomorphic processes, landforms, and soils; paleoclimatic and earthquake-hazards interpretations. 2R, 3L. Field trips (includes spring break field trip). *Bull*


**GERMAN**

Professors Renate A. Schulz, *Acting Head*, Jean R. Beck (*Emeritus*), Max Dufner, David J. Woloshin (*Emeritus*)

Associate Professors David H. Chisholm, Dennis I. Greene, Richard C. Helt, Babette Luz (*Emerita*), Roland Richter

Lecturer John R. Wendel

The Department of German offers courses on German language, literature and culture. The department also offers courses in German and Scandinavian literature in translation and training for secondary-school and college teachers of German as well as for technical translators.

The degrees available are Bachelor of Arts and Master of Arts with a major in German, and Bachelor of Arts in Education and Master of Education with a teaching major in German.
The major: 24 units beyond 201b, including 302a-302b, 315a-315b, 400a-400b, and 410a-410b. Ger. 307a-307b is highly recommended.

The supporting minor must be selected with the assistance and approval of the major adviser.

The teaching major: includes 302a or 302b, 315a-315b, 400b, 410a-410b, 475a, and 479a-479b. Candidates must demonstrate oral proficiency in German at the level of ACTFL ETS Oral Proficiency Advanced Plus. The work done in the College of Education will include S.Ed. 493a, which carries up to ten units of credit. The student may proceed to student teaching after demonstrating the required level of oral proficiency.

The department offers no teaching minor.

For graduate admission and degree requirements, consult the Graduate Catalog.

Honors: The department participates in the Honors Program.

101a-101b-101i. Elementary German (4-4-6) GRD 101i: I Intensive. Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Schulz

201a-201b-201i. Intermediate German (4-4-6) GRD Speaking, understanding, writing, and reading Ger. 201i: II Intensive. P, 101b or 101i. Both 201a and 201b are offered each semester. Helt

207a-207b. Conversation (2-2) GRD Intermediate course for students who wish to concentrate on spoken Ger. P, 101b. 207a is not prerequisite to 207b.

208. Intensive Conversation (4) S Intensive training toward fluency in spoken German; emphasis on frequent idioms and conversational patterns dealing with contemporary life in Germany. Successful completion fulfills foreign language proficiency at 16-unit level. P, three semesters of college level German.

270a-270b. German Literature in Translation (3-3) Reading and discussion of representative works from the 13th century to the present. 270b: Emphasis on modern works after Romanticism. Will not count toward fulfillment of language requirement or a major or minor in Ger. 270a is not prerequisite to 270b. Dufner/Helt

302a-302b. Masterpieces in German Poetry and Prose (3-3) GRD Careful study of significant expressions in literature of German thought and life, with attention to periodic and individual differences in style. P, 201b. 302a is not prerequisite to 302b.

307a-307b. Advanced Conversation (2-2) GRD Intensive practice leading toward fluency in spoken Ger., using material based upon topics of current interest. P, 201b or 207b. 307a is not prerequisite to 307b.

315a-315b. Oral Expression and Written Composition (3-3) GRD Review and practical application of important grammatical principles; vocabulary building. P, 201b or 207b. 315a is not prerequisite to 315b. Richter

345. Yiddish Literature in Translation (3) I GRD Reading and discussion of representative works of Yiddish literature in English translation. (Identical with Or.S. 345)

371. Scandinavian Literature in Translation (3) II GRD Outstanding works of Scandanavian poetry, drama and narrative prose read in English translation to trace their development in relation to intellectual and social evolution of Denmark, Norway, and Sweden. Chisholm

400a-400b. History of German Literature (3-3) GC GRD Historical survey of German literary development from the beginning to the modern period; lectures in Ger., alternating with conferences in Eng. P, six units of upper-division Ger. 400a is not prerequisite to 400b. Greene

405. History of the English Language (3) GC II (Identical with Eng. 405)

410a-410b. Cultural Development of Germany (3-3) GC GRD Social, political, religious, and artistic elements entering into the growth and development of Germany; lectures in English. 410a is not prerequisite to 410b. Dufner/Richter Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

426b. German Art (3) GC II (Identical with Art. 426b)

469a-469b. Germanic Folklore: An Introduction to Nonliterary Forms (3-3) GC Tales, balladry, folk speech, customs and lore of the Germanic people. Readings and lectures in Eng. Readings in Ger. for Ger. majors. 469a is not prerequisite to 469b. (Identical with Eng. 469a-469b)

475a-475b. Advanced Grammar and Stylistics (3-3) GC GRD Practical training in written Ger. through the study of the more complex refinements of German grammar and style, as found in representative documents. P, 315b. 475a is not prerequisite to 475b. Richter
479a-479b. Problems of Teaching German (3-3) GC 479a: Modern methods of language teaching with emphasis on the particular problems presented by Ger. 479b: Emphasis on applied linguistics. 479a is not prerequisite to 479b. Schulz

496. Proseminar
a. Translation (3) [Rpt./2] GC I II P, 315b.

502a-502b. German Lyric Verse from the 16th to the 20th Century (3-3) 1986-87 Introduction to the principles and forms of poetry; analysis and interpretation of outstanding examples of German lyric verse from the 16th through the 20th century. P, 302a, 302b, 400a or 400b. 502a is not prerequisite to 502b. Chisholm

503. Eighteenth-Century German Literature (3) II 1985-86 Klopopstock, Lessing, Wieland, Goethe, Schiller, Hoelderlin and other authors. P, six units of upper-division Ger. Dufner

505a-505b. Nineteenth-Century German Literature (3-3) 1986-87 GRD A survey. P, six units of upper-division Ger. 505a is not prerequisite to 505b. Richter/Helt

507. Goethe's Faust (3) II 1986-87 A close reading of the poem and an introduction to some of the critical secondary literature. P, six units of upper-division Ger. Dufner

509a-509b. Modern German Literature (3-3) GRD 1985-86 Class and collateral reading, lectures and reports, partly in Ger. P, six units of upper-division Ger. 509a is not prerequisite to 509b. Helt

511a-511b. Middle High German (3-3) GRD 1986-87 Brief study of Middle High German grammar; selective readings from representative literary works of the period. P, 302b, 315b.

520a-520b. History of the German Language (3-3) GRD 1985-86 Introduction to Germanic philology; the development of the German language from its roots in the Indo-European language family to New High German. P, eight units of upper-division Ger. (Identical with Engl. 520a-520b)

525. Beowulf (3) II (Identical with Engl. 525, which is home)

527a. Studies in Medieval Language and Literature (3) (Identical with Engl. 527a)

594. Practicum
a. Translation (2 to 5) [Rpt./3] P, 496a or departmental proficiency exam.

596. Seminar
i. Germanic Linguistics (3) [Rpt.] I II (Identical with Engl. 596i, which is home)

597. Workshop
a. Translation (3) [Rpt./3] I II P, competency at third-yr. undergrad. level or pass departmental placement test.

601a-601b. Materials and Methods of Research (2-2) Survey of the tools of literary and linguistic research and methods of dealing with research. 601b concentrates on principles of literary criticism. 601a is not prerequisite to 601b. Chisholm

696. Seminar
a. Literature (2 to 4) I II
b. Linguistics (2 to 4) I II (Identical with Engl. 696b)
c. Folklore (2 to 4) I II (Identical with Engl. 696c)
d. Pedagogy (2 to 4) I II
e. Translation (2 to 4) I II

GERONTOLOGY

Committee on Gerontology

Professors William A. Stini (Anthropology), Chairperson, Daniel R. Boone (Speech and Hearing Sciences), John T. Boyer Internal Medicine, Herbert E. Carter (Biochemistry), Victor A. Christopherson (Family and Consumer Resources), Dorothy I. Marquart (Psychology), Roy G. Spece Jr., (Law), Charles W. Weber (Nutrition and Food Science), Jack H. Wilmore (Exercise and Sport Sciences)

Associate Professors J. Lyle Bootman (Pharmacy Practice), Theodore H. Koff (Management and Policy), Jessie V. Pergrin (Nursing)

Assistant Professor William L. Roberts (Family and Community Medicine)

Because of its multidisciplinary nature, courses in gerontology are located in a number of departments. The Committee on Gerontology plays a facilitating role in the
coordination and development of aging studies and will guide students who wish to include an emphasis in gerontology in their course of study. Although the Committee offers neither an undergraduate nor graduate major it is possible for students to include an emphasis in gerontology in several ways. Students may choose to incorporate courses into their regular degree program to supplement work in their major field. In addition they can pursue a gerontological focus through work in a practicum, internship, independent study or thesis. While no formal recognition is offered it is possible to obtain a rich background in gerontology this way.

Formal recognition for gerontological study is available at both undergraduate and graduate levels. In the College of Arts and Sciences an undergraduate may satisfy requirements for a minor or for Subject Area III in General Studies by following an approved curriculum. The Committee Coordinator serves as minor adviser for these students. At the graduate level the Committee offers a doctoral minor which is most appropriate for students in areas such as education, administration, health, nutrition, and the social and behavioral sciences. A minimum of fifteen units is required. In addition it is possible for graduate students to obtain formal recognition through the Committee’s Gerontology Certificate Program, an eighteen-unit course of study similar to that offered in many other colleges and universities in this country. Both unclassified students and degree candidates may enroll in the program which is designed primarily for individuals planning to enter or to continue in a profession which involves provision of services and/or administration of programs for the aging.

Students should consult with the major department about developing a gerontological emphasis within the major field through course work, research, thesis and dissertation. This most commonly occurs in the departments of Counseling and Guidance, Management and Policy, Psychology, Rehabilitation, Speech and Hearing Sciences, the School of Family and Consumer Resources, and the Colleges of Nursing and Pharmacy. In addition, graduate work with a strong gerontological focus is available in long term care administration (M.P.A.) and gerontological nursing (M.S.).

Courses in other departments identified as having content which deals specifically with elderly and with aging processes include: Coun. 570, C.T. 445, Law 656, Nurs. 589, N.F.S. 538, Ph.Pr. 549, Psyc. 421, M.A.P. 365, 454, 466, 595d, 662, Rhab. 455, Sp.H. 554R, 554L.

Students wishing further information on study in gerontology should contact the Coordinator, Committee on Gerontology, Anthropology 214.

243. Sociology of Adult Life (3) II (Identical with Soc. 243 )
338. Theories of Biological Aging (2) II (Identical with N.F.S. 338 )
406. Social Gerontology. (3) GC II (Identical with Soc. 406 )
413. Issues in Aging (3) GC II (Identical with C.D.F.R. 413 )
435. Psychological Problems of the Aged (3) GC I (Identical with Psyc. 435 )
436. Economics of Aging (3) GCII (Identical with C.S. 436 )
447. Perspectives in Geriatrics Laboratory (1) GC II (Identical with Ph.Pr. 447 )
448. Perspectives in Geriatrics (2) GC II (Identical with Ph.Pr. 448 )
470a. Human Adaptability (3) GC I (Identical with Anth. 470a )
695. Colloquium
   a. Research in Gerontology (1) I II

GOVERNMENT
(See Political Science)

GREEK
(See Classics)
HEALTH-RELATED PROFESSIONS

Professor William H. King
Associate Professors Sue Criswell, Kam Nasser
Assistant Professor Harold Potter, Jr.
Lecturers Sue Habkirk, Judith Nevin, Sr. Joann Thomas

The School of Health-Related Professions, an integral part of the Arizona Health Sciences Center, offers the Bachelor of Science in Health Sciences degree with majors in health education, medical technology, and occupational safety and health; and the Master of Education degree with a major in health education.

Health-Related Professions

210. Introduction to the Health Field (3) I II Interdisciplinary course for the orientation of students to the various health sciences and current health-care concepts. (Identical with Rhab. 210)

301. Social Perspectives of Health Sciences (3) I II Examination of the health sciences and their relationships with economic, political and cultural systems.

302. Introduction to Health Statistics (3) I II Introduction and application of statistics to the health sciences, including basic statistical methods, survey research, indices for health status, sources of health data, and research design.

460. Introduction to Epidemiology (3) GC I II Introduction to the purposes, principles, and methods of epidemiology.

549. Interdisciplinary Approaches to Health Care of the Aged (3) S (Identical with Ph.Pr. 549)

564. Principles and Methods of Epidemiology (3) II Study of chronic diseases and mortality; indices of health, factor-disease associations; measures of disease frequency, study design, data analysis, and interpretation of results; discussion of basic biostatistical procedures.

Health Education

Health education offers preparation for careers focusing on critical societal health problems.

Requirements for admission to the nonteaching option: Engl. 102, or 103 and 104, Chem. 103a-103b, 104a-104b, Psyc. 101, M.C.B. 103, Ecol. 104, 159a-159b, N.F.S. 101, Pol. 103, Soc. 202, Hlth. 178, Ex.S.S. 261, Math. 117e, six units from humanities/arts.

Requirements for admission to the teaching option: Engl. 102 or 103, 104, hum. option (six to eight units), Math. 116, Ecol. 159a-159b, Psyc. 101, Chem. 101a, 102a, Hist. 106 or 107, Hlth. 178, 180, or 181, Pol. 110, N.F.S. 101, Ex.S.S. 261.

The teaching option: 33 units, including Hlth. 330, 430, 431, 432, 433, 434, 437, 440, and Micr. 357. The candidate for the degree with this major must also complete the following education courses: Ed.P. 311, Rdng. 435, S.Ed. 225, 329, 330, 340, 417, 493a, and 494b.

Supporting courses required for students planning careers in community health education: Micr. 357, M.A.P. 100, Soc. 100, Ecol. 321, H.R.P. 302, O.S.H. 486, O.S.H. 487. Additional courses will be selected from an approved list, in consultation with advisers, according to students' individual needs and career objectives.

The teaching minor in health education: Twenty units, including 178, 180, or 181, 330, 433, 434, 437, and Ex.S.S. 261.


Students in the health education teaching option may select any of the approved College of Education teaching minors.
178. **Introduction to Health Science Education** (3) I, II
Introduces and analyzes basic personal and community health problems, with emphasis on current scientific information essential to health promotion and maintenance of individual health.

180. **Secondary School Health Education** (3) I
Emphasis on health science information pertaining to secondary school health instruction programs, community and individual health problems. Credit allowed for this course or 181, but not for both.

181. **Elementary School Health Education** (2) I, II
Emphasis on health science information applicable to elementary health education classes; for students preparing to teach in elementary schools. Credit allowed for this course or 180, but not for both.

330. **Human Sexuality** (3) I, II
Discussion of the basic aspects of human sexuality, including male and female reproductive physiology, congenital defects, venereal disease, myths and fallacies, variations of sexual response.

430. **Critical Analysis of Health Education** (3) GC I
Analysis and evaluation of curriculum, new teaching techniques and administrative trends in health science education; critical discussion of issues, research publications, and current periodicals in the area of health education. P, 180 or 181.

431. **Field Work in Health Education** (3) GC I
On the job participation and observation in health programs of public and voluntary health organizations. Open to health education majors only.

432. **Organization and Administration of School Health Education** (3) GC I
Principles and techniques for organizing and administering school health programs; discussion of curriculum, facilities, personnel, school health legislation, administrative problems.

433. **International Health Problems** (3) GC I
Interprets the major health problems not only of the developed and emerging nations, but also the situations in underdeveloped countries; includes assistance programs by international health groups.

434. **Sex Education** (3) GC II
Critical analysis of the current philosophy, principles, programs, problems, trends and basic issues in sex education on the elementary, junior high and high school levels.

435. **Safety Education and Accident Prevention** (3) GC II
Analysis of accident prevention programs in schools, colleges, communities, and industry, with emphasis on specific protective measures pertaining to athletics, physical education, recreation, highway safety, and vocational training.

436. **Traffic Safety Education** (3) GC I, II
Principles of accident prevention and traffic survival education, with emphasis on the certification of secondary school teachers preparing to teach driver education and training.

437. **Contemporary Community Health Problems** (3) GC II
Analysis of the concept of community health services, human ecology, and conservation of human resources, with emphasis on modern miasmas such as air, water, and noise pollution; sociological problems of alcohol, alcoholism, and drug abuse. P, 178.

440. **Survey of Health Education Literature** (3) GC II
Examination of health education literature from ancient societies to present, including an analysis of current health literature from various professional, community, voluntary, public and international health organizations.

448. **Perspectives in Geriatrics for Health Professionals** (3) GC II (Identical with Ph.Pr. 448)

475. **Alcohol Abuse and Alcoholism** (1) GC S
Review of the nature and ramifications of alcohol problems, as well as analysis of physical, psychological and social implications.

496. **Proseminar**
a. **Tobacco, Alcohol, and Narcotics** (3) GC I, II

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**Medical Technology**

Director: Dr. Sue Criswell

Medical technology is the health profession responsible for clinical laboratory analysis, including quantitative, qualitative, and morphological measurements which assist the physician in clinical diagnosis and treatment.

Completion of the medical technology program, accredited by the American Medical Association and the National Accrediting Agency for Clinical Laboratory Sciences, qualifies the individual for various National Registry examinations.
Requirements for admission to the program: Engl. 101 or 103, and Engl. 102 or 104, Hum. 250 (or two hum. opt.)*, soc. sci. (twelve units)*, Math. 117e and 118 or 117f, 125a or 263, C.Sc. 111 or 115 or S.I.E. 272, Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b, Ecol. 159a-159b, Phys. 102a-102b, 180a-180b, Micr. 110. In addition, the following courses are required: Chem. 322, 323, N.F.S. 406a-406b or Chem. 460 and Micr. 450, V.Sc. 423, Micr. 419, 420R and 420L.

The major: 49 units as follows: 387, 481a-481b, 482a-482b, 483a-483b, 484a-484b, 485, 496a.

*See College of Arts and Sciences section of this catalog.

387. Problems In Medical Technology (3) II Medical lab. procedures and theory. 2R, 3L.

481a-481b. Clinical Laboratory: Hematology (6-4) GC [Rpt./1] S Basic hematology and hematological procedures including cell structure and function, inherited and acquired anomalies, hemostasis, cell enumeration and differentiation, cytogenetics. P, committee permission.

482a-482b. Clinical Laboratory: Immunology and Immunohematology (4-4) GC [Rpt./1] Serological methods used in the clinical laboratory and interpretation of results; blood banking procedures. P, committee permission.

483a-483b. Clinical Laboratory: Chemistry (6-6) GC [Rpt./1] Fundamental concepts of clinical laboratory chemistry including pathophysiology and clinical correlations. P, committee permission.

484a-484b. Clinical Laboratory: Microbiology and Parasitology (5-6) GC [Rpt./1] Clinical laboratory techniques to safely and accurately culture or isolate and identify pathogenic organisms; physiological consequences of parasitism and the role of the laboratory in treatment. P, committee permission.

485. Clinical Laboratory: Sciences (2) GC [Rpt./1] I Basic principles of instrumentation, laboratory mathematics, biostatistics, quality control, toxicology, nuclear medicine, laboratory management and laboratory safety. P, committee permission

496. Proseminar
   a. Senior Proseminar (2) II P, 387.

Occupational Safety and Health

Director: Dr. M. Van Ert

The occupational safety and health program is concerned with training students in the recognition, evaluation and control of environmental factors and stresses arising from the work place and causing sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or citizens of the community.

Students may elect a concentration in industrial hygiene or industrial safety.

Requirements for admission to the program: Engl. 102 or 103, 104, 308, H.R.P. 210, hum. option (four units)*, Sp.C. 112, Psyc. 101, Econ. 210, soc. sci. (three units)*, S.I.E. 170R, 170L, Math. 117e, 125a-125b, Chem. 103a-103b, 104a-104b, 241a, 243a, Ecol. 159a, Phys. 102a-102b or 103a-103b, 180a-180b, ex.s.s. (two units).


*See College of Arts and Sciences section of this catalog.

402. Industrial Hygiene Instrumentation and Analysis (3) GC II Introduction to field sampling instruments, concepts, quality control, and statistical analysis, with emphasis on instrument selection and calibration. 2R, 3L. P, 486a, Chem. 322, 323, and CR Chem. 324.

410. Physical Exposures (3) GC II Recognition, evaluation, and control of physical exposures, including radiation, noise, vibration, and heat stress. Student is required to recognize potential exposures, use correct instrumentation to collect and evaluate data, and develop controls. 2R, 3L. P, 486a.

320  DEPARTMENTS AND COURSES OF INSTRUCTION

486.  Fundamentals of Industrial Hygiene (3) GC I  Introduction to the principles of occupational safety and health, with emphasis on industrial hygiene aspects including recognition, evaluation, and control of environmental and industrial health hazards. (Identical with C.E. 486 and Fin. 486 and Tox. 486)

487.  Advanced Industrial Hygiene and Safety (3) GC II  An in-depth coverage of the industrial hygiene and safety professions emphasizing the principles of contaminant generation and behavior, the design of industrial hygiene/safety programs, and survey of industrial plants. P, 486. (Identical with C.E. 487, Fin. 487 and Tox. 487)

488.  Applied Industrial Safety (3) GC II  Thorough study of technical safety topics such as fire technology, systems safety, manual materials handling; selected topics in construction and manufacturing safety. P, 486b.

495.  Colloquium  

HEALTH SERVICES ADMINISTRATION  
(See Management and Policy)

HEBREW  
(See Oriental Studies)

HIGHER EDUCATION  

Center for the Study of Higher Education

Professor Larry L. Leslie, Director, Don L. Bowen (Management and Policy), Clifton F. Conrad, Vine Deloria, Jr. (Political Science), Lawrence O. Nelson (Educational Foundations and Administration), F. Robert Paulsen (Educational Foundations and Administration)

Associate Professors Donal M. Sacken (Educational Foundations and Administration)

The major objectives of the Center for the Study of Higher Education are the development and dissemination of knowledge about higher education policy and operation; instruction at the graduate level leading to graduate degrees; facilitation of research by faculty members and students; and research studies and service activities for state and institutional needs and national, international, and regional governmental units and organizations.

The Center offers programs leading to the Master of Arts, Master of Education, Doctor of Philosophy, and Doctor of Education degrees with a major in higher education. For admission and degree program please see the Graduate Catalog.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

497.  Workshop  
a. Fiscal Stress in Higher Education (1) [Rpt./1] GC I

560.  Higher Education in the United States (3) I  The scope of higher education in the United States; brief survey of historical developments and philosophic bases; public policy issues at the state and federal level; types of institutions and their purposes; characteristics of faculty, students and curricula.

562.  Foundations of Student Personnel Work in Higher Education (3) I  Orientation to student personnel work in colleges and universities; interdisciplinary foundations; professional aspects; integrated lab. experience in selected campus settings. (Identical with Coun. 602)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>607</td>
<td>The College Student (3) I History and characteristics of the college student; interactions with campus environmental influences; developmental and normative trends; major research findings.</td>
<td>(Identical with Coun. 607)</td>
</tr>
<tr>
<td>609</td>
<td>Organization and Administration in Higher Education (3) I Organizational theory, structures, systems, and administrative procedures in varied higher education institutions; patterns of governance and policy development.</td>
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<tr>
<td>610</td>
<td>History and Philosophy of Higher Education (3) II Historical backgrounds and philosophical bases for higher education from early beginnings, through the medieval period, the Renaissance and the Enlightenment, to the modern day.</td>
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</tr>
<tr>
<td>615</td>
<td>Adult Education and Development (3) I Analysis of adult education and development; characteristics of adult learners and behavior; and the consideration of life-long learning.</td>
<td>(Identical with Ed.P. 615)</td>
</tr>
<tr>
<td>617</td>
<td>Student Personnel Services in Higher Education (3) II Student personnel services; purposes; procedures; representative programs; current trends.</td>
<td>(Identical with Coun. 617)</td>
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<tr>
<td>620</td>
<td>History and Philosophy of Higher Education (3) II Early classical curriculum; development and administration of general education and professional studies; modern curriculum developments and innovations.</td>
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<tr>
<td>621</td>
<td>Teaching in Higher Education (3) II Planning, organizing, and evaluating learning experiences for mature students.</td>
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<tr>
<td>625</td>
<td>Administration of Academic Programs (3) I Administration of all phases of the academic area, including curriculum, personnel, facilities, financing, planning, evaluation and accreditation, with attention to newer delivery systems, nontraditional education, contract plans and potential future developments. Field trips.</td>
<td>P, 601 or 609.</td>
</tr>
<tr>
<td>640</td>
<td>Institutional Research and Planning (3) I Development of institutional research programs for short-term and long-term planning; input and output measures.</td>
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<tr>
<td>641</td>
<td>Computer Applications in Higher Education (3) II Administrative uses of computers in higher education institutions; teaching with computers; computer as a research tool; information networks; public service applications. Field trips.</td>
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<tr>
<td>650</td>
<td>Higher Education Finance (3) I Historical patterns of financing private and public higher education; current sources and types of financial support; alternative methods of financing; social benefits and consumer theories.</td>
<td>Field trips.</td>
</tr>
<tr>
<td>651</td>
<td>Higher Education Business Management (3) II Budget planning and execution; systems of resource allocation; personnel management; physical plant planning and construction; information systems and use in management.</td>
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<tr>
<td>675</td>
<td>The Law and American Education (3) I (Identical with Ed.F.A. 675)</td>
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<tr>
<td>677</td>
<td>Higher Education and the Law (3) II Critical court decisions, past and present, affecting higher education; increasing role of the courts in decision making and policy development. Field trips.</td>
<td>P, 601, 609, 610, 620 or 650, (Identical with Ed.F.A. 677)</td>
</tr>
<tr>
<td>693</td>
<td>Internship</td>
<td>a. Administrative Internship (3 to 9) I II</td>
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<td>b. Instructional Internship (3 to 8) I II Biweekly seminar meetings required. P, bachelor's degree plus twelve units, 621 (for students without a subject-field methods course), 615, 560.</td>
</tr>
<tr>
<td>695</td>
<td>Colloquium</td>
<td>a. Community College Developments (1 to 3) I 1985-86 Field trips.</td>
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<tr>
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<td></td>
<td>c. Public Policy Issues in Higher Education (1) [Rpt.] I II</td>
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<td>d. Community Colleges in the Future (1) [Rpt.] I II</td>
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<tr>
<td>696</td>
<td>Seminar</td>
<td>a. Community College Administration (3) I II Field trips.</td>
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<td></td>
<td>d. Governance and Coordination (3) I II Field trips.</td>
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<td>e. Topics in Higher Education (1) [Rpt./2] I II.</td>
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<td>f. Topics in Community College Education (1) [Rpt./2] I II.</td>
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<td></td>
<td>g. Topics in Higher Education Administration (1) [Rpt./2] I II.</td>
</tr>
<tr>
<td>697</td>
<td>Workshop</td>
<td>a. Collective Negotiations (1 to 3) I II (Identical with Ed.F.A. 697a, which is home)</td>
</tr>
<tr>
<td>796</td>
<td>Seminar</td>
<td>a. Research in Higher Education Administration (3) I II.</td>
</tr>
</tbody>
</table>
HINDI
(See Oriental Studies)

HISTORY

Professors Donald Weinstein, Head, Ludwig W. Adamec (Oriental Studies), Herman E. Bateman (Emeritus), Gail Bernstein (Oriental Studies), Robert P. Browder, Paul A. Carter, William G. Dever (Oriental Studies), Leonard Dinnerstein, James Donohoe, Harwood Hinton, Ursula Lamb (Emerita), Murdo MacLeod, James M. Mahar (Oriental Studies), John V. Mering, Michael C. Meyer, Roger L. Nichols, Heiko A. Oberman, J. Gregory Oswald, Thomas W. Parker (Emeritus), Michael Schaller, William H. Sewell, Boyd Shafer (Emeritus), Jing-shen Tao (Oriental Studies), Robert Vignery


Assistant Professors Karen S. Anderson, Michael E. Bonine (Oriental Studies)

Lecturer William R. Noyes

The Department of History offers courses designed to provide broad perspectives on the human past, with more specialized instruction in particular areas and periods, and with theoretical and practical training in historical research.

The department offers the degrees of Bachelor of Arts, Master of Arts and Doctor of Philosophy with a major in history. A Bachelor of Arts in Education and a Master of Education with a teaching major in history are also available. For information on graduate degrees, please see the Graduate Catalog.

The major: 33 units, including 396a, three units in a course dealing with the period before 1500, and six units in each of three of the following areas: United States, Latin America, Europe, and Comparative history. (Hist. 228a-228b, 247, 430, 458, and other courses the department may approve, including many special topics courses, may be counted toward the Comparative area.) No fewer than eighteen units must be upper-division. No more than three units of independent study or six units of internship may be applied toward the major. Hist. 101-102 or 103-104, but not both, may be applied toward the major.

The supporting minor should be selected from foreign languages, the humanities, the social sciences, and other subjects as may be individually justified.

The teaching minor: 21 units, including 101-102 or 103-104, 106-107, one upper-division United States history course, and two other history courses.

Honors: The department participates in the Honors Program.

101. Introduction to the History of the Western World to the 17th Century (3) I II CDT A survey of Western development from antiquity to the 17th century, with emphasis on social and political institutions.

102. Introduction to the History of the Western World since the 17th Century (3) I II CDT A survey of Western development from the 17th century to the present, with emphasis on social and political institutions.

103. Introduction to Western Civilization to the End of the Middle Ages (3) I The cultural history of the West from classical Greece to the end of the Middle Ages with emphasis on art, philosophy and religion.

104. Introduction to Western Civilization: End of Middle Ages to Present (3) II The cultural history of the West from the end of the Middle Ages to the present, with emphasis on art, philosophy and religion.

106. History of the United States from 1607 to 1877 (3) I II CDT Political, economic, and social history of the American people from the founding of colonial Jamestown to 1877.
107. History of the United States from 1877 to the Present (3) I II CDT Political, economic, and social history of the American people from the end of Reconstruction to the present.

117. History of England to 1603 (3) I Survey of English history from pre-history to 1603, with emphasis on legal and constitutional history. Cosgrove

118. History of England from 1603 to the Present (3) II Survey of English history from 1603 to present, with emphasis on political and social history. Cosgrove

159. Colonial Latin America to 1700 (3) II 1986-87 A survey of the African, Amerindian, and European backgrounds to Latin America. MacLeod

160. The Latin American Nations, 1700-1880 (3) I Latin America from colonial status to the modern era. Brubaker

161. Modern Latin America (3) II Latin America from 1880 to the present. Latin America’s entry into the twentieth century. Brubaker

170a-170b. Introduction to Asian Civilizations (3-3) (Identical with Or.S. 170a-170b)

171. Ancient Civilizations of the Near East (3) I (Identical with Or.S. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II (Identical with Or.S. 172)

204. Ancient History: Greek History (3) I A political, social and cultural history of Greek civilization from the Bronze Age to the death of Alexander the Great. (Identical with Clas. 204) deLaix

205. Ancient History: Roman History (3) II A survey of Roman civilization from the founding of the monarchy to the emporership of Constantine the Great. (Identical with Clas. 205) deLaix

214a-214b. History of Modern Europe (3-3) Emphasis on political, social and economic developments. 214a: From the Renaissance to Waterloo. 214b: From the Congress of Vienna to the present. 214a is not prerequisite to 214b. Sewell

215. The Two World Wars (3) I The origins and consequences of World War I and World War II. Oswald

227. Nuclear Age (3) II 1985-86 The impact of nuclear science and technology on 20th century society. An examination of the nuclear arms race and the Cold War. The exploration of outer space. (Identical with Pol. 227) Lenoir

228a-228b. The Evolution of Scientific Thought (3-3) The growth of scientific thought and achievement from antiquity to the 20th century, with emphasis on the social, cultural and intellectual factors instrumental in shaping modern science. 228a is not prerequisite to 228b. Lenoir

230. The History of Black America (3) I History of the Blacks in the United States from their African origins until the present. (Identical with Bl.S. 230)

233. History of the Mexican American (3) I Survey from the 16th century to the present, with emphasis on social, political and economic trends in their historical context. (Identical with M.A.S. 233) Garcia

236. Indians in U.S. History (3) History of Indians in U.S. development from 1500 to the present with emphasis on relations between competing Indian groups and between Indians and whites. Nichols

244. Western America (3) Survey of the patterns of American expansion and settlement in the western United States. Nichols

245. Frontier America (3) Survey of the patterns of frontier expansion and settlement in the eastern and mid-western United States. Nichols

247. Science and Society (3) I The historical impact of science on society; selected examples of the interaction of science with religion, politics, art, literature, and social thought from the 16th century to the present. Lenoir

253a-253b. History of Women in the United States (3) Changing role of women in American society from colonial times to the present. (Identical with W.S. 253a-253b) Anderson

315. United States Military History (3) I Survey of American wars from colonial times to the present; military institutions, doctrine, application of the principles of war, campaign strategies and tactics, technology, and leadership. Oswald

339. Tradition, Technology and Business (3) Traces the technological aspects of North Atlantic civilization and culture with emphasis on the role of technology in nineteenth and twentieth century capitalist development. Rebel
347. The Old South (3) Social and political history from Jamestown to secession. (Identical with Bl.S. 347) Gaines

348. The South Since the Civil War (3) From the Civil War to the present. (Identical with Bl.S. 348) Mering

368. Mexico (3) From discovery through the War for Independence. (Identical with M.A.S. 368) MacLeod/Meyer

369. Mexico since Independence (3) Struggle for political, economic and social stability; international relations, cultural patterns. (Identical with M.A.S. 369) Meyer

370a-370b. History of the Jews (3-3) (Identical with Or.S. 370a-370b)

372a-372b. History and Religion of Israel in Ancient Times (3-3) (Identical with Or.S. 372a-372b)

374. The Holocaust (3) (Identical with Or.S. 374)

375a-375b. History of China (3-3) (Identical with Or.S. 375a-375b)

396. Proseminar

401. Ancient Mesopotamia (3) GC I 1986-87 (Identical with Anth. 401)

402. History of Biology (3) GC II Great writings in biology and medicine. (Identical with Ecol. 402) Lenior

403a-403b. History of Greece (3-3) GC 403a: From prehistoric times to the outbreak of the Peloponnesian War. 403b: From the outbreak of the Peloponnesian War to the end of the Hellenistic Age. 403a is not prerequisite to 403b. (Identical with Clas. 403a-403b) de Laix

404a-404b. History of Rome (3-3) GC 404a: The Republic to the death of Caesar. 404b: The Empire through the reign of Constantine the Great. 404a is not prerequisite to 404b. (Identical with Clas. 404a-404b) de Laix

405a-405b. Medieval Europe (3-3) GC Major institutions and trends in Europe from the breakup of the Roman World to the 15th century. 405a is not prerequisite to 405b. (Identical with Reli. 405a-405b) Bernstein

406. Medieval England (3) GC I From the Roman conquest to the War of the Roses, with emphasis on political, economic, and cultural developments. Bernstein

407. Intellectual History of Medieval Europe (3) GC II Fusion of the Greco-Roman, Christian, and German traditions and analysis of major medieval cultural and intellectual achievements. (Identical with Reli. 407) Bernstein

408. The Renaissance (3) GC I Social, economic, cultural, and religious history of the 14th and 15th centuries; humanism, artistic revolution, and new world discoveries. (Identical with Reli. 408) Weinstein

409. The Reformation (3) GC II Social, economic, cultural, and religious history of the 16th and early 17th centuries; the Protestant revolt, Catholic Reformation and Counter-Reformation. (Identical with Reli. 409) Oberman

410. History of Hell in Early Europe (3) GC II The concept of punishment after death in Western Europe from the Bible to Dante. Includes the Hebrew, Greco-Roman, Germanic, and Christian traditions. (Identical with Reli. 410) Bernstein

411. European Intellectual History to 1750 (3) GC I Dominant themes in European intellectual history from the end of the Middle Ages to the period of the Enlightenment. Reading and discussions of texts from Petrarch to Locke. Donohoe

412. European Intellectual History: 1750 to 20th Century (3) GC II Dominant themes in European intellectual history from about 1750 to the 20th century. Reading and discussions of texts from David Hume to Friedrich Nietzsche. Donohoe

413. War and Peace in Europe (3) GC II European background to contemporary international relations from the Congress of Vienna through the outbreak of World War II. Browder

414. Medieval and Early Modern Germany (3) GC I The political, social, economic and cultural history of Germany from the late Middle Ages to about 1800. Donohoe/Rebel

415. Modern Germany (3) GC II The political, social, economic and cultural history of Germany from the period of the French Revolution to the present. Donohoe/Rebel
416. Tudor-Stuart England (3) GC I An intensive study of English history from the accession of Edward IV to the Hanoverian dynasty. (Identical with Reli. 416) Cosgrove

417. History of Modern Britain (3) GC II An intensive study of English history from the accession of George III to the present. Cosgrove

418. France under the Old Regime, 1589-1789 (3) GC I French political development, institutions, and culture from Henry IV to the eve of the French Revolution. Vignery

419. The French Enlightenment (3) GC I Cultural history of France in the 18th century, with emphasis on the works of the philosophes. Vignery

420. The French Revolution and Napoleon (3) GC II The origins and progress of the Revolution in France. Vignery

421. History of Russia: Early Period (3) GC I Political, socio-economic, and cultural history of Russia in medieval and early modern times. Kellogg

422. History of Russia: Modern Period (3) GC II Political, socio-economic, and cultural history of Russia in the modern era until the Bolshevik Revolution. Kellogg

423. Intellectual History of Russia (3) GC II The historical significance of social, political, and revolutionary thought in 19th- and 20th-century Russia. Oswald

424. The Russian Revolutions (3) GC I The era of reform and revolutions in Russia from 1890 to 1921, culminating in the formation of the Soviet regime. Browder

425. History of the Soviet Union (3) GC I The Bolshevik Revolution and problems of Soviet Russian history from 1917 to the present. Oswald


427. Russian-American Relations: 1781 to the Present (3) GC II Diplomatic, social, economic and cultural relations between Russia and the United States. Browder

429. The Scientific Revolution, 1500-1700 (3) GC II The individuals, theories, and institutions that contributed to the rise of early modern science, in their relation to the intellectual and cultural trends of the period. Lenoir

431. Colonial America (3) GC I The experience and evolving institutions of the North Atlantic colonists from the first landings to the end of the French and Indian War. Marietta

432. The Era of the American Revolution (3) GC II Origins, progress, and character of the struggle against Great Britain; internal political, constitutional, social, and economic developments; the problems of the "Critical Period" and the making of the Constitution. Marietta

433. Jefferson and the New Nation, 1790-1825 (3) GC I The Federalists and the rise of the Republican party; a biographical, economic, political and social history of the early North, South and expanding West. Gaines

434. The Jacksonian Era, 1825-1850 (3) GC I II Political, social and economic developments in the United States from the adoption of the Monroe Doctrine through the Mexican War. Gaines/Mering

435. The Coming of the Civil War, U.S. 1845-1861 (3) GC I Political, constitutional, social and economic developments in the U.S. from the Mexican War through the Civil War. (Identical with Bl.S. 435) Mering

436. Civil War and Reconstruction, U.S. 1861-1878 (3) GC II Political, constitutional, economic, and military developments in the U.S. and the Confederacy during and after the Civil War. (Identical with Bl.S. 436) Mering

437. U.S. 1876-1919 The Gilded Age and Progressive Era (3) GC Examination of economic, social and political developments in years of rapid industrialization from the end of Reconstruction through World War I. Carter

438. U.S. 1918-1945 From World War I through World War II (3) GC Prosperity, Depression and the New Deal in peace and war. Carter/Garcia

440. United States: 1945 to Present (3) GC I II American society and the role of the United States in world affairs from the Yalta Conference to the present. Dinnerstein/Schaller

442. History of American Society and Thought: Pre-Civil War (3) GC I American political, religious, cultural and philosophical ideas as expressed in colonial, revolutionary, and pre-Civil War society. Carter
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Department</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Course Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>443</td>
<td>History of American Society and Thought Since the Civil War (3) GC II</td>
<td></td>
<td></td>
<td></td>
<td>The transformation of American minds since the Civil War as expressed in literary, philosophic, religious, and other cultural forms. Carter</td>
</tr>
<tr>
<td>446</td>
<td>History of Arizona (3) GC I</td>
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<td></td>
<td></td>
<td>The history of Arizona from the entrance of the Spaniards in 1539 to its emergence as a modern state in the Southwest. Hinton</td>
</tr>
<tr>
<td>449</td>
<td>History of American Foreign Relations to 1914 (3) GC I</td>
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<td></td>
<td></td>
<td>Examines the rise of America from a struggling colony to a world class power, including its relations with Europe, Latin America and Asia. Schaller</td>
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<tr>
<td>450</td>
<td>History of American Foreign Relations since 1914 (3) GC II</td>
<td></td>
<td></td>
<td></td>
<td>Examines the pivotal role played by the United States in world affairs since WWI, focusing on America's struggle with revolutionary movements in Europe, Asia and Latin America. Schaller</td>
</tr>
<tr>
<td>451</td>
<td>The United States and East Asia: 1840 to the Present (3) GC II 1986-87</td>
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<td></td>
<td></td>
<td>An examination of American interaction with Japan and China since the Opium Wars, with special attention given to economic, cultural, and military relations and conflicts. (Identical with Or.S. 451) Schaller</td>
</tr>
<tr>
<td>452</td>
<td>American Ethnic History (3) GC II A history of the various ethnic minorities in America from Colonial times to the present, with emphasis on adjustment, acculturation and degrees of assimilation. (Identical with Bl.S. 452) Dinnerstein/Garcia</td>
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<tr>
<td>453</td>
<td>History of Women and Work (3) GC I History of women and work in western and non-western nations from prehistoric times to the present. (Identical with W.S. 453) Anderson</td>
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<td>455</td>
<td>Feminism: A Comparative History (3) GC II International history of feminism as an ideology and a political movement from the 17th century to the present. (Identical with W.S. 458) Anderson</td>
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<td>456</td>
<td>Historical Archaeology (3) GC II (Identical with Anth. 459)</td>
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<td>457</td>
<td>History of the Hispanic Borderlands (3) GC II The Spanish and Mexican experience in the Southwest from the 16th century to 1848. (Identical with M.A.S. 460)</td>
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<td>460</td>
<td>The Iberian Empires (3) GC II European background to, and results of, Iberian expansion from the 15th through 17th centuries. Spanish colonialism in the New World is contrasted with Portuguese systems in the East. MacLeod</td>
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<td>462</td>
<td>Intellectual History of Latin America since 1810 (3) GC II 1986-87 Latin American thought from Independence to the 20th century; major Latin American thinkers and writers, and influences from Europe and the United States. Brubaker</td>
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<td>463</td>
<td>Marxism in East Asia (3) GC I (Identical with Or.S. 463)</td>
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<td>464</td>
<td>History of Argentina (3) GC I Survey of Argentine history and culture from the colonial era to the present. Guy</td>
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<td>465</td>
<td>History of Spain (3) GC I II S History of Spain from remote times to the present; emphasis on the period from 1492, Spain's role in the world and the Spanish Civil War; Spain's cultural contributions. Brubaker</td>
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<td>466</td>
<td>History of Brazil (3) GC II Brazil's political, economic, social and intellectual development. Guy</td>
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<td>467</td>
<td>Contemporary Latin America (3) GC II Revolution, social change and reaction in Latin America from 1930 to the present. Guy</td>
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<td>468</td>
<td>Asia and the West (3) GC I (Identical with Or.S. 468)</td>
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<td>469</td>
<td>History of Women in Latin America (3) GC II Women's history in Latin America from the Conquest to the present. (Identical with W.S. 469) Guy</td>
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<td>471</td>
<td>Introduction to Indic Civilization (3) GC I (Identical with Or.S. 471)</td>
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<td>472</td>
<td>History of Medieval India (3) GC I 1985-86 (Identical with Or.S. 472)</td>
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<td>473</td>
<td>History of Modern India and Pakistan: 1750-Present (3) GC II 1985-86 (Identical with Or.S. 473)</td>
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<td>474a-474b-474c</td>
<td>History of Japan (3-3-3) GC (Identical with Or.S. 474a-474b-474c)</td>
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<td>475a-475b-475c-475d-475e</td>
<td>Periods in Chinese History (3-3-3-3-3) GC (Identical with Or.S. 475a-475b-475c-475d-475e)</td>
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<td>476</td>
<td>Modern Chinese History (3) GC (Identical with Or.S. 476)</td>
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<td>477a-477b</td>
<td>History of the Middle East (3-3) GC (Identical with Or.S. 477a-477b)</td>
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<td>478</td>
<td>Modern History of the Middle East (3) GC I (Identical with Or.S. 478)</td>
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<td>479</td>
<td>The Ottoman Empire to 1800 (3) GC II 1986-87 (Identical with Or.S. 479)</td>
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480a-480b. History of Iran and Central Asia (3-3) GC (Identical with Or.S. 480a-480b)

482. Social History of China (3) GC (Identical with Or.S. 482)

488. History of Byzantium (3) GC II Political, social, and cultural history of Byzantium from A.D. 325 to 1453, including the Byzantine legacy in Europe and the Middle East. (Identical with Clas. 488) Kellogg

489. Women in East Asia (3) GC I (Identical with Or.S. 489)

495. Colloquium
a. Revolution in Chinese History (3) GC I II (Identical with Or.S. 495a, which is home)
b. Studies in Black America (3) GC I II (Identical with Bl.S. 495b)
c. The Mexican American (3) GC I II (Identical with M.A.S. 495c)
d. Modern Chinese Frontier Areas (3) GC I 1985-86 (Identical with Or.S. 495d) Hedtke

496. Proseminar
a. Historical Research and Writing (3) GC I II

595. Colloquium
Certain colloquia in Oriental studies may be used for hist. grad. credit.
a. Advanced Studies in United States History (3) I II
b. Advanced Studies in Latin American History (3) I II
c. Advanced Studies in European History (3) I II
d. Applied History (3) I Field trips. (Identical with La.S. 595d)
e. Advanced Studies in the History of Women (3) I II GRD (Identical with W.S. 595e)
f. Advanced Studies in Ancient History (3) II Consult department before enrolling. (Identical with Clas. 595f)

596. Seminar
Certain seminars in Oriental studies may be used for hist. grad. credit.
a. Colonial U. S. History (3) I II  g. Nineteenth-Century Europe (3) I II
b. Nineteenth-Century U. S. History (3) I II  h. Twentieth-Century Europe (3) I II
c. Twentieth-Century U. S. History (3) I II  i. Colonial Latin America (3) I II
d. Ancient History (3) I II  j. Latin America: Modern Period (3) I II
e. Medieval Europe (3) I II  k. Historical Writing and Editing (3) I II
f. Early Modern Europe (3) I II  l. History of Science (3) I II

597. Workshop
a. College Teaching (1) I

HISTORY AND PHILOSOPHY OF SCIENCE

Committee on History and Philosophy of Science (Graduate)

Professors Leon Blitzer (Physics), William A. Longacre (Anthropology)
Associate Professors Henry C. Byerly (Philosophy), Chairperson, Robert M. Harnish (Philosophy), Timothy Lenoir (History), Richard E. Michod (Ecology and Evolutionary Biology)

History of science deals with the origins and development of the human quest for understanding of the world in which we live. Philosophy of science treats the logical analysis of scientific reasoning, the clarification of fundamental scientific concepts, and methodological problems common to many fields of inquiry.

The committee offers a Doctor of Philosophy minor in the history and philosophy of science. For admission and degree requirements, please see the Graduate Catalog.

HOME ECONOMICS
(See Family and Consumer Resources)

HOME MANAGEMENT
(See Family and Consumer Resources)
HONORS PROGRAM

The Honors Program exists to provide special opportunities to those students who
demonstrate the highest levels of maturity, self-direction, creativity, intellectual curiosity, and
scholarship. These opportunities include special classes, a variety of small group and inde-
pendent study options, and certain academic privileges.

The University-wide Honors Program is jointly sponsored by the Honors Center and
the various participating academic departments. All honors offerings are identified by the
suffix “H” attached to the course number. Prior to registering for any course designated as
an “H” section, students should check with the University-wide Honors Program to see if
admission to the program is a prerequisite for the course. The courses listed below require
such admission before registration in the course. The honors offerings sponsored by the
Honors Program are as follows:

280H. Student Planning Board (1 to 3) [Rpt.] I II Open to select honors students interested in working
in the Honors Program organization.

295H. Honors Colloquium (2) [Rpt.] I II Small group discussion of special topics. Open to all honors
students.

380H. Peer Leadership (3) I II Open to select upper-division honors students who are considering
college teaching as a potential career.

In addition to the above Honors Center courses, honors courses are offered by indi-
vidual departments. Certain of the departmental honors courses are standardized, and all
departments participating in the Honors Program offer these courses:

299Ha-299Hb. Honors Readings (1 to 3) Selected topic readings under faculty supervision.
GRADES AVAILABLE: A, B, C, D, E, I, W

399Ha-399Hb-399Hc. Honors Independent Study (3-3-3) A three-semester sequence leading to
"Graduation with Honors."
GRADES AVAILABLE: A, B, C, D, E, I, W

Individual departments will offer other honors courses in addition to those described
above. Such courses might be 396H, Honors Proseminar; Ed.F.A. 495Ha, 495Hd, Ed.P.
495Hb; or Engl. 495Ha, 495Hb; or courses designated by any number followed by an “H”.
Students in the Honors Program should check catalog and schedule-of-hours listings to
determine what offerings are available.

Additional information regarding departmental Honors Programs can be obtained by
contacting departmental honors advisers or the Honors Center.

HORTICULTURE
(See Plant Sciences)

HUMAN SERVICES ADMINISTRATION
(See Management and Policy)

HUMANITIES

Associate Professor Jon Solomon, Director
Lecturer Donna E. Swaim

250a-250b-250c. Introduction to Humanities (4-4-4) The cultural life of the Western world as it devel-
oped in literature, art and philosophy from the Greeks to the present. P, Engl. 101, 102, 104; 102,
104; or 103, 104, 250a, 250b, and 250c are offered each semester.

355. Contemporary Complexities (4) I II [Rpt./1] An interdisciplinary survey of contemporary culture
from 1940 to the present as expressed in literature, art, and philosophy. Field trips. P, Humanities
250a or 250b or 250c. May be repeated with department approval.
HYDROLOGY AND WATER RESOURCES

Professors Nathan Buras, Head, Donald R. Davis, Stanley N. Davis, Lucien Duckstein, Daniel D. Evans, Martin M. Fogel (Watershed Management), John W. Harshbarger (Emeritus), Simon Ince, Thomas Maddock, III, Shlomo P. Neuman, Eugene S. Simpson, David A. Woolhiser (Adjunct)

Associate Professors Michael D. Bradley, Soroosh Sorooshian

Assistant Professor Roger C. Bales

Hydrology and water resources include the origin, distribution, and properties of the waters of the Earth, as well as the development and management of water resource systems for multiple purposes. The faculty offers competence in hydrogeology, hydrogeochemistry, ground-water and surface-water hydrology, mathematical and statistical methods in hydrology (including numerical modeling), and water resource planning, management and administration.

The department offers the Bachelor of Science in Hydrology and the Master of Science and Doctor of Philosophy degrees with majors in both hydrology and water resources administration. See College of Engineering section of this catalog for the undergraduate requirements. For information regarding graduate degrees, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.

Hydrology

101a-101b. Water and the Environment (4-4) Relation of physical and biological sciences to the understanding of the water cycle; man's impact on water resources, with emphasis on factors affecting the availability and quality of water in arid and humid regions. 3R, 3L. Field trips. 101a is not prerequisite to 101b. Open to nonmajors only.

150. Principles of Hydrology (3) II Basic principles of hydrology dealing with the chemical, physical, and biological aspects of water movement and mass transfer; techniques of measurement of hydrologic variables; relations used by man to develop water supplies. 2R, 3L.

296. Proseminar a. Hydrology (1) [Rpt./1] II

350. Environmental Hydrology (3) II Chemical and physical properties of water in relation to man's use; transport and dispersion of pollutants in surface and subsurface water; chemical and transport models. 2R, 3L. Field trips. P, Chem. 103a-103b, Math. 125b, S.I.E. 170.

405. Hydrology of Unsaturated Media (3) GC I Physical properties and processes of unsaturated media related to storage and movement of water and transport of contaminants. P, Phys. 103b, Math. 125b. (Identical with S.W.405)

414a-414b. Field Hydrology (Summer Camp) (3-3) GC S Field methods of collection, compilation, and interpretation of data in surface and ground-water hydrology; investigation of a small water resources project; preparation of hydrologic reports. Daily field work. Fee.

423. Hydrology (3) GC I (Identical with C.E. 423)


457. Physical Oceanology and Limnology for Hydrologists (2) GC II 1985-86 Origin, distribution, and characteristics of oceanic water; advective and convective processes; estuarine and
DEPARTMENTS AND COURSES OF INSTRUCTION

shoreline processes; effect on coastal aquifers; classification and hydrologic regimen of lakes. P, Math. 125b.

502. Snow Hydrology (2) I 1986-87 (Identical with Ws.M. 502)


504. Numerical Methods in Subsurface Hydrology (4) II Finite difference and finite element methods for subsurface fluid flow and mass or energy transport; applications to aquifers, unsaturated soils, seepage through earth dams, geothermal systems. 3R, 3L. P, Math. 422a.

506. Water Quality Dynamics (3) II Chemical and physical methods are used to study the quality of ground and surface waters with emphasis on electrolyte chemistry, heterogeneous processes, colloids, and surface processes including sorption phenomena. Equilibrium and dynamic models of water chemistry. P, Chem. 480a or 350.


536. Development of Ground-Water Resources (3) II Analytic techniques to evaluate geohydrologic systems; case histories used to study management of ground- and surface-water resources; planning and design of regional water resource investigations. Field trips. P, 535. (Identical with Geos. 536)


545. Advanced Statistical Hydrology (3) I 1986-87 Advanced application of statistics and probability to hydrology and water resources; multivariate modeling, choice of models and parameters, simulation, Bayesian decision theory. P, 445.

564. Isotope Hydrology (3) (Identical with Geos. 564)

565. Hydrochemistry (3) II 1985-86 (Identical with S.W. 565)

596. Seminar
p. Hydrogeology (1 to 3) [Rpt./2] I II (Identical with Geos. 596p)

603. Well Hydraulics and Pumping Test Analysis (2) II 1986-87 Flow to wells in aquifers, with emphasis on design and interpretation of pumping tests; confined, unconfined, and leaky aquifer systems; fractured rocks; automatic curve matching. P, 503 or 535, Math. 422a.

605. Soil Water Dynamics (3) II 1986-87 (Identical with S.W. 605)


695. Colloquium
a. Hydrology (1 to 3) [Rpt./1] I II

696. Seminar
b. Unsaturated Flow (2 to 3) I II
c. Regional Hydrologic Analysis (1 to 3) II P, 423, 435.
d. Desert Hydrology (1 to 3) [Rpt./2] I II 1986-87
e. Pollutants in the Hydrologic Environment (1 to 3) I II

Water Resources Administration

250. Introduction to Water Resources (3) I Introductory examination of water resources from a physical, institutional, and historical perspective; effects of man's intervention in the hydrologic cycle; planning and management of water resource systems at local, national, and international levels. Field trip.

401. Introduction to Water Resources Management (3) GC II Water resources projects as instruments for implementing socioeconomic policies; the role of behavioral sciences (social, legal, economic, political, and psychological) in planning the development, conservation, and utilization of water resources; environmental influences of water resources projects. (Identical with Geog. 401)
461. Population and Resources (3) GC I (Identical with Geog. 461)
476. Natural Resource Economics (3) GC II (Identical with A.Ec. 476)
480. Forest Policy and Administration (3) GC II (Identical with Ws.M. 480)
481. Environmental Policy (3) GC II (Identical with Pol. 481)
501a-501b. Water Resources Policy and Administration (3-3) Institutional and policy aspects of water resources administration; management, organizational theory, and international problems of water use and development; ground-water management and policy. 501a is not prerequisite to 501b.
525. Water Quality Modeling (3) I (Identical with C.E. 525).
526. Water Quality Management (3) II Optimization and systems analysis techniques used in modeling; current models used in formulation and implementation of water quality policy. P, 525. (Identical with C.E. 526).
544a-544b. Quantitative Methods in Water Resources Administration (3-3) Applications of quantitative methods to water resource management; benefit-cost analysis, and optimization. 544a: Structure and basis of planning process; Principles and Standards. 544b: Operations research methods (linear, quadratic, and dynamic programming). P, FORTRAN, microeconomics, Math. 125a. 544a is not prerequisite to 544b.
556. Finite State Methods in Water Resources Management (3) II 1986-87 Finite state methods; applications to natural resource systems as arise in hydrology, ecology, and earth sciences, including the modeling of interfaces such as socioeconomic processes. P, Math. 254, S.I.E. 170. (Identical with S.I.E. 556)
576a-576b. Advanced Natural Resource Economics (3-3) (Identical with A.Ec. 576a-576b)
643. Water Resources Systems Analysis (3) I Applications of mathematical programming to the analysis of interactions of hydrology, engineering, economics, and socio-institutional environment in regional water resources systems. P, 544b or consult dept. before enrolling.
695. Colloquium
   b. Water Resources Administration (1 to 3) [Rpt./1] I II
696. Seminar
   h. Long-Range Resource Planning (1 to 3) [Rpt./2] I
   i. International Water Resource Management (1 to 3) [Rpt./2] I
   m. Water Storage Systems (1 to 3) [Rpt/1] II P, consult department before enrolling.

INDUSTRIAL ENGINEERING
(See Systems and Industrial Engineering)

INTERDISCIPLINARY PROGRAMS

The Office of Interdisciplinary Programs coordinates both interdisciplinary programs and courses. Such programs are described under "Office of Interdisciplinary Programs" in the General Divisions of the University section of this catalog.

In most cases, interdisciplinary courses are listed under a "home" department and crosslisted in a variety of other departments. Such courses would not appear in this section. Those interdisciplinary courses for which no department acts as "home" are listed below.

596. Seminar
   u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Arch. 596u, Geog. 596u, L.Ar. 596u, Psyc. 596u, and Ping. 596u).

INTERIOR DESIGN
(See Family and Consumer Resources)
IRRIGATION
(See Soils, Water and Engineering)

ITALIAN
(See French and Italian)

JAPANESE
(See Oriental Studies)

JOURNALISM

Professors Philip Mangelsdorf, Head, Donald W. Carson, Abraham S. Chanin, George W. Ridge, Jr.
Associate Professors Ford N. Burkhart, William F. Greer, James W. Johnson
Assistant Professors C. Bickford Lucas, Jimmy D. Patten, Jacqueline E. Sharkey

The department's program is designed to balance a student's development in the theory and practice of journalism, with an even stronger emphasis on the humanities, arts and sciences. The department offers instruction in the basic reporting, writing and editing skills necessary to begin a journalism career. The program also requires courses that provide students with an understanding of journalism's role in the growth of America and its society. The department offers programs combining the major in journalism with that in Oriental studies or Latin American studies.

The department offers the degrees of Bachelor of Arts and Master of Arts with a major in journalism. For graduate admission and degree requirements consult the Graduate Catalog. A Bachelor of Arts in Education with a teaching major in journalism also is available.

The major in journalism: twenty-six units in addition to the general education requirements for the Bachelor of Arts degree described in the College of Arts and Sciences section of this catalog. All majors must take 205, 206, 208, 301, 302, 320, 470. In addition, students must select one of the following areas of emphasis: the emphasis in newspapers--413, 450 or 451, and one from 411, 412, 415 and 452; emphasis in magazines-- 412, 451 or 452, and one from 411, 412, or 415; emphasis in community journalism-- 413, 450 and one from 411, 412, 415, 451, 452; emphasis in photojournalism-- 403, 450 or 451, and one from 411, 412, 413, 452, 497. Jour. 450 may be repeated with permission. No more than 33 units of journalism will count toward the 125 units needed for the degree.

All majors must complete at least six units in the social or natural sciences in addition to those units required by the College of Arts and Sciences. All majors must complete at least nine units in Engl. writing or lit. in addition to the freshman Engl. units required by the College.

The supporting minor: Students are strongly advised to minor or obtain a second major in econ., Engl. writing or literature, hist., pol., a modern language, anth., psyc., soc. or the natural sciences.

The teaching major: thirty units, including 205, 206, 208, 301, 302, 320, 411 or 413; 450, 470.

The teaching minor: twenty units, including 205, 206, 301, 302, 320, 422, 470.
Honors: The department participates in the Honors Program.

The Arizona Journalism Institute: The department sponsors the Arizona Journalism Institute, a permanent center for study and conference among professional journalists in the state.

Freedom of the Press Award: Each year the department gives a plaque, under the name the John Peter Zenger Award, to a journalist whose professional work has made an outstanding contribution to the preservation of freedom of the press and the people's right to know.

Publications: The department publishes the local edition of The Tombstone Epitaph; the South Tucson Independiente; and The Pretentious Idea, a media review. In addition, the department operates the Arizona News Service, a program in which students report on state
government and the legislature for 50 community newspapers. During the spring semester, the department awards the Don Bolles Fellowship to permit one student to work full time in Phoenix covering the legislature.

Guadalajara Exchange: Students interested in Latin American reporting are offered a one-year exchange program with the School of Journalism at the Autonomous University of Guadalajara in Mexico. The Department of Journalism is accredited by the Accrediting Council on Education for Journalism and Mass Communications.

151. **News in Mass Communications** (3) I II Designed to acquaint the nonjournalist with communications techniques used by newspapers, wire services, information agencies, news magazines and broadcast news; analysis of social and historical influence on the news media.


206. **Advanced Reporting** (3) I II Comprehensive and accurate news presentation, with emphasis on interview techniques and coverage of major news stories. P, 205.

208. **Law and Ethics of Journalism** (3) I Libel; introduction to press freedom and responsibility.

301. **Photojournalism** (2) I II Reporting and interpreting the news through pictures.

302. **Photojournalism Laboratory** (1) I II Open to majors only. P, CR 301.

305. **Broadcast Writing** (3) I II (Identical with R.T.V. 305)

320. **Editing** (2) I II Theory and techniques of copy editing and headline writing; training on video display terminals. 1R, 3L. P, 208, 206 or CR. Department permission required.


364. **Creative Advertising** (3) I II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Mktg. 364)

366. **Public Relations** (3) I II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Mktg. 366)

403. **Advanced Photojournalism** (3) GC I II Open to majors only. P, 301, 302.

405. **The Study of News** (3) GC I II Critical study and problem analysis of the media. Field work may include publication of conclusions.

411. **News Features** (3) GC I II Writing the basic news feature article; specialized reporting and rewriting techniques. P, 206. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).


413. **Reporting Public Affairs** (3) GC I II Study and practice of newsgathering on executive, legislative, and judicial levels in city, county, state and federal governments, with emphasis on news sources and interpretive writing. P, 206, 208. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

414. **The News Agency: Arizona News Service** (1) GC [Rpt.] I II Role and operations of the news agency, wire service or syndicate. Class members will form staff of Arizona News Service to supply client newspapers from bureaus in Tucson and Phoenix. Field trips. P or CR, 411 or 413.

415. **The Editorial Page** (3) GC I II Critical study of opinion-makers, with emphasis on editors and public-affairs columnists; analysis of editorial pages in a changing society; writing of editorials. P, 206.

416. **The Weekly Newspaper** (3) GC I II Community and suburban weeklies, including problems of news coverage, production, advertising and circulation. Integration of electronic text systems. Field trips.

417. **Sports News Writing** (3) GC I Students will cover sports events and write sports features. Interview and rewriting techniques. P, 206.

422. **Publications Layout and Design** (3) GC I Theory and practice of layout, typography, and design for magazines. P, permission of dept.

450. **Community Journalism: The Tombstone Epitaph** (3) GC [Rpt.] I II Class members work as editorial staff to produce the local newspaper for Tombstone, Arizona. Intensive study of problems and responsibilities of community newspapers. P, 206, 208, 301, 320, discussion of preparation with instructor.

451. **Community Journalism: El Independiente** (3) GC [Rpt.] I II Class members work as editorial staff to produce a publication for the city of South Tucson. Intensive study of problems and responsibilities of journalism. P, 206, 208, 301, 320, discussion of preparation with instructor.

452. **Press Criticism: The Pretentious Idea** (3) GC I II Study of press criticism, including the publication of a press review. Open to majors only. P, 206, 208, 320, discussion of preparation with instructor.

470. **The Press and Society** (3) GC I II Critical study of press performance in current affairs; changing requirements for socially responsible and professional journalism in a democracy. (Identical with R.T.V. 470)

471. **International Communications** (3) GC I II Study of world news systems, including newsgathering agencies, role of the foreign correspondent, the foreign press, and factors influencing international news flow.

497. **Workshop**  
   a. **Color Photography** (2) [Rpt./1] GC S Two-week field trip with fee.

502. **Freedom of Expression** (3) II Analysis of access and barriers to information and communication at local, state, national and international levels; intensive study of the legal relationship between mass media and society. Open to majors only.

509. **Media in the Twentieth Century** (3) I The social, cultural, and economic role of a free press in American society. Interaction of press and government at judicial, executive, and legislative levels.

596. **Seminar**  
   a. **History of Mass Media** (3) I II  
   b. **International Communications** (3) I II  
   c. **Reporting Governmental Affairs** (3) I II  
   d. **Magazines** (3) I II  
   e. **Electronic Media** (3) I II  
   f. **Community Journalism** (3) I II  
   g. **Journalism Education** (3) I II  
   h. **Latin-American Press** (3) I II  
   i. **News Analysis** (3) I II  
   j. **Media Organization** (3) I II

660. **Research Methodologies I** (3) I (Identical with Sp.C. 660)

670. **Research Methodologies II** (3) II (Identical with Sp.C. 670)

**LANDSCAPE ARCHITECTURE**  
(See Renewable Natural Resources)

**LATIN**  
(See Classics)

**LATIN AMERICAN STUDIES**  
*Latin American Area Center*

Director: Michael C. Meyer  
Assistant Director: Susan M. Deeds

*Committee on Latin American Studies*

Professors Michael C. Meyer (History), **Director**, Donald W. Carson (Journalism), Roger Fox (Agricultural Economics), Lanin A. Gyurko (Spanish and Portuguese), Boris S. Kozolchyk (Law), Edward J. Williams (Political Science)
Associate Professor Celestino Fernández (Sociology)
Assistant Professor Susan M. Deeds

The Latin American Area Center offers an interdisciplinary program designed primarily for students planning government, business, teaching, or other careers. The Center offers a Bachelor of Arts degree, a Master of Arts degree, and a doctoral minor in Latin American studies. A student with an interest in the Latin American area selects a concentration in one department and enriches that concentration with related studies, cultural or professional, in other departments.

Students admitted to the B.A. program must complete a minimum of thirty upper-division units (courses numbered 300 and above) and choose a concentration from one of the following: anthropology; economics; geography and regional development; history; political science; Portuguese; and Spanish. A minimum of twelve upper-division units must be chosen from the concentration.

A minimum of eighteen upper-division units, with no fewer than six in any one department, must be selected from two or three departments offering related studies: agricultural economics; anthropology; art history; business and public administration; economics; English as a second language; educational foundations and administration; family and consumer resources; geography and regional development; history; journalism; music; political science; Portuguese; sociology; and Spanish. A student may not duplicate in related studies the department chosen for the concentration. La.S. 495a must be taken once; upon consultation with an adviser, credit for this course may be applied toward the concentration or the related studies.

The student must demonstrate proficiency in either Portuguese or Spanish, depending upon the student’s career goals, by completion of Port. 202b or Span. 305 with a grade of "B," or by an equivalency exam.

Honors: The department participates in the Honors Program.

495. Colloquium
   a. Latin American Studies (3) GC II P, Span. or Port. proficiency. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

595. Colloquium
d. Applied History (3) I (Identical with Hist. 595d, which is home)

596. Seminar
   a. Latin American Studies (3) I P, Span. or Port. proficiency.

The College of Law offers course work leading to the Juris Doctor degree. The course program has been thoroughly revised and expanded to include a modernized set of required courses and a wide variety of problem-method courses, seminars and clinical programs. For course descriptions and degree requirements, please see the College of Law Catalog.

600. Contracts (5)

601a-601b. Introduction to Legal Process and Civil Procedure (3-2)
DEPARTMENTS AND COURSES OF INSTRUCTION

602. Criminal Procedure (4)
603. Research and Writing (2)
604a-604b. Torts (2-3)
605. Property (5)
606. Constitutional Law (4)
607. Appellate Practice and Moot Court (1)
608. Evidence (4)
609. The Legal Profession (2)
610. Decedents’ Estates (2) I
611. Trusts and Fiduciary Administration (4) II
612. Family Law (2) II
613. Law and Medicine (2) II
614. Workers’ Compensation (2) II
616. Private Corporations (3) I
617. Corporate Finance (2) II P, 616.
618. Antitrust Law (3) II
620. Immigration Law (2) I
621. Administrative Law (3) I
622. Law Review (1 to 3) I II
623. Conflict of Laws (3) II
624. Labor Law (3) I
626. Jurisprudence (3) I
628. Comparative Law (3) I
630. Legal Process (3) II
631. Indian Law (2) I
633. Commercial Transactions (4) I II
634. Products Liability (2) II
635a-635b. Insurance (2 - 3) I 635a is not prerequisite to 635b.
636. Federal Tax Procedure (2) II P, 646.
638. Real Estate Transactions (3) II
639. Community Property (2) I
640. Mining and Public Land Law (3) I
641. Water Law (3) I
642. Federal Jurisdiction (3) II
643. Arizona Civil Procedure (3) II
644a-644b. Remedies (1-3)
645a-645b. Trial Practice (2 - 3) P, 608, 609.
646. Federal Income Taxation (5) I
647. Corporate Taxation (3) II P, 646.
648. Estate and Gift Taxation and Basic Estate Planning (3) I P, 610, 611.
649. Torts II (3) II
650. Criminal Law (3) II
651. Accounting and the Law (2) II
652. Income Taxation of Estates and Trusts (2) II P, 611, 646.
653. Advanced Appellate Practice and Moot Court (2) II
654. The First Amendment (3) II
655. Civil War Amendments (3) I
656. Law of the Elderly (2) I
658. Securities Regulation (3) II
659. Growth Controls (3) II (identical with Geog. 659, which is home)
660. Land-Use Planning (3) II
661. Moot Court Board (2) I II
662. Creditors' Remedies and Bankruptcy (3) II
665a-665b. Interviewing, Counseling and Negotiation (1-1) 665a is not prerequisite to 665b.
666. Lawyering Skills Outside the Courtroom (2) II P or CR 696cc or substantial clerking experience.
669. Preservation of Historic Environments (3) II 1985-86 (Identical with Ping. 669, which is home)
696. Seminar
   c. Juvenile Delinquency (2) I P, 609.
   e. Business Planning (3) II P, 616, 647.
   f. Current Constitutional Problems (3) I
   g. Mass Communication (3) II
   j. Child, Family and State (3) I
   m. Landlord and Tenant (2) I
   o. Law and Psychiatry (3) I
   t. Law and Technology (3) I II
   bb. Advanced Civil Procedure (3) I
   cc. Clinical Practice (2) I II P, 608, 609, 645.

LIBRARY SCIENCE
(Graduate Library School)

Professors Margaret F. Maxwell, Acting Director, Ellen Altman, Donald C. Dickinson, Lawrence Clark Powell (Emeritus), Elinor C. Saltus (Emerita), Arnulfo D. Trejo (Emeritus)

Associate Professors Helen M. Gothberg, Peter Hernon, Helen Renthal (Emerita), Rodes Trautman, Ronald A. Van De Voorde

The Graduate Library School offers programs for students who wish to follow a professional career in library work. Courses emphasize the basic aims of the profession: to acquire, organize, and make information available to the public.

Advanced degree is the Master of Library Science. For admission and degree requirements, please see the Graduate Catalog.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

417. Media in Instruction (3) GC I II S (Identical with S.Ed. 417)
441. Children's Literature in Spanish (3) GC I (Identical with Span. 441)
443. Mexican-American Literature (3) GC II (Identical with Span. 443)
480. Literature for Children (3) GC I II Literature to promote literary appreciation and to meet the interests and needs of elementary school children. (Identical with Rdng. 480)
485. Literature for Adolescents (3) GC I II Literature to meet recreational and developmental needs of the junior and senior high school age, including some books for adults. Reviewing and book talks. (Identical with Rdng. 485)
486. Oral Presentation of Children's Literature (2) GC II Principles and techniques of storytelling and of reading aloud to children; stories for different age groups, presentation of picture stories; practice in reading and telling stories and in planning the story hour. P, 480.

487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)

488. Microcomputer Application in Education (3) GC I II S (Identical with Ed.F.A. 488)


503. Library Collection Development (2) I II Principles of collection development; evaluation and review of materials; selection tools; acquisition of materials; problems in selection, including censorship.

504. Foundations of Library and Information Services (2) I II Elements of librarianship, historical backgrounds, types of libraries, the role of the library in American life, current issues.

505. Basic Reference (3) I II Survey of general reference sources; discussion of reference technique.

506. Research Methods (2) I II Need and opportunities for research in librarianship; types of research; research methodology; study of research design; elementary statistics.

507. Library Management (3) I II Introduction to management concepts, the organizational structure of libraries, systems analysis, financial administration and the utilization of library personnel.

509. Information Sources for Agricultural Scientists (1) I (Identical with Agri. 509)

510. Introduction to Information Science (3) Methods, theories, and technology of information science; elements of computer programming and systems design; implementation and management of computer systems in libraries and information centers.

511. Information Storage and Retrieval (3) Student involvement in on-line, interactive systems. P, 510.

512. Automation in Libraries (3) I II Introduction to automated procedures currently in use in libraries, including systems analysis of actual technical services and planning for their automation. P, 510.


515. Library Cooperation and Networks (3) Study of the background and state of the art of library cooperative systems, networks, and bibliographic utilities.

520. Technical Service Problems (3) I Examination of problems in acquisitions, cataloging, serials, and other areas related to activities in academic, public, school, and special libraries; consideration of developing technology. P, 502.


522. Automated Alternatives to the Library Catalog (1) II Alternatives to the card catalog with consideration given to type of library function, size, and budget; comparisons of card, printed book, on-line, and micro-image catalogs. Field trips. P, 502, 505.

523. Indexing and Abstracting (3) II Theory and current practices for compiling manual and computer-produced indexes; vocabulary control and thesaurus construction; production and evaluation of indexes and abstracts.

526. Introduction to Bibliography (3) Introduction and critical examination of various styles of bibliographic description; practical application in construction of a systematic bibliography. P, 505.

530. Public Librarianship (3) I Administration of tax-supported libraries serving the general public, including problems of governmental relationships, community responsibilities, financial support, buildings, personnel, collections. P, 507.

534. Library Service to Children and Young Adults (1) I Investigation of the programs and materials useful in working with children and young adults in libraries. P, 480.

540. Academic Librarianship (3) I Present trends in academic libraries, including financial administration, collection evaluation, personnel requirements and building needs. P, 507.

550. Special Librarianship (3) II Mission, organization and administration of the special library. P, 507 or equivalent experience.
LINGUISTICS

560. History of Books and Printing (3) I Survey of the history of books and printing from early times to the present, including development of the alphabet, manuscript books, the invention and dissemination of printing and modern printing techniques.

561. History of Children's Literature (3) II Survey of literature for children in England and America from earliest times to the close of the 19th century, together with study of cultural and social values reflected in the literature. (Identical with Elem. 561, Engl. 561, and Rndg. 561)


563. Communication in Libraries: Public Service (1) II Problems of face-to-face communication at public service desks.

570. Information Sources and Services in the Sciences (3) I Creation, organization, and dissemination of scientific and technical literature; reference function and problems of bibliographic control. A science background is not required. P, 505.

571. Information Sources in the Social Sciences and Humanities (3) II Advanced bibliographic and reference sources in the humanities and social sciences, with emphasis on the structure of knowledge in the various disciplines and evaluation of user services. P, 505.

573. Government Publications (3) II Examination of the varieties of government publications available from municipal, county, state, national and international agencies, with emphasis on selection and use of publications of the U. S. government.

576. Administration of Reference (2) I Theory of information service, policy development, special services, and administration of reference services. Open to majors only. P, 505.


582. Audiovisual Materials in Libraries (2) I Introduction to AV information resources for the library.

600. Introduction to Graduate Study in Music (3) (Identical with Mus. 600)

607. Planning Library Services (3) I The total planning cycle as a management approach to various library/information center services. Open to majors only. P, 506.

616. Coordination of Instructional Media Programs (3) (Identical with S.Ed. 616)

617. Preparation of Instructional Materials (3) II (Identical with S.Ed. 617)

693. Internship
   a. Academic Library (2 to 4) [Rpt./1] I II S. P, 502, 503, 505, 507, CR 540.
   b. Special Library (2 to 4) [Rpt./1] I II S. P, 502, 503, 505, 507, CR 550.
   c. Public Library (2 to 4) I II S. P, 502, 503, 505, 507, CR 530.
   d. School Library (2 to 4) [Rpt./1] I II P, 480 (elementary only) or 485 (secondary only), 502, 503, 505, CR 581.
   e. Community College Library (2 to 4) [Rpt./1] I II S P, 503, 504, 507.

695. Colloquium
   a. Theory of Classification (1 to 3) I II
   g. Laboratory in Library Communications (1 to 3) I II
   f. Issues in Library and Information Science (1 to 3) [Rpt./4 units]

LINGUISTICS

Professors Peter W. Culicover, Head, Richard Demers, Robert Michael Harnish (Philosophy), Adrienne Lehrer, Susan Steele
Associate Professor Richard T. Oehrle
Assistant Professor Ann Farmer

Linguistics is a science concerned with the nature of human language. Individual linguists may concentrate their studies on a particular language or a small number of languages, but the ultimate goal is to acquire an understanding of the universal properties of human language.

The Department of Linguistics offers programs leading to a Bachelor of Arts, a Master of Arts, and a Doctor of Philosophy with a major in linguistics. For graduate admission and degree requirements, please see the Graduate Catalog.
The major for the B.A.: Thirty units in ling., including 101, 495a, one year of coursework in a non-Indo-European language, and different courses chosen from each of the following fields: (1) Syntax (200, 300 or 400). (2) Phonology: (200, 413, or 414). (3) Phonetics: (260, 413, or Sp.H. 367). (4) Semantics: (422, 464, or 465). (5) Historical Linguistics: (430, 480, or Engl. 405. (6) Language Structure: (210, Span. 423a-423b, Or.S. 411a-411b, 420a-420b, 426). Majors are urged to continue their foreign language study beyond the minimum 16 units required by the college.

Coursework for the supporting minor is selected in consultation with the undergraduate adviser.

101. Introduction to Linguistics (3) I II S Survey of linguistic concepts and methods: communication among animals; physiology of human speech; elementary phonetics, syntax, and language change; language and the brain; language and thought.

102. Linguistics for Native American Communities (3) I S Introduction to descriptive linguistics for Native Americans; practical linguistic and social issues in Native American languages; phonetics and phonology; orthography; dialects and language change; classroom applications. (Identical with A.In.S. 102)

200. Fundamentals of Linguistic Analysis (3) II The basic nature of linguistic investigation with the aim of discovering some of the regularities of language structure. P, 101.

203a-203b. Elementary Navajo Language (4-4) Speaking, reading, writing, understanding and transcribing. (Identical with A.In.S. 203a-203b)

207a-207b. Elementary Papago Language (3-3) GRD Speaking, reading, writing, and oral comprehension in the Papago language. 3R, 1L. (Identical with A.In.S. 207a-207b)

210. Native Languages of North America (3) I Genetic and typological diversity of North American native languages; areal features, i.e., characteristics spread over a geographical region; and the history of the study of these languages, concentrating on individuals and the problems of classification. (Identical with A.In.S. 210)

222. The Structures and Sources of American English Words (3) I II Linguistic principles governing the internal structure of English words and the ways in which new words are created, with a focus on spelling, sounds and morphemes.

260. Speech Science (4) II (Identical with Sp.H. 260)

276. The Nature of Language (3) I II (Identical with Anth. 276)


303. Sex Differences and Language (3) I 1985-86 (Identical with Anth. 303)

376. Introduction to the Philosophy of Language (3) I 1986-87 (Identical with Phil. 376)


411a-411b. Modern Japanese Grammar (3-3) GC (Identical with Or.S. 411a-411b)

413. Introduction to Phonetics and Phonology (3) GC Analysis of the articulatory and acoustic properties of the sounds used in human language. Introduction to basic notions of phonological theory, with emphasis on motivating the distinctive features.

414. Fundamentals of Phonological Theory (3) GC Principles which underlie current theories of phonology, concentrating on sound patterns and alternations and the relationship of these topics to linguistic rules.

417a-417b. Sanskrit Grammar and Texts (3-3) GC 1986-87 (Identical with Or.S. 417a-417b)

420a-420b. Linguistic Structure of Modern Chinese (3-3) GC (Identical with Or.S. 420a-420b)

422. Linguistic Semantics and Lexicology (3) GC II 1986-87 Study of word and sentence meanings, relationship between the lexicon and the grammar, idioms, metaphor, etymology, and change of meaning. P, one course in ling. (Identical with Phil. 422)

423a-423b. Theory of Spanish Syntax (3-3) GC (Identical with Span. 423a-423b)

426. Introduction to Arabic Linguistics (3) GC (Identical with Or.S. 426)

427. Applied Spanish Linguistics (3) GC I (Identical with Span. 427)
429. Pedagogical Linguistics: Applied Linguistics for Language Teachers (3) GC II (Identical with Or.S. 429)

430. Language Variation (3) GC I Study of geographical and social dialects, stylistic differences, and idiolectal variation and the implications of variation for writing grammars and for understanding language change. P, one course in ling.


450. Language and Social Issues (3) GC II S 1985-86 Systematic investigation of selected topics in social issues involving language from a linguistics perspective; "standard" versus "nonstandard" language, minority dialects, language attitudes and prejudice, and the role of language in the educational system.

451. Acquisition of Speech and Language (3) GC II (Identical with Sp.H. 451)

452. Linguistics and the Study of Literature (3) GC II 1986-87 Linguistic methods in the analysis of literature and implications of literary language for linguistic theory; detailed consideration of prosody, metaphor, narrative technique and irony. (Identical with Engl. 461)

454. Semantics (3) GC 1985-86 (Identical with Phil. 464)

455. Pragmatics (3) GC 1985-86 Study of language use, its relationship to language structure and context; topics such as speech acts, presupposition, implication, performatives, conversations. (Identical with Phil. 465)

473. Natural Language Processing (3) GC II 1986-87 Introduction to the processes underlying speech production and comprehension: speech sounds, words, parsing, semantics and pragmatics. (Identical with Phil. 473)

476. Language in Culture (3) GC II (Identical with Anth. 476)

477. Discourse and Text (3) GC II 1985-86 (Identical with Anth. 477)

480. Historical Comparative Linguistics (3) GC I (Identical with Anth. 480)

495. Colloquium

a. Linguistics (1) [Rpt./3] GC I

500. Linguistics for Nonmajors (3) I Conceptual foundations, methodology, and current theoretical frameworks. Students will carry out actual linguistic analysis. For students in fields other than linguistics.


502. Advanced Syntax (3) I Analysis of various grammatical constructions; treatments of the distinction between local and nonlocal dependencies. P, 501.

514. Advanced Phonology (3) I Phonological processes of natural language and their theoretical treatment including standard generative phonology and multilinear extensions of it, such as autosegmental phonology and metrical phonology. P, 413.

540. Language Change and Reconstruction (3) II Introduction to the methods in, theory of, and problems in reconstruction of phonology, syntax, and semantics. Data will be drawn from a variety of the world's language families, but will concentrate on American Indian languages and languages with little or no written record.

544. Language Universals (3) I Consideration, from a typological viewpoint, of aspects of the phonological, syntactic, and semantic systems of a representative sample of the world's languages.

583. Sociolinguistics (3) I (Identical with Anth. 583)

596. Seminar

u. Case and Paninian Grammar (3) [Rpt.] II 1985-86 (Identical with Or.S. 596u, which is home)

600. Current Issues in Linguistic Research (3) [Rpt./1] Current research in linguistics, with emphasis on relationships among syntax, semantics, and phonology.

696. Seminar

a. Syntax and Semantics (3) [Rpt./2] I II
b. Topics in Phonological Theory (3) [Rpt./2] I II
c. Diachronic Linguistics (3) [Rpt./2] I II
d. Current Issues in Syntactic Theory (3) II [Rpt./2]
f. Linguistic Investigations and Applications (3) I II (Identical with Sp.C. 696f, which is home)
MANAGEMENT
See Management and Policy

MANAGEMENT AND POLICY


Associate Professors Nicholas J. Aquilano, Michael K. Block, Robert W. Buckingham, Jon B. Christianson, Marvin Fortman, Vernon L. Greene, Theodore H. Koff, David A. Tansik, Robert E. Tindall, Ronald J. Vogel

Assistant Professors Lawton R. Burns, J. Richard Harrison, Bharat Kaku, Margaret A. Neale, Gregory B. Northcraft, Richard B. Polley, David Torres, W. Gary Wagner, Douglas Wholey

Lecturers Louie B. Chester, Donald Leckie, Robert Wallace, William W. Wissler

The Department of Management and Policy offers course work focusing on the task of integrating human and material resources in the development, implementation and evaluation of organizational strategies in the public and private sectors. The curriculum is designed to prepare students for a wide variety of managerial and staff positions, as well as for postgraduate work in such fields as business, public administration and law. The department participates in the following undergraduate degrees:

Bachelor of Science in Public Administration with majors in health services administration, public management, human services administration, criminal justice administration and public recreation administration.*

Bachelor of Science in Business Administration with majors in operations management and personnel management.

For degree requirements, please see the College of Business and Public Administration section of this catalog.

The Department offers a selection of courses open only to participants in the University Honors program. Emphasis is on smaller classes, individual instruction and critical thinking. For details contact the department honors adviser.

The Master of Science with a major in management and policy is also available, and the department participates in the Master of Business Administration, Master of Public Administration, and the Doctor of Philosophy with a major in business administration programs. For admission and degree requirements please see the Graduate Catalog.

The course listing to follow divides courses into groups serving majors in business administration and public administration degree programs. However, students in either program may take courses in any group for which they have the necessary prerequisites.

*The public recreation administration major is under review. See department head for information.

General Management and Policy


320.* Business Law (3) I II Nature and sources of business law; the judicial system; contract, sales, and agency law; unfair trade practices.

375.* Statistical Inference in Management (3) I II GRD Further topics in statistical analysis and inference applied to managerial decision making. P, 275.

400. Quantitative Methods for Administrators (3) I II S (Identical with M.I.S. 400)

420.* Advanced Business Law (3) GC I II GRD Negotiable instruments, partnerships, corporations, and property rights. P, CR 320 or admission to BPA graduate programs. (Identical with Acct. 420)
426. * Wills, Estates, and Trusts (3) GC I Wills, inheritances, estates, and trusts; the administration of estates, including the duties and liabilities of executors and trustees; basic estate and gift tax laws applicable to estate planning.


496. * Proseminar
Ha. Honors (3) [Rpt./2] I II

500. Management Case Analysis and Presentation (3) I II Written analysis of cases and other reports; development of skills in analysis, decision making, and written and oral presentation, with emphasis on the total situation of each case considered. Open only to students admitted to BPA graduate programs.

552. Statistical Decision Making (3) I II Probability and statistical analysis; random variables, sampling distributions, hypothesis testing, Bayesian analysis, time series, statistical investigation. Open only to students admitted to a BPA graduate program. P, M.I.S. 500, or Math. 119 and 123.

554. Research Methodology (3) I Behavioral research techniques; bias, validity, reliability, and applicable statistical techniques; critiques of research articles and reports. P, 552.

571. Management Strategy (3) I II Case method approach to problems and policies facing top management. May only be taken in the final semester of the M.B.A. program. P, 500b, 502, Fin. 511, Mktg. 500.

582a-582b. Multivariate Analysis in Management (3-3) 582a: Multiple, polynomial, stepwise regression including indicator variables, inference, remedial measures. 582b: Analysis of variance and covariance, principal components, discriminant analysis, canonical correlation. P, 275 or 552. 582a is not prerequisite to 582b.

696. Seminar
n. Research Design: Statistical Methods (2 to 4) I II

Criminal Justice Administration

331. * The Crime Problem (3) I Theory and research on the nature, causes and control of crime from an interdisciplinary perspective.

332. * Legal Aspects of the Criminal Justice Process (3) I II Analysis of selected principles of criminal law, criminal procedure and correctional law.

337. * Criminal Justice Administration (3) II Theory and practice of criminal justice organizations; police, courts and correctional institutions.

431. * The Criminal Justice System (3) II Background, philosophy, and modes of operation in the United States criminal justice system. Emphasis on crime in institutional contexts such as business and labor organizations.


595. Colloquium
f. Criminal Justice (3) [Rpt./12 units] I II

693. Internship
b. Criminal Justice (1 to 6) I II

696. Seminar
g. Criminal Justice Administration (1 to 3) I II

Health Services Administration

354. * Acute Health Care Policy and Administration (3) I Delivery modes for acute care, analysis of public policies relating to such care and discussion of general issues in its administration, including inpatient care (hospitals), outpatient care (solo physicians, group practices, HMOs), and emergency care.

454. * Chronic Health Care Policy and Administration (3) II Delivery modes for chronic or long-term care, analysis of public policies relating to such care and discussion of general issues in its administration, including institutional care (nursing homes, mental health institutions), home care (community based home health services), hospice care, and other alternatives.
455. * Preventive Health Care Policy and Administration (3) I Preventive health care activities, analysis of public policies relating to such care, and discussion of general issues in its administration including health promotion, health education, environmental health, and the nature and functions of public health departments and planning agencies.

456. * Current Issues in Health Services (3) II Current public policy issues in health services administration.

595. Colloquium

c. Health Care (3) [Rpt./12 units] I II

650. Analysis of Health Systems (3) I Introduces the student to the scope and nature of public and private health systems in the U.S.; examines roles of government and private enterprise in the development and operation of health institutions. P, 601

651. Health and Public Policy (3) II Examines public policy issues in health, including recent developments in health policy and planning at the national, state and local levels, and their impact on administrative behavior. P, 650. (Identical with Ping. 651)

653. Comparative Management in Health Administration (3) I Assists students in applying general management principles to particular types of health agencies. Models of organizational behavior are used to develop a paradigm for comparative analysis. P, 650.

655. Efficiency Analysis in Health Administration (3) II Professional-level treatment of economic and related principles as they apply to the health-care industry, and of the impacts of health policy and program alternatives; case study method used. P, Econ. 500a. (Identical with Ping. 655)

693. Internship
d. Health Services Administration (1 to 6) I II

696. Seminar
e. Health Services Administration (1 to 3) I II

Human Services Administration

348. * Social Welfare Policy (3) II Policy issues and options analyzed in the area of social welfare. Emphasis on specialized needs of vulnerable groups such as children and the socially disadvantaged.

360. * Program Planning and Administration for Human Services (3) I The planning and administrative Process in human services programs; needs assessment, program design, implementation, evaluation; principles of managerial control.

365. * Introduction to Administration of Services for the Aging (3) I Administration of services, planning, and public policy related to the multiple issues of growing old in modern society. Field trips.

463. * Community Agencies and Human Services (3) II Examines the structure, function and environment of community organizations and organizational networks in the development and provision of human and social services. (Identical with Ping. 463)

466. * Public Policy and the Elderly (3) I Consideration of public policy as it relates to the needs of elderly persons in modern industrial societies. Emphasis on vulnerable groups such as poor and minority elderly.

595. Colloquium
d. Aging and Society (3) [Rpt./12 units] I II

652. Management of Long Term Care Facilities and Programs (3) II Problems and principles of management of facilities and community based programs providing health and social services to the chronically impaired. P, 650.

662. Aging and Public Policy (3) I Policy framework for administration of programs, plans, priorities, and legislation related to the needs of the aging in modern society. (Identical with Ping. 662)

693. Internship
f. Long Term Care Administration (1 to 6) I II

Human Resource Management/Organizational Behavior

305. * Management and Organizational Behavior (3) I II GRD Integration of classical and organizational behavior approaches to management in private and public organizations in various cultures. Special sections of this course are offered for participants in the University Honors Program. P, 275 Econ. 201b.

330. * Personnel Management (3) I II GRD Policies and current practices in utilizing human resources effectively at all organizational levels.
413. * Administrative Leadership (3) GC I Elements of leadership, as applied to selected administra-
tive situations.

430. * Personnel Policies (3) GC II An integrative, case-oriented course focusing on problems and
policies in the procurement, development, compensation, and motivation of personnel. P, 330
and six units in personnel mgmt. major.

432. * Bargaining and Negotiation in Organizations (3) GC Examination of the state of the art of
bargaining and negotiation and the development of bargaining skills in a wide variety of business
and interpersonal settings. P, 305.

433. * Topics in Performance Appraisal (3) GC Examination of theoretical and practical bases of

444. * Group-Process Methods in Management (3) GC II Application of behavioral science knowl-
edge to group functioning in public agencies with emphasis on observation, analysis, feedback
and intervention in small groups; the SYMLOG theory and method of group analysis, along with
other perspectives from social psychology and sociology. P, 472. (Identical with Soc. 444 )

470. * Organizational Decision Making (3) I II Theory, research and applications concerning the
behavior of decision makers in organizations. P, 305.

480. * Women In Management (3) I II An integrative course for women who are aspiring to be manag-
ers and for men who expect to be dealing with female managers. P, 305. (Identical with W.S. 480 )

502. Organization Theory and Behavioral Relations (3) I II The interactions, effects, and interrela-
tionships of managers, employees, and organizational structures and systems. Open only to
students admitted to a BPA graduate program.

503. Human Resource Management (3) I Principles, methods, research relevant to management of
an organization's human resources, with emphasis on employment psychology, training, develop-
ment, compensation. P, 305 or 502.

504. Organization Development and Change (3) II Concepts and skills relevant to persons con-
cerned with problem diagnosis and organizational development and change. P, 305 or 502.

525. Intermediate Complex Organizations (3) (Identical with Soc. 525)

580a-580b. Theory of Management and Organization (3-3) 580a: Analysis of behavior in organiza-
tional systems; review of classical, behavioral, and contingency theories of management with a
focus on internal systems phenomena. 580b: Organizations in their environments; analysis of
organizations in the context of their environmental interfaces. P, 305 or 502. 580a is not prerequi-
site to 580b.

600. Behavioral Science Theory and Method in Management (3) [Rpt./1] I Conceptual and the-
oretical frameworks for the analysis of management problems from a behavioral science perspec-
tive. Relevant material drawn from social psychology, sociology, anthropology, and political
science.

696. Seminar
I. Organizational Behavior (3) [Rpt./6 units] I II P, 600.
m. Organizational Theory (3) [Rpt./6 units] I II P, 600.

Operations Management

373. * Basic Operations Management (3) I II GRD Quantitative techniques applied to design, opera-
tion, control and updating of operating systems. P, 275, Math. 123.

473a-473b. * Production and Operations Management (3-3) GC Productive systems, including ser-
vice type industries; activities entailed in selecting, designing, operating, controlling, and updat-
ing systems. 473a: General coverage, including planning, scheduling and control systems. 473b:

474. * Work Simplification (3) GC I II Work simplification and motion economy; methods of increasing
productivity of employees; flow process charts and flow diagrams; appraisal of fatigue. P, 305.

475. * Productivity Improvement (3) GC II Productivity measurement; monitoring with statistical qual-
ity control techniques; improvement through use of small group processes. P, 373.

476. * Management of Service Operations (3) GC I Application of operations management concepts
to service organizations and interaction with other functional areas; case analyses of banks,
airlines, health care, motels, food service, others. Field trip. P, 373.

477. * Materials and Logistics Management (3) GC I Organization, management, and control of
material flow processes; logistical strategies and relationships of procurement, handling, ware-
housing, transportation, and inventory control. P, 373, 473a.
478.* Project Management (3) GC Definition of programs and projects, organizational forms, developing the work breakdown structure, scheduling techniques (PERT and CPM), control mechanisms such as milestones, cost reports and progress reports. Lectures and case analyses. P, 305, 373

479.* Sociotechnical Systems (3) GC I Theory and practice of installing high-commitment work systems to increase productivity and improve the quality of working life.

572. Operations Management (3) I Intended for students without a background in production management. Survey of techniques useful in operating manufacturing and service production.

585. Material Requirements Planning and Control (3) II Material management with emphasis on forecasting and inventory theory within a dependent demand environment.

**Policy and Planning**

300.* Introduction to Planning (3) I II Development of public sector planning in the U.S. during the 20th century, with emphasis on contemporary issues and solutions. (Identical with Ping. 300)

485.* Zoning Fundamentals (3) GC I Survey of the zoning process; nature, structure, and function of zoning, problems of zoning administration; new concepts of zoning content and administration. (Identical with Ping. 485)

506. Fundamentals of Physical Planning (3) I Basic considerations in site analysis and planning, and transportation and utility systems; subdivision planning and plat review. (Identical with Ping. 506)

507. Social Service Planning (3) I Survey of the variety of planning efforts designed specifically to increase social welfare through the delivery of services using historical, comparative, and evaluative perspectives. (Identical with Ping. 507)

575. Housing and Residential Areas (3) II Physical, social, and economic aspects of housing development and residential areas and their relationship to other land uses and functions. (Identical with Ping. 575)

602. Analytic Methods in Planning and Management (3) II Methods and models for program planning and policy analysis; forecasting, service demand, facility location in capital investment programming, task sequencing, program analysis and evaluation. P, 457 or 552. (Identical with Ping. 602)

609. Policy Problems in Structure and Change (3) II Problems presented by structure and change in modern urban society from the standpoint of social systems analysis; evaluation of strategy and effectiveness of public policy and planning. (Identical with Geog. 609, Ping. 609)

612a-612b. Projects in Policy and Planning (2-3) Lab. and field projects simulating various aspects of professional practice. Open to majors only. P, 12 units toward M.S. (Identical with Ping. 612a-612b)

693. Internship g. Policy and Planning (1 to 4) S Open to majors only. (Identical with Ping. 693g)

696. Seminar h. Land-Use Regulation (3) I II (Identical with Ping. 696h)

   i. Legal Inquiry in Policy and Planning (3) II (Identical with Ping. 696i)

   j. Environmental Planning (3) I II (Identical with Ping. 696j)

   k. Planning Administration (3) I II (Identical with Ping. 696k)

**Public Management**

100. Issues in Public Policy (3) I II Major issues, problems and options facing public sector policymakers and administrators.

401.* Environment and Strategic Management in Organizations (3) II Administration of organizations dealing with complex operating environments; emphasis on interaction of public and private sector organizations.

405.* System and Program Evaluation (3) I Methodology of evaluating the performance of programs and strategies in the context of policy assessment.


411.* Public Administration and the Mexican-American (3) GC I Hispanic-American cultural and historical impact on public administration in the southwestern U.S. from 1775 to the present;
patterns of contemporary Spanish-speaking participation in state and local governmental administration of services. (Identical with Ed.F.A. 411 and M.A.S. 411)

72. Administration in Public Organizations (3) II Application of major theories of human behavior in organizations to decision making in public sector organizations from the perspective of upper echelon executive; case study emphasis. P. 305, 410a, Pol. 474. Writing-Emphasis Course. P. Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

14. Cost-Benefit Analysis (3) II (Identical with A.Ec. 514)

73. Business, Government and Society (3) I II Relationships between the institutions of business and government; economic, social and political aspects. P. 305 or 502.

95. Colloquium
   a. Public Management (3) [Rpt./12 units] I II

01. Public Management (3) I Fundamentals of management structure and process in public sector: emphasis on professional practice. Open only to students admitted to a BPA graduate program.

05. Research and Evaluation in Public Administration (3) I Research and evaluative methodologies which support public sector policies and administration, including the philosophical basis of these methods and a research design exercise. P. 552, 601.

10a-610b. Fiscal and Budgetary Administration of Public Agencies (3-3) 610a: Internal fiscal operation and the budgetary cycle of public and nonprofit agencies. P. 601, Acct. 572. 610b: Cost/benefit analysis for public agencies. 610a is not prerequisite to 610b. (Identical with Pol. 610a-610b)

21. Administrative Patterns in the Federal System (3) I Legal, political, and social framework of interjurisdictional and interagency relations; trends, emerging issues, and devices for securing coordination and responsibility.

93. Internship
   c. Public Management (1 to 6) I II

96. Seminar
   a. Development Administration (1 to 3) I II
   b. Program Planning and Development (1 to 3) I II
   c. Performance Measurement and Accountability (1 to 3) I II

Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

MANAGEMENT INFORMATION SYSTEMS

Professors Jay F. Nunamaker, Jr., Head, Seymour Goodman, James F. LaSalie, Averill M. Law, Roy E. Marsten, Richard O. Mason
Associate Professor Benn Konsynski III
Assistant Professors Arnold J. Greenfield, Matthew J. Saltzman, Robert F. Schneider, Yng-Yuh Richard Wang, E. Sue Weber
Instructor Wayne M. Eirich, William Kelly

Education in management information systems enables students to establish careers involving the analysis, design, implementation, use and management of computerized information systems in an organizational environment. Course work is available at the graduate and undergraduate levels.

The department offers the Bachelor of Science in Business Administration with a major in management information systems. Interested students should follow the program of studies in the College of Business and Public Administration section of the catalog. Non-business students who desire a minor in management information systems should contact the head of the department for a list of courses.

A Master of Science with a major in management information systems is also available. Management information systems is also a part of the Master of Business Administration. A Doctor of Philosophy degree with a major in business administration is available.

11. Introduction to Computing (3) I II Description of computer hardware and software; computer terminology; program design; with emphasis on problem definition and flowcharting; introduction to a general purpose programming language. (Identical with C.Sc. 111)
DEPARTMENTS AND COURSES OF INSTRUCTION

121. Business Programming (3) I II GRD Cobol programming language; file organization and retrieval of data from magnetic tape and disc storage media; internal and external sorting techniques; problems of file maintenance and file updating. P, 111. (Identical with C.Sc. 121)

122. Scientific Programming (3) I II (Identical with C.Sc. 122)

123. Nonnumerical Programming (3) II (Identical with C.Sc. 123)

301. * Program and Data Structures (3) I II Application system development techniques, fundamental data structures, design and analysis of selected software procedures for business applications. P, 121, Math. 123. (Identical with C.Sc. 301)


327. * Comparative Programming Languages (3) I II (Identical with C.Sc. 327)


341. * Information Systems Analysis and Design (3) I II The analysis and logical design of business data processing, management information and management control systems; project management and cost-benefit analysis; techniques for stating and analyzing information systems requirements. P, 301, CR 307.

342. * Data Structures (3) I II (Identical with C.Sc. 342)

400. Quantitative Methods for Administrators (3) I II S Applications of quantitative techniques to problems in administration; functions, time value of money, compound interest systems of linear equations and inequalities, matrix algebra; sequences and limits, applications of differential calculus. Open only to M.B.A. and M.P.A. degree candidates. (Identical with M.A.P. 400)

411. * Information Systems in Society (3) I II Societal implications of computerized information systems; positive and negative effects of computer utilization; selected applications of computer systems in society and future prospects.

421. * Simulation Modeling and Analysis (3) I II Modeling and analysis of probabilistic real-world systems by means of simulation; building simulation models in FORTRAN and in a simulation language such as SLAM or GPSS; introduction to the analysis of simulation output data. P, M.A.P. 275, M.I.S. 301. (Identical with C.Sc. 421)

422. * Mathematical Programming and Applications (3) GC Formulation and solution of mathematical programming models with applications to decision problems involving profit maximization or cost minimization. Topics include linear programming, network flow programming, and integer programming. P, 301, Math. 119. (Identical with C.Sc. 422)

441. * Information System Design and Implementation (3) I Design of program structures, subsystems, user interfaces; hardware/software selection and evaluation; system configuration and modeling; system implementation, conversion, performance evaluation. P, 341.

451. * Advanced Business Programming Techniques (3) I Large scale business systems, advanced file organization concepts and programming, advanced COBOL features, software testing and debugging support tools, programming language generics. P, 301.

461. * Accounting Information Systems (3) GC I II (Identical with Acct. 461)

471. * Policy Formation and Management Information Systems (3) I II Integration of the M.I.S. function with the overall operations of the business organization; decision-making relative to planning, organizing, actuating, and controlling. P, Fin. 311, M.A.P. 305, Mktg. 361, Senior Standing. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

* Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

501. Management Information Systems (3) I II Computer problem solving using BASIC and canned programs; conceptual and practical foundations of information processing support for management and decision-making functions; cost benefit analysis. Open only to students admitted to BPA graduate programs.

511. Behavioral and Economic Aspects of Information Systems (3) I Data validation and data completeness; comparison of centralized and decentralized systems; computer pricing policies and cost allocation; economies of scale; legal considerations and computer frauds; security considerations; problems of changing computer systems. Open only to students admitted to BPA graduate programs. P, 441 or 501.
521a-521b. Advanced Systems Modeling and Simulation (3-3) Optimization models of information systems; application of graph theory and integer programming; branch and bound; simulation of operating systems, computer networks, file organizations, memory management and relevant areas involving M.I.S. policy decisions. Open only to students admitted to BPA graduate programs. P, 501, M.A.P. 552, Math. 119. (Identical with C.Sc. 521a-521b)

531a-531b. File Organization and Data Base Management (3-3) Data and storage structure; file design and analysis of data organization techniques; indexed sequential, clustered, multilist and inverted files; D.B.M.S. design and implementation of network (CODASYL), hierarchic and relational data bases. Open only to students admitted to BPA graduate programs.

541a-541b. Computer-Aided Information Systems Analysis and Design (3-3) Analysis and logical design of M.I.S. and management control systems; techniques for stating and analyzing information systems requirements; optimization models of subsystems; hardware/software selection and evaluation; system implementation and performance evaluation. Open only to students admitted to BPA graduate programs. (Identical with C.Sc. 541a-541b)

551a-551b. Business Systems Programming Methods (3-3) Business systems programming environment; structured COBOL; sequential and indexed sequential files; program management standards; advanced features of COBOL; direct and multi-key files; RPG; access methods. Open only to students admitted to BPA graduate programs. P, 501.

553. Operations Analysis (3) II Modeling techniques for decision-making in operations analysis and production; applications include production mix, lot size, logistics, factory and warehouse location, inventory management, queueing processes, scheduling, PERT/CPM, and strategic policy decisions. Open only to students admitted to BPA graduate programs. P, M.A.P. 552.


577. Nonlinear Mathematical Programming (3) I II S Introduction to the formulation, solution, and implementation of nonlinear mathematical programming models; main methodological areas of nonlinear programming; representative applications; Medium-scale models will be run on the computer. P, 421a.

578. Systems Design for Management (3) I Application of computer technology to distributed processing; computer-aided tools in support of administration; electronic mail, telecommuting. P, 501.


596. Seminar
a. Computers in Auditing (3) I II P, 341 or Acct. 461. (Identical with Acct. 596a)

696. Seminar

699. Seminar
d. Advances in Optimization Theory (3) I II P, 421a.

896. Seminar
a. Research Methodology (3) [Rpt./6 units] Open to majors only.

979. Workshop

MARKETING

Professors Joseph W. Newman, Head, Gary M. Munsinger, Lyman E. Ostlund
Associate Professors Richard A. Scott, Melanie R. Wallendorf, Robert A. Westbrook
Assistant Professor William C. Black
Marketing involves understanding the changing wants of individuals and organizations, the development and distribution of goods and services to meet those wants, and the maintenance of satisfactory customer relationships. Graduates may qualify for positions in product, brand and service management, marketing research and planning, advertising and promotion, sales and sales management, retailing and international marketing.

An undergraduate major in marketing is offered within the Bachelor of Science in Business Administration described in the College of Business and Public Administration section of this catalog. The Master of Science degree with a major in marketing is offered, and the department participates in the Master of Business Administration and Doctor of Philosophy degrees with a major in business administration.

Honors: The department participates in the Honors Program.

361. Introduction to Marketing (3) I II Role of marketing in the economy and in business and nonprofit organizations; environmental factors affecting marketing; nature of marketing management decisions. P, Econ. 201a.

364. Creative Advertising (3) I II Use of visual and audio techniques to plan, create and produce effective advertising campaigns. Not acceptable for credit toward mktg. major. (Identical with Jour. 364 and R.T.V. 364)

366. Public Relations (3) I II The nature, role and management of public relations. Case problems and projects give practical experience in developing public relations programs. Not acceptable for credit toward mktg. major. (Identical with Jour. 366 and R.T.V. 366)

410. Small Business Marketing and Management (3) I II Planning, organizing, and establishing a small business; evaluation of existing businesses and franchise operations; market feasibility studies; preparation of a business development plan. P, 361.

420. Marketing for Nonprofit Organizations (3) GC II Application of marketing concepts and tools for public agencies, health services, public transportation, the arts, schools, museums, churches, etc.; role of marketing planning, research, product and service development, pricing, promotion, public relations. P, 361.

440. Marketing Research (3) I II Concepts and techniques of research for marketing decisions; problem definition, determination of information needs, sources, methods of gathering and analyzing data; presentation of findings for management. P, 361, M.A.P. 375.

450. Buyer Behavior (3) I II Customer behavior and the application of concepts and research findings from the behavioral sciences in the solution of marketing problems. P, 361.


452. Advertising and Promotion Management (3) I II Role of advertising and special promotions in the economy and business and nonprofit organizations, concepts and strategy for programs, budgets, media selection, evaluation of effectiveness. P, 361.

454. Management of Sales Operations (3) GC I The sales function and its relationship to the total marketing program; sales strategies and objectives; development and administration of sales organizations; control and evaluation of sales operations. P, 361.


456. International Marketing Management (3) II Marketing operations for foreign environments; cultural, political and economic factors affecting the international marketer. P, 361.

458. Product Management (3) II Product (services) strategy for achieving financial growth; evaluating opportunities; generating ideas; launching new offerings; managing the product (services) portfolio. P, 361.

460. Marketing and Public Policy (3) GC I Trends in public opinion, legislation and practices of governmental regulatory bodies; implications for marketing decision making; role of marketing research in public policy development. P, 361.
471.* Marketing Policies and Operations (3) I II An integrative, capstone course focusing on comprehensive marketing problems; development, control, and auditing of marketing organizations and operations. P, 440, 450; three additional units of mktg. at the 400 level. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

*Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

500. Marketing Management (3) II Scope, environment and nature of marketing management; customer and market analysis for product, service, price, promotion and distribution decisions. Open only to students admitted to BPA graduate programs.

530. Management of Marketing Communications (3) I Application of communications theory and research findings in advertising, sales promotion, publicity, personal selling; planning, conduct and administration of programs of information and persuasion. P, 500.

550. Consumer and Organizational Buyer Behavior (3) I Nature of the purchase decision process for goods and services. Theories, concepts and research methods and findings are examined for use in management and public policy decision making. P, 500.

559. Product Strategy (3) II Formulating and implementing strategy for growth; analyzing and influencing market structure; developing, pricing, testing new entries; managing the portfolio. P, 500.

560. International Marketing (3) II Marketing planning and strategies for foreign environments; cultural, political, economic factors affecting the international marketer, multinational corporation and multinational market groups. P, 500.

572. Research and Marketing Management (3) I Specification of management information needs, evaluation of research proposals and findings, methods of gathering and analyzing data, administrative aspects of research and decisions. P, 500, M.A.P. 552.

695. Colloquium a. Research in Marketing (1) [Rpt./7] I II


MATERIALS SCIENCE AND ENGINEERING

Professors William G. Davenport, Head, Louis J. Demer, J. Brent Hiskey (Research), Kenneth L. Keating, Thomas M. Morris (Emeritus), Daniel J. Murphy (Emeritus), David R. Poirier, Sigmund L. Smith (Emeritus)

Associate Professors David C. Lynch, Srinivasa Raghavan

Assistant Professor Mark D. Pritzker (Research)

Materials science is the science of the structure, properties and behavior of metals, alloys, semiconductors, ceramics, polymers, and composite materials. The materials scientist strives to expand the knowledge of the properties of existing materials and to develop new materials. Materials engineering emphasizes the fundamental knowledge necessary to produce, select, process and apply materials for societal needs. The materials engineer strives to efficiently produce, transform and apply materials to practical use.

The curriculum of the department prepares the student for employment in materials research, development, production and application. Three main fields are emphasized: processing of raw substances to produce useful materials; evaluation of the structure and properties of the materials; and application of them to useful products.

The department offers the following degrees: Bachelor of Science in Materials Science and Engineering; Master of Science with a major in materials science and engineering, and Doctor of Philosophy degrees with a major in materials science and engineering.

The prescribed curriculum for the B.S. in M.S.E. is found in the College of Mines section of this catalog.
At the time of publication of this catalog, modifications to the undergraduate and graduate curricula were under active consideration. Prospective students should consult the most recent catalog supplement or contact the Department of Materials Science and Engineering for details.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>122</td>
<td>Materials in Contemporary Society (2)</td>
<td></td>
<td>I Introduction to the role of materials in society. Selected topics, including the underlying scientific and technological principles, pertaining to the supply and utilization of metallic and nonmetallic materials will be discussed.</td>
</tr>
<tr>
<td>202</td>
<td>Introductory Engineering Analysis (3)</td>
<td></td>
<td>(Identical with Ch.E. 202)</td>
</tr>
<tr>
<td>221</td>
<td>General Metallurgy (3)</td>
<td></td>
<td>I Unit processes employed for the production of metals from ores and concentrates. Not applicable to the met. major.</td>
</tr>
<tr>
<td>224</td>
<td>Analysis of Metallurgical Processes (3)</td>
<td></td>
<td>I Analysis of metallurgical problems using engineering calculating methods. P, Chem. 103b, S.I.E. 170 or CR.</td>
</tr>
<tr>
<td>310</td>
<td>Metallurgical Thermodynamics (3)</td>
<td></td>
<td>II Thermodynamics, with emphasis on the application of these principles in pyrometallurgical processes; thermochemistry, thermophysics, entropy, free energy, and thermodynamic equilibrium. P, 224R, Math. 125b.</td>
</tr>
<tr>
<td>325</td>
<td>Principles of Health and Safety in the Mineral Industry (2)</td>
<td></td>
<td>(Identical with Mn.E. 325)</td>
</tr>
<tr>
<td>331 R</td>
<td>Fundamentals of Materials for Engineers (3)</td>
<td></td>
<td>I Scientific principles which underlie and relate the behavior and properties of materials to their engineering applications. P, Phys. 103a; Chem. 103b or CR.</td>
</tr>
<tr>
<td>331 L</td>
<td>Engineering Materials Laboratory (1)</td>
<td></td>
<td>I Fundamental lab. techniques for the evaluation of properties and behavior of metals and materials for engineering applications. 1R, 2L. P, 331R or CR.</td>
</tr>
<tr>
<td>401 R</td>
<td>Mineral Processing (3)</td>
<td></td>
<td>GC I Unit operations employed for the beneficiation of minerals. Field trip. P, 221 or 411.</td>
</tr>
<tr>
<td>401 L</td>
<td>Mineral Processing Laboratory (1)</td>
<td></td>
<td>GC I Lab. experiments dealing with unit operations. P, 401R or CR.</td>
</tr>
<tr>
<td>403</td>
<td>Flotation (3)</td>
<td></td>
<td>GC II Theory and application of surface chemical principles to mineral separation and concentration via flotation and flocculation, including process control. 2R, 3L. P, 401R.</td>
</tr>
<tr>
<td>411</td>
<td>Metallurgical Transport Phenomena (4)</td>
<td></td>
<td>GC I Principles and applications of momentum, energy and mass transport, as applied to metallurgical phenomena and processes. P, Math. 254.</td>
</tr>
<tr>
<td>412</td>
<td>Metallurgical Physical Chemistry (3)</td>
<td></td>
<td>GC II Physical, chemical topics of particular concern to metallurgical engineers, including kinetics, electrochemistry, and surface chemistry. P, 310, Math. 223.</td>
</tr>
<tr>
<td>420 R</td>
<td>Extractive Metallurgy (3)</td>
<td></td>
<td>GC II Unit processes employed in extractive metallurgy. Field trip. P, 224, 310, 411.</td>
</tr>
<tr>
<td>420 L</td>
<td>Process Metallurgy Laboratory (1)</td>
<td></td>
<td>GC II Lab. experiments involving application of thermodynamic and transport phenomena fundamentals to metallurgical processes. P, 224, 310, 411.</td>
</tr>
<tr>
<td>421</td>
<td>Process Metallurgy of Iron and Steel (3)</td>
<td></td>
<td>GC I Reduction, conversion, and refining of steel and ferrous alloys; slag-metal equilibria, and applications of process engineering principles to sinter plants, blast furnaces, and steelmaking furnaces. P, 310, 411, 420R.</td>
</tr>
<tr>
<td>422</td>
<td>Extractive Metallurgy of Nonferrous Metals (2)</td>
<td></td>
<td>GC II Extractive metallurgy of selected nonferrous metals considered from the standpoint of an economic and process analysis. P, 420R.</td>
</tr>
<tr>
<td>423</td>
<td>Electrometallurgy (3)</td>
<td></td>
<td>GC I Principles and applications of electrometallurgy in aqueous and fused salt solutions. 2R, 3L. Open to Ch.E. or Met. majors only.</td>
</tr>
<tr>
<td>424</td>
<td>Ceramic and Refractory Materials (2)</td>
<td></td>
<td>GC I Nonmetallic materials used in high temperature applications. P, 331R, 430aR or Chem. 480b, or CR.</td>
</tr>
<tr>
<td>426</td>
<td>Hydrometallurgy (3)</td>
<td></td>
<td>GC II Principles of hydrometallurgy; chemical and physical classifications of processes; liquid-solid separation techniques; solution purification and concentration and metal recovery technology. P, 224, 401R, 412.</td>
</tr>
<tr>
<td>430aR-430bR</td>
<td>Physical Metallurgy (3-3)</td>
<td></td>
<td>GC The structure and behavior of metals and alloys; with fundamental theory of metallurgical phenomena. P, 310 or CR; Phys. 103b; Chem. 103b, 104b; C.E. 217 or CR.</td>
</tr>
</tbody>
</table>
430aL-430bL. Physical Metallurgy Laboratory (1-1) GC Fundamental lab. techniques for the preparation, examination, and interpretation of microstructures of metals and alloys; correlation with physical and mechanical behavior under applied conditions. P, 430aR-430bR or CR.

432. X-Ray Methods in Metallurgy (3) GC II Fundamentals of X-ray diffraction and fluorescence analysis; application of X-ray techniques to metallurgical problems. 2R, 3L. P, 430bR or CR.


435. Corrosion (2) GC II The science of corrosion reactions and their application to engineering problems. P, 331R; 412 or Chem. 480b or CR. (Identical with Ch.E. 435)

441. Metallurgical Engineering Design Economics (2) GC I Principles of process design, plant design, and economics involving equipment design, preliminary process design, and capital and operating cost estimation. P, CR 442a.

442a-442b. Metallurgical Plant Design (2-1) GC Practice in the application of engineering principles to the design of a metallurgical process. 442a : 1R, 2L. 442b : 3L. P, CR 441.

450R. Unit Operations in Metal Processing (3) GC I Unit operations employed in the solidification and mechanical working of metals. P, 331R, 430aR; 411 or A.M.E. 340b; C.E. 217. (Identical with A.M.E. 450R)

450L. Metal Processing Laboratory (1) GC I Lab. experiments in metal processing, including solidification and mechanical forming processes. Field trip. P, CR 450R. (Identical with A.M.E. 450L)

451. Advanced Metal Processing (3) GC II Consideration in detail of modern refining, casting, and surface treatment processes, with emphasis on the relation between process variables and product properties. P, 450R.

452. Nondestructive Evaluation of Materials (3) GC II Introduction to the field of nondestructive testing of metals, with emphasis on application of magnetism, penetrants, radiography, ultrasonics, and other methods of evaluation. 2R, 3L. P, 331R, 430bR or N.E.E. 331.

457. Integrated Circuit Technology Laboratory (3) GC I II (Identical with E.C.E. 457)

460. Health Hazards in the Mine Environment (2) GC II 1985-86 (Identical with Mn.E. 460)

461. Accident Prevention in the Mine Environment (2) GC II 1986-87 (Identical with Mn.E. 461)

501. Advanced Mineral Processing (3) GC II Advanced study of mineral processing theory and applications, and analysis of mineral processing systems. P, 401R.

510. Advanced Metallurgical Thermodynamics (3) I Treatment of thermodynamics of condensed phase multicomponent systems, with emphasis on metallurgical applications. P, 310.

513. Advanced Phase Diagrams (3) I Multicomponent constitution diagrams involving metals and ceramic materials. P, 430aR.

520. Advanced Metallurgical Process Engineering (3) II Analysis and synthesis, from a thermodynamic, kinetic, and transport phenomena viewpoint, of a variety of ferrous and nonferrous metallurgical processes. P, 310, 411.

532. Solid-Fluid Reactions (3) I (Identical with Ch.E. 532)

533. Imperfections in Metals (3) I Nature, causes and behavior of imperfections in the crystal structure of metals, of microscopic and macroscopic discontinuities in polycrystalline metal aggregates; their effects on various properties. Field trip. P, 430bR, Math. 254.


535. Advanced Microstructural Characterization (3) I Theory and applications of modern techniques for characterizing chemical and microstructural features of solids; transmission and scanning electron microscopy, microprobe, and Auger analysis. 2R, 3L. P, 430aR, 432.

595. Colloquium
   a. Materials Colloquium (1) [Rpt./5] II
MATHEMATICS


Assistant Professors Christopher Jones, Daniel Meiron, John N. Palmer, Robert Valentini

Lecturers Robert C. Dillon, John L. Leonard, Stephen G. Tellman

The department offers courses in pure mathematics, applied mathematics, probability and statistics, computer mathematics, mathematics education, and engineering mathematics. Planned minors in numerous professional fields are available; interested persons may receive additional information on request.

Mathematics is available as a major for the following degrees: Bachelor of Arts and Bachelor of Science (College of Arts and Sciences), Bachelor of Science in Engineering Mathematics (College of Engineering), Bachelor of Arts in Education and Bachelor of Science in Education (College of Education), Master of Arts, Master of Science, Master of Education and Doctor of Philosophy.

The major for the B.A. and B.S. has four options, each consisting of 40 units which includes the following core courses: 125a-125b, 145 (first year); 215, 225, 255, 275 (second year); 423 (third year). The options are described below.

The comprehensive mathematics option: 40 units including the core above; 415; 416 or 413; 425; and six additional units of 400-level math. courses (except 404, 405, 410, 422a-422b, 461). For a B.S. degree the supporting minor must be chosen from Group VI or systems engineering or computer science. For a B.A. degree the minor may be chosen from any discipline (other than mathematics) available at the University.

The applied mathematics option: 40 units including the core above; 424; a one-year sequence chosen from 454 and 455, 454 and 456, 464 and 466, or 475a-475b; and at least six additional units of 400-level math. courses (except 404, 405, 410, 422a-422b, 461), at least one of which must be 420, 421, 443, 454, 455, 456, 464, 466, 468, 473, 475a, 475b, 478, 479 or 484. Also required are six units of physics with calculus and a minor, to be approved by a departmental adviser, in a subject which significantly uses mathematics.

The computer science option: 40 units including the core above; C.Sc. 115 and 227 (first year); C.Sc. 237 (second year); 475a-475b; 415 and either 443 or 447 or 479; C.Sc. 327, 342, 430, and one additional 3-unit computer science elective; and at least one additional 3-unit, 400-level math. course (except 404, 405, 410, 422a-422b, 461). A computer science minor is included in this program.

The probability and statistics option: 40 units including the core above; 464, 466 and 468; and at least six additional units chosen from 400-level math. courses (except 404, 405, 410, 422a-422b, 461), Stat. 465, S.I.E. 405, 422, and 440. The minor, to be approved by a departmental adviser, must be in a subject which significantly uses mathematics.

Students planning to do graduate work in mathematics should select the comprehensive mathematics option or include 415 and 425 in their program.

A minor in mathematics with the College of Arts and Sciences: a minimum of 20 units including 125a-125b, 215, 223 or 225, and at least six upper-division units.

The teaching major (for prospective secondary school teachers): 34 units, including 125a-125b, 145, 215, 275, 305, 330, either 362 or 461 or 464, 396a (one unit), 397a (one unit), and one from each of the following: 404, 405, 430; and 413, 415, 423, 446. One additional course should be selected in consultation with a department adviser.

The teaching minor: A minimum of 24 units, including 125a-125b, 215, 275, 305, 330, and at least two electives from the following: 362 or 404, 405, 410, 430, 446, 461.
The elementary education major area of specialization: 105a-105b; and a minimum of 14 units selected from 119 or 125, 122, either 123 or 125a-125b, 160, and 305.

The engineering mathematics major: Requirements are given in the College of Engineering section.

Readiness tests in elementary courses: Students enrolling in elementary algebra courses 116 and 117a through 117f, finite math 119, and in calculus courses 123 and 125a will be given readiness tests to determine whether they are adequately prepared.

Prerequisites: Because of the nature of mathematics, the department recommends that students refrain from enrolling in any course that carries prerequisites unless those prerequisites have been completed with a grade of "C" or better. The department strongly recommends that students not enroll in any prerequisite for courses in which they have already received credit.

Honors: The department participates in the Honors Program.

101. Survey of Mathematical Thought (3) A study of the nature of mathematics and its role in civilization, utilizing historical approaches and computational examples. Not applicable to the math. major. P, fulfillment of University entrance requirements in math. without deficiency.

105a-105b. Understanding Elementary Mathematics (3-3) Development of a basis for understanding the common processes in elementary mathematics. 105a: Concepts of number. 105b: Concepts of geometry and probability. 2R, 3L. Open to elem. majors only. P, fulfillment of University entrance requirements in math. without deficiency.

116.‡ Intermediate Algebra (3) I II Not applicable to the math. major or minor. Linear and quadratic equations in one and two variables, systems of two equations, polynomials, algebraic fractions, exponents, radicals, logarithms, and inequalities.

116a-116b-116c.‡ Intermediate Algebra (1-1-1) The sequence 116a-116b-116c is equivalent to 116. Unless a student has already passed 116a or 116b, he or she should enroll in 116. A student who has already passed one or more of the parts, 116a or 116b, should enroll in the remaining part or parts. Not applicable to the math. major or minor. 116a, 116b and 116c are offered each semester.

117a.*‡ Introduction to Algebraic Skills (1) I II Review of 116. Includes notation, factoring, graphing, solving equations or inequalities. Not applicable to math. major or minor. P, 116 or 116c or an acceptable score on the departmental readiness test.

117b.*‡ Introduction to Functions (1) I II Linear and quadratic functions, polynomial and rational functions, exponential and logarithmic functions. Not applicable to math. major or minor. P, 116 or 117c or an acceptable score on the departmental readiness test.

117c.*‡ Introduction to Finite Mathematics (1) I II Systems of linear equations; sequences, series; combinatorial algebra and probability. Not applicable to math. major or minor. P, 117b or acceptable score on the departmental readiness test.

117d.*‡ Introduction to Trigonometry (1) I II Trigonometric functions, identities, trigonometric equations, inverse trigonometric functions. Not applicable to math. major or minor. Students with credit in 117f or 118 will obtain no graduation credit for 117d. P, 117b or an acceptable score on the departmental readiness test.

117e.*‡ College Algebra (3) I II Equivalent to and duplicates the sequence 117a - 117b - 117c. Not applicable to math. major or minor. P, 116 or 116c or an acceptable score on the departmental readiness test.

117f.*‡ Precalculus (4) I II Equivalent to and duplicates the sequence 117a - 117b - 117c - 117d. Intended for students planning to take 125a. Not applicable to math. major or minor. Students with credit in 117d or 118 will obtain only three units of graduation credit for 117f. P, 116 or 116c or an acceptable score on the departmental readiness test.

*Credit will not be given for this course if the student has already passed a higher level math course.

118.* Plane Trigonometry (2) I II Not applicable to the math. major or minor. Students with credit in 117d or 117f will obtain only one unit of graduation credit for 118. P, one entrance unit in geometry, and either 1 1/2 entrance units in algebra, or 116 or 116c.

119.* Finite Mathematics (3) I II Elements of set theory and counting techniques, probability theory, linear systems of equations, matrix algebra; linear programming with simplex method, Markov chains. P, 117e.

122. Scientific Programming (3) I II (Identical with C.Sc. 122)

123.* Elements of Calculus (3) I II Introductory topics in differential and integral calculus. P, 117e.
125a-125b. * Calculus (3-3) Differentiation and integration of trigonometric, logarithmic, and exponential functions, techniques of integration, applications of differentiation and integration, sequences, convergence or series, power series, indeterminate forms. Some sections may include an integrated introduction to elementary FORTRAN and numerical work using the departmental computer. P, 117f, or 117e and 118, or acceptable score on the departmental readiness test. 125a and 125b are offered each semester.

145. * Discrete Mathematics (3) II Topics to be selected from elementary combinatorics, probability theory, graph theory, and finite geometry. Not recommended for jrs. or srs. P, CR 125a.


160. * Introduction to Statistics (3) I II Basic probability, uses of numerical data, useful probability distributions, estimation and hypothesis testing. Not applicable to the math. major. P, 117e.


255. * Analysis of Ordinary Differential Equations (3) II Basic solution techniques for linear systems, qualitative behavior of nonlinear systems, numerical methods, computer studies; applications drawn from physical, biological and social sciences. P, 215, and 275 or knowledge of FORTRAN.

263. * Statistical Methods in Biological Sciences (3) I II An introduction to descriptive and inferential statistical techniques, with special emphasis on analysis of biological and clinical data. P, 117e.

305. Fundamental Concepts of Mathematics (3) I II Set theory, cardinal numbers, construction of number systems, elementary number theory, theory of algebraic equations; examples of groups, rings, fields, and vector spaces. P, 125b.

322. Mathematical Analysis for Engineers (3) I II Linear algebra, vector analysis, line and surface integrals, Fourier series, partial differential equations. Credit allowed for this course or 422a, but not for both. P, 223 or 225; 254 or 255.

330. Geometry (3) I Topics to be selected from 2- and 3-dimensional combinatorial geometry, postulational Euclidean geometry, Euclidean transformational geometry, symmetry, and 2-dimensional crystallography. P, 125b.

362. Introduction to Probability Theory (3) I II Sample spaces, random variables and their properties, with considerable emphasis on applications. P, 123 or 125b.

396. Proseminar
a. Problems in Mathematics Education (1) I II Open only to teaching majors in math. P, 305.

397. Workshop
a. Mathematics Education (1) I I Open only to teaching majors in math. P, 305.
402. **Mathematical Logic** (3) GC II 1985-86
Sentential calculus, predicate calculus; consistency, independence, completeness, and the decision problem. Designed to be of interest to majors in math. or phil. P, 125a or Phil. 325. (Identical with C.Sc. 402)

403. **Foundations of Mathematics** (3) GC II 1986-87
Topics in set theory such as functions, relations, direct products, transfinite induction and recursion, cardinal and ordinal arithmetic; related topics such as axiomatic systems, the development of the real number system, recursive functions. P, 215. (Identical with Phil. 403)

404. **History of Mathematics** (3) GC I
The development of mathematics from ancient times through the 17th century, with emphasis on problem solving. The study of selected topics from each field is extended to the 20th century. Not applicable to M.A., M.S., or Ph. D. degrees for math majors. P, 125b.

405. **Mathematics in the Secondary School** (3) GC II
Not applicable to B.A., B.S., M.A., M.S., or Ph.D. degrees for math majors. (Identical with S.Ed. 405)

410. **Matrix Analysis** (3) GC I II
General introductory course in the theory of matrices. Advanced-degree credit not available to math. majors. P, 123 or 125b.

413. **Linear Algebra** (3) GC II

415. **Introduction to Abstract Algebra** (3) GC I
Introductory to groups, rings, and fields P, 215.

416. **Applications of Algebra** (3) GC II
Various applications of abstract algebra, e.g. to coding theory, crystallography, etc. P, 415.

420. **Calculus of Variations** (3) GC I
1985-86
Euler equations and basic necessary conditions for extrema, sufficiency conditions, introduction to optimal control, direct methods. P, 225, and 254 or 255.

421. **Fourier Series and Orthogonal Functions** (3) GC I
Linear spaces, orthogonal functions, Fourier series, Legendre polynomials and Bessel functions. P, 225 and 254 or 255.

422a-422b. **Advanced Analysis for Engineers** (3-3)
GC Laplace transforms, Fourier series, partial differential equations, vector analysis, integral theorems, matrices, complex variables. Not applicable to M.A., M.S., or Ph.D. degrees for math majors. Credit allowed for 422a or 322, but not for both. P, 223 or 225, and 254 or 255. 422a is not prerequisite to 422b. Both 422a and 422b are offered each semester.

423. **Intermediate Analysis** (3) GC I II
Elementary manipulations with sets and functions, properties of real numbers, topology of the real line, continuity, differentiation, sequences and series of real valued functions of a real variable, with emphasis on proving theorems. Not applicable to graduate programs in math. P, 223 or 225. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

424. **Elements of Complex Variables** (3) GC I II
Complex numbers and functions, conformal mapping, calculus of residues. P, 223 or 225.

**Credit will be allowed for only one of 424 or 422b. 422a-422b will not be considered a two-semester course at the 400 level in the Master of Arts degree program.**

425. **Advanced Calculus I** (3) GC II
Continuity and Riemann integration in one or two dimensions, improper integrals, uniform convergence, differentiation in n-space, inverse function theorem. P, 423.

426. **Advanced Calculus II** (3) GC I
Curves, surfaces, change of variables in multiple integrals; extremal properties; theorems of Green, Gauss, and Stokes; exact differentials. P, 425.

434. **Introduction to Topology** (3) GC II
Properties of metric and topological spaces and their maps; topics selected from geometric and algebraic topology, including the fundamental group. P, 425.

436. **Metric Differential Geometry** (3) GC II
Differential geometry of surfaces; nonintrinsic geometry: fundamental forms, Gaussian and mean curvatures; intrinsic geometry: Theorema Egregium, geodesics, Gauss-Bonnet theorem. P, 223 or 225, and 253 or 254 or 255.

443. **Theory of Graphs and Networks** (3) GC II
1985-86
Undirected and directed graphs, connectivity, circuits, trees, partitions, planarity, coloring problems, matrix methods, applications in diverse disciplines. P, 119 or 215 or 223. (Identical with C.Sc. 443)

446. **Theory of Numbers** (3) GC I
1986-87
Divisibility properties of integers, primes, congruences, quadratic residues, number-theoretic functions. P, or 215.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>447.</td>
<td>Combinatorial Mathematics (3) GC II 1986-87</td>
<td>Enumeration and construction of arrangements or designs, theorems on existence and nonexistence of designs, applications to design of experiments and error correcting codes. P, 215 or 243.</td>
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<tr>
<td>455.*</td>
<td>Elementary Partial Differential Equations (3) GC II</td>
<td>Theory of characteristics for first order partial differential equations; second order elliptic, parabolic, and hyperbolic equations. P, 225, and 254 or 255.</td>
</tr>
<tr>
<td>461.</td>
<td>Elements of Statistics (3) GC I II</td>
<td>Probability spaces, random variables, standard distributions, point and interval estimation, parametric and nonparametric hypothesis testing. Math. majors will not receive grad. credit. P, 123 or 125b. (Identical with Stat. 461)</td>
</tr>
<tr>
<td>473.</td>
<td>Theory of Computation (3) GC II (Identical with C.Sc. 473)</td>
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<tr>
<td>475a-475b</td>
<td>Mathematical Principles of Numerical Analysis (3-3) GC 475a: Analysis of errors in numerical computations, solution of linear algebraic systems of equations, matrix inversion, eigenvalues, roots of nonlinear equations, interpolation and approximation. P, 215; 223 or 225; 254 or 255; and a knowledge of a scientific computer programming language. 475b: Numerical integration, solution of systems of ordinary differential equations, initial value and boundary value problems. (Identical with C.Sc. 475a-475b)</td>
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<tr>
<td>478.</td>
<td>Computational Methods of Algebra (3) GC II Applications of machine computation to various aspects of algebra, such as matrix algorithms, character tables and conjugacy classes for finite groups, coset enumeration, integral matrices, crystallographic groups. P, 410 or 413 and a knowledge of a scientific computer programming language. (Identical with C.Sc. 478)</td>
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<tr>
<td>479.</td>
<td>Game Theory and Mathematical Programming (3) GC II 1985-86 Linear inequalities, games of strategy, minimax theorem, optimal strategies, duality theorems, simplex method. P, 410 or 413 or 415. (Identical with C.Sc. 479)</td>
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<tr>
<td>484.</td>
<td>Operational Mathematics (3) GC I Basic concepts of systems analysis, Fourier and Laplace transforms, difference equations, stability criteria. P, 421 and 424, or 422b.</td>
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<tr>
<td>487.</td>
<td>Microcomputers in Education (3) GC I II S Not applicable to B.A., B.S., M.A., M.S., or Ph.D. degrees for math majors. (Identical with Ed.F.A. 487)</td>
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<tr>
<td>515a-515b</td>
<td>Modern Algebra (3-3) Structure of groups, rings, modules, algebras; Galois theory. P, 415.</td>
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<tr>
<td>516a-516b</td>
<td>Algebraic Number Theory (3-3) 1985-86 Dedekind domains, complete fields, class groups and class numbers, Dirichlet unit theorem, algebraic function fields. P, 515b.</td>
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<tr>
<td>517a-517b</td>
<td>Group Theory (3-3) 1986-87 Selections from such topics as finite groups, noncommutative groups, abelian groups, characters and representations. P, 515b.</td>
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<tr>
<td>518.</td>
<td>Topics in Algebra (3) [Rpt.] I II Advanced topics in groups, rings, fields, algebras; content varies.</td>
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<tr>
<td>519.</td>
<td>Topics in Number Theory and Combinatorics (3) [Rpt.] I II Advanced topics in algebraic number theory, analytic number theory, class fields, combinatorics; content varies.</td>
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<tr>
<td>525a-525b</td>
<td>Real and Complex Analysis (3-3) Functions of bounded variation; Riemann-Stieltjes, Lebesgue and Lebesgue-Stieltjes integral; real and complex Lp spaces; differentiation of real and complex functions; basic theory of analytic functions. P, 425.</td>
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529. Topics in Modern Analysis (3) [Rpt.] I II Advanced topics in measure and integration, complex analysis in one and several complex variables, probability, functional analysis, operator theory; content varies.

534a-534b. Topology (3-3) 1986-87 Point set topology, homotopy, homology. Applications, such as manifolds, duality, fixed point theorems, solutions to differential equations. P, 415 and 434.

536a-536b. Calculus of Tensors and Exterior Differential Forms (3-3) 1986-87 Affine tensors, tensor analysis on differentiable manifolds, calculus of exterior differential forms; calculus of variations, Riemannian geometry, applications to field theories. P, 423.


538. Topics in Geometry and Topology (3) [Rpt.] I II Advanced topics in point set and algebraic topology, algebraic geometry, differential geometry; content varies.

539. Algebraic Coding Theory (3) II 1985-86 Construction and properties of error correcting codes; encoding and decoding procedures and information rate for various codes. P, 415. (Identical with E.C.E. 539)

555a-555b. Partial Differential Equations (3-3) 1985-86 Theory and examples of linear equations; characteristics, well-posed problems, regularity, variational properties, asymptotics. Topics in nonlinear equations, such as shock waves, diffusion waves, and estimates in Sobolev spaces. P, 525a or 585a.

556a-556b. Dynamical Systems and Chaos (3-3) 1985-86 Qualitative theory of dynamical systems, phase space analysis, bifurcation, period doubling, universal scaling, onset of chaos. Applications drawn from atmospheric physics, biology, ecology, fluid mechanics and optics. P, 422a-422b or 454.


562a-562b. Statistical Inference (3-3) 1985-86 A decision theoretic approach to estimation and hypothesis testing, sequential methods, large sample methods. P, 423, and 464 or 564a. (Identical with Stat. 567a-567b)


579. Topics in Applied Mathematics (3) [Rpt.] I II Advanced topics in asymptotics, numerical analysis, approximation theory, mathematical theory of mechanics, dynamical systems, differential equations and inequalities, mathematical theory of statistics; content varies.


585a-585b. Principles and Methods of Applied Mathematics (3-3) Boundary value problems; Green's functions, distributions, Fourier transforms, the classical partial differential equations (Laplace, heat, wave) of mathematical physics. Linear operators, spectral theory, integral equations, Fredholm theory. P, 424 or 422b or CR 525a.

586. Case Studies in Applied Mathematics (1 to 3) [Rpt./6 units] I II In-depth treatment of several contemporary problems or problem areas from a variety of fields, but all involving mathematical modeling and analysis; content varies.


588. Topics in Mathematical Physics (3) [Rpt.] I II Advanced topics in field theories, mathematical theory of quantum mechanics, mathematical theory of statistical mechanics; content varies.
589. Nonlinear Wave Motion (3) II 1986-87 Nonlinear partial differential equations describing wave phenomena in water, gases, plasmas, lasers; shocks, modulated wave trains, parametric resonance, solitons and exactly solvable equations. P, 422b or 456 or 455.

596. Seminar
   a. Topics in Mathematics (3) [Rpt./1] S

636. Information Theory and Coding (3) II 1986-87 (Identical with E.C.E. 636)

MECHANICAL ENGINEERING
(See Aerospace and Mechanical Engineering)

MEDICAL TECHNOLOGY
(See Health-Related Professions)

MEDICINE

Interdepartmental

495. Colloquium
   a. Introduction to the Neurosciences I (2) GC P, Consult dept. before enrolling. (Identical with Anat. 495a and Psio. 495a)
   b. Introduction to the Neurosciences II (2) GC P, 495a or consult dept. before enrolling. (Identical with Neur. 495b, Psio. 495b and Psyi. 495b)

596. Seminar
   Many interdepartmental seminars are numbered at both the 500 and the 800 levels. See 896 below for a complete listing.

801. Preparation for Clinical Medicine (1 to 12) I II No grade is given until the full 12 units are completed.

802. Human Behavior and Development (6) I II

896. Seminar
   a. Introduction to Forensic Pathology (1 to 3) II
   j.* Cardiovascular Pharmacology (2)
   n. Research Methods for Clinical and Epidemiological Studies (2) II P, Graduate students must consult the department before enrolling.
   s.* Fluid and Electrolyte Balance and Renal Immunology (2)
   t.* Pathophysiology of Respiratory Diseases (2)
   aa. Introduction to Computers in Medicine (2)
   bb.* Geriatrics-Gerontology (1 to 3) II
   dd.* Maternal/Child Health (1 to 3)
   ee.* Clinical Epidemiology (2)
   gg.* Medical Jurisprudence (2)
   pp. Human Sexuality (2)
   uu. Physical and Biological Basis of Nuclear Medicine (2)
   zz.* Pathogenesis and Approach to Immunological Diseases (2)

*Available as both 596 and 896.

Anatomy

See Anatomy elsewhere in this catalog.
Anesthesiology

Professors Burnell R. Brown, Jr., Head, I. Glenn Sipes
Associate Professors Stuart R. Hameroff, Charles W. Otto
Assistant Professors Barre S. Bernier (Clinical), Randall C. Cork, Joseph A. Gallo, Jr., A. Jay Gandolfi, Ph.D., William S. Gegg (Clinical), Reynolds J. Saunders
Lecturer H. Burton Walker

800. Research (1 to 6) [Rpt./1]

810. Clerkship
   a. Anesthesiology (1 to 18)

815. Subspecialty
   p. Critical Care Medicine (1 to 18) (Identical with I.Med. 815p)

891. Preceptorship
   a. Anesthesiology and Subspecialties (1 to 18)
   c. General Anesthesiology (4 - 6)

Biochemistry

See Biochemistry elsewhere in this catalog.

Family and Community Medicine

Professors Anthony F. Vuturo, Head, Herbert K. Abrams, John T. Boyer, Barton R. Burkhalter (Research), George D. Comerci, Pedro Luis Escobar (Clinical), Eric P. Gall, Melvin H. Goodwin, Wadie W. Kamel, Thomas E. Moon (Research), Andrew W. Nichols, Augusto Ortiz (Clinical), James R. Shaw, Martin E. Silverstein (Research), William A. Stini, Hugh C. Thompson
Associate Professors Peter J. Attarian, Frank A. Hale, Gail G. Harrison, Daniel O. Levinson, Cheryl K. Ritenbaugh (Research), Ronald R. Watson (Research)
Assistant Professors George H. Adams (Research), Kay A. Bauman (Clinical), Jay Christensen-Szalanski (Research), Dorian H. Cordes, Mark R. Dambro (Clinical), Ronald S. Fischler, Henry A. Garcia (Clinical), Jonathan C. Hake, Barbara R. Hartmann (Research), Evan W. Kligman (Clinical), Craig L. McClure, Michael K. Magill, J. Kristin Olson-Garewal (Clinical), Ronald E. Pust, Joseph L. Rea (Clinical), Robert C. Rhode (Clinical), Arthur B. Sanders, Lee Sennott-Miller (Research), Randolph E. Soo Hoo (Clinical), Barry D. Weiss
Lecturers Beverly S. Bechtel, Ruth M. Becker, Lianna M. Edwards, Jil K. Feldhausen, Diane Hedgecock, Lois W. Kamel, Bertha Leis, Dalton McClelland, Gail Silverstein, Bernhardt E. Stein,

487. Poverty and Health (3) II (Identical with Nurs. 487)

500. Research (2 to 16) [Rpt./2]. P, basic science courses.

549. Interdisciplinary Approaches to Health Care of the Aged (3) S (Identical with Ph.Pr. 549)

588. Clinical Anthropology (3) I II (Identical with Nurs. 588)

596. Seminar
   Some seminars are numbered at both the 500 and the 800 levels. See 896 below for a complete listing.

696. Seminar
   a. Research Topics and Methodologies in Family and Community Medicine (1) [Rpt./1] II Consult dept. before enrolling.

800. Research (2 to 16) [Rpt./2].

803. Clinical Clerkship (6 to 9)

815. Subspecialty
   b. The Dying Patient (1 to 6) [Rpt./1]
   c. Alcoholism: A Community Health Problem (3) [Rpt./1] II Field trips.
   d. Community Health Problems (6 to 12)
   g. Community Geriatrics (3 to 12) [Rpt./12 units] Field trips. Consult department before enrolling.

891. Preceptorship
   a. Primary Care (6 to 12)
   b. Family Medicine (3 to 12) P, 4th year medical student. Consult department before enrolling.
   f. Clinical Preceptorship in International Health (6 to 12)
362 DEPARTMENTS AND COURSES OF INSTRUCTION

896. Seminar
a. International Health (3) S Open to health majors only
b. * Epidemiologic Methods (3) I II
c. Approaches to Managing Behavior Problems of Children and Adolescents (2)
e. * Occupational and Environmental Health (1 to 3)
f. The Doctor-Patient Relationship (2)
u. * Current Issues in Health Services (2)
cc.* Community and International Nutrition (1 to 3) II (Identical with N.F.S. 596cc)
ss. * Tropical Disease Problems (2)

*Available as both 596 and 896.

Internal Medicine


Assistant Professors Frederick Ahmann, John W. Bloom, Marlene Bluestein, Keith Comess, Timothy C. Fagan, Paul E. Fenster, Michael Habib, Ronald C. Hansen, Shoei-Kuen Huang, Frederick Kogan, Murray Korc, Stewart Levine, Thomas Miller, Charles Otto, John Palmer, Stuart E. Quan, Paul Rutala, Arthur B. Sanders, Brian Y. Shon, Gayle A. Traver, David B. VanWyck

Instructors Stephen S. Algeo, Anthony Camilli, Richard Gay, Laryenth Lancaster, Joy Logan

Lecturers Robert J. Brooks, Benjamin Burbank, James Corrigan (Pediatrics), William Fair, Marlene Fines, David Flieger, Gerald Goldstein, Robert Heusinkveld (Radiology), Margaret Miller, Susan Newman (Social Services), Milan Novak, Gail E. Riggs, Hans F. Stein

500. Research (2 to 16) [Rpt./1]

555. Cancer Biology (3) II 1986-87 (Identical with Micr. 555)

800. Research (2 to 16) [Rpt./1]

803. Clinical Clerkship (12)

810. Clerkship
a. Internal Medicine (6)
b. Ambulatory Diagnosis and Therapeutics (1 to 18)
c. Geriatrics and General Medicine Extended Care (6) [Rpt./1] P, 803.

815. Subspecialty
a. Clinical Cardiology Elective (6)
b. Clinical Dermatology (1 to 6)
c. Endocrinology (6)
d. Clinical Gastroenterology (6)
e. Hematology-Oncology (6)
f. Immunology, Arthritis and Allergy (6)
g. Infectious Diseases (1 to 6)
h. Pulmonary Diseases (1 to 6)
j. Pulmonary Laboratory and Consultation Service (3 to 6)
k. Nephrology, Renal Diseases (6)
l. Clinical Allergy (1 to 6) (Identical with Ped. 815i)
m. Medical Subspecialties (1 to 18) [Rpt.]
n. Physical Medicine and Rehabilitation (4 to 6) [Rpt./1] CDT P, 3rd or 4th yr. med school.
p. Critical Care Medicine (1 to 18) (Identical with Anes. 815p)
r. Neurological and Neuromuscular Disorders (3 to 6) P, 803. (Identical with Neur. 815r)
s. Arthritis and Clinical Immunology (3 to 18) P, 803.

891. Preceptorship
a. General Medicine and/or Subspecialties (1 to 18) [Rpt./2]
Microbiology and Immunology

See Microbiology and Immunology elsewhere in this catalog.

Neurology

Professors Peggy Ferry (Pediatrics), William A. Sibley
Associate Professor Colin R. Bamford, Acting Head
Assistant Professors Enrique L. Labadie, Kalarickal Oommen
Lecturer Robert H. Hamilton

495. Colloquium
   b. Introduction to Neurosciences II (2) GC (Identical with Med. 495b, which is home)

500. Research (2 to 16) [Rpt./1]

800. Research (1 to 12) [Rpt./1]

803. Clinical Clerkship (3 to 6).

810. Clerkship
   a. Neurology (3 to 6).

815. Subspecialty
   r. Neurological and Neuromuscular Disorders (3 to 6) (Identical with I.Med. 815r, which is home)

891. Preceptorship
   a. Neurology (1 to 18) [Rpt./2]

Obstetrics — Gynecology

Professors C. D. Christian, Head, Jack Pearson, Lewis Shenker
Associate Professors Diane S. Fordney, William C. Scott, Louis Weinstein
Assistant Professors Herbert E. Pollock, Kathryn Reed, Sheldon Weiner
Instructors Steven Calvin, Allan Hartsough

800. Research (1 to 18) [Rpt./1]

803. Clinical Clerkship (6 to 9)

810. Clerkship
   a. Preparation for Practice (1 to 18)

891. Preceptorship
   a. Obstetrics and Gynecology (1 to 18)
   b. Gynecology-Endocrinology (6)

Ophthalmology

Professor Albert M. Potts (Clinical), Acting Head
Associate Professor Andrzei W. Fryzckowski (Research)
Assistant Professors William J. Durant, Sam E. Sato

800. Research (6 to 18) I II

815. Subspecialty
   a. Ophthalmology (3 to 6)

891. Preceptorship
Pathology


Associate Professors James M. Byers, III, Anna R. Graham, Thomas M. Grogan, Mary Jane Hicks, Douglas H. McKelvie, Richard E. Sobonya

Assistant Professors Jerry L. Bangert (Clinical), Thomas E. Henry (Clinical), Allen M. Jones (Clinical), Maria L. Paquin (Clinical), Ronald Schifman, Catherine M. Spier, Karen K. Steinbronn

Lecturers Louis Hirsch, Paula F. Lowe, Claire M. Payne

489. Introduction to Forensic Science: Pathology, Anthropology, Toxicology and Law (2) GC III
Opportunity for the criminal investigator and attorney with a background in forensic pathology to better understand the results of trauma, toxic substances and environmental catastrophes. Taught off campus only.

801. General and Systemic Pathology (10) I II

810. Clerkship
a. Anatomic Pathology (1 to 18)
b. Clinical Pathology (1 to 18)
c. Special Topics (1 to 18) [Rpt.] P, 801.

891. Preceptorship
a. Pathology (1 to 18) [Rpt./2]

Pediatrics


Associate Professors Sergio A. Bustamante, M. Eleanor Grimm (Clinical), Marilyn J. Heins, John J. Hutter, Stanley M. Lee, Mary E. Rimsza (Clinical) Michael J. Schumacher, Elsa Sell


Instructor Alice E. Carroll

Lecturers Nancy N. Dambro, Victor A. Elsberry, Maureen J. Hutter, Sydney E. Salmon, Mary Ann Schaber

800. Research (1 to 18)

803. Clinical Clerkship (6 to 9)

810. Clerkship
a. Externship in Inpatient Pediatrics (6) P, 803
b. Pediatric Care in a Cross-Cultural Setting (6)
c. Inpatient Pediatrics (6)

811. Subinternship
a. Ambulatory Pediatrics (1 to 18)
b. Behavioral and Developmental Pediatrics (1 to 18)

815. Subspecialty
a. Advanced Neonatology (6)
b. Pediatric Infectious Diseases (6)
c. Cardiac Ultrasound Echo and Doppler (4 to 6)
d. Pediatric Cardiology (6)
e. Pediatric Neurology (6)
f. Pediatric Hematology/Oncology (6)
g. Pediatric Neurology (6)
h. Poison Center (4 to 6) P, 803
i. Pediatric Clinical Pharmacology (1 to 12) [Rpt./1]
j. Clinical Allergy (1 to 6) (Identical with I.Med. 8151, which is home)
k. Pediatric Endocrinology (1 to 18)

891. Preceptorship
a. Pediatrics (1 to 18)
b. Preparation for Practice (1 to 18)
**Pharmacology**

See Pharmacology elsewhere in this catalog. Toxicology courses are listed under Pharmacology and Toxicology.

**Physiology**

See Physiology elsewhere in this catalog.

**Psychiatry**


Associate Professors Diane S. Fordney (Obstetrics and Gynecology), Alfred Kaszniaik, Stephen B. Shanfield, Henry I. Yamamura (Pharmacology)

Assistant Professors Peter J. Attarian (Family and Community Medicine), Shirley N. Fahey, Milton Frank, Russell D. Martin, John J. Misiaszek, Rebecca L. Potter, Catherine M. Shisslak


495. Colloquium
   b. Introduction to Neurosciences II (2) GC (Identical with Med. 495b, which is home)

800. Research (1 to 12)

803. Clinical Clerkship (6 to 9) [Rpt./1].

810. Clerkship
   a. Clinical and Community Psychiatry (1 to 18)
   b. Child Psychiatry (1 to 18).

815. Subspecialty

891. Preceptorship
   a. Psychiatry (1 to 18) [Rpt./2] P, 803.

**Radiology**


Associate Professors Silvio A. Aristizabal, John C. Bjelland, George T. Bowden, Tom Cetas, William G. Connor, Kai Haber, Robert Henry, Bruce Hillman, Tim Hunter, Gerald Pond, Bryan Westerman Assistant Professors Raymond Carmody, Mark Chernin, Jon Kotler, John D. Newell, Def Steinbronn, Jeffrey F. Williamson, Peter Yang

Instructor Arthur Janssen

Lecturers Richard Claypool, Jack N. Hall, Douglas McKeivie (Animal Resources)

501. Radiation Biology (3) II Basic principles of radiation effects in mammalian cell and tissue systems, with emphasis on biochemical aspects, such as DNA damage and DNA repair, and cellular responses, such as cell kinetics defects and radiation repair and recovery; radiation and chemical (especially radiomimetic drugs) carcinogenesis. P, intro. bio. and chem.

551. Environmental Carcinogenesis (3) II 1966-87 See 851 for description. (Identical with Micr. 551 )

555. Cancer Biology (3) II 1966-87 (Identical with Micr. 555 )
366 \textit{DEPARTMENTS AND COURSES OF INSTRUCTION}

596. \textbf{Seminar}
   h. Control of Proliferation in Animal Cells (1 to 2) I P, permission of instructor. (Identical with Micr. 596h )

800. \textbf{Research} (1 to 6) [Rpt./1]

815. \textbf{Subspecialty}
   a. Diagnostic Radiology (6)
   b. Nuclear Medicine (1 to 6)
   c. Radiation Oncology (1 to 16)

851. \textbf{Environmental Carcinogenesis} (3) II 1986-87 Phenomenological and mechanistic aspects of cancer etiology as induced by physical and chemical agents in our environment, with special emphasis on possible molecular and cellular mechanisms involved in cancer etiology. P, consult department before enrolling.

891. \textbf{Preceptorship}
   a. Radiology (1 to 18) [Rpt./1] P, 815a

896. \textbf{Seminar}
   h. Control of Proliferation in Animal Cells (1 to 2) I (Identical with Micr. 896h )

\textbf{Surgery}


Assistant Professors Robert B. Dzioba, Robert W. Emery, J. David Gibeault, Robert P. Iacono, Kenneth V. Iserson, Steven M. Joyce, Keith R. Kaback, Kenneth E. McIntyre, Arthur B. Sanders, John B. Sullivan

Instructors Thomas R. Elliot, Mark M. Levinson, William J. Quinlin, Jeffrey R. Rubin

Lecturers Michael A. Buldra, Janice A. Copeland, Anthony C. Guzauskas, Ann Kerwin, Kathleen V. Kintner, Joseph M. Leal, Donald B. Lewis, John D. Lewis, Mary Jane McAleer, Mary A. McAfee, David G. Poedel, Ruth L. Smothers, Holly A. Tyson, Walter P. Work

800. \textbf{Research} (1 to 12) P, 803.

803. \textbf{Clinical Clerkship} (6 to 9)

807. \textbf{Specialty Clerkship} (3) P, basic science courses.

810. \textbf{Clerkship}
   a. General Surgery (6)

815. \textbf{Subspecialty}
   a. Urinary Stone Disease (6)
   b. Cardiothoracic Surgery (6)
   c. Neurosurgery (6)
   d. Surgical and Medical Problems in Fluid and Electrolyte Balance (1 to 3) [Rpt./1]
   e. Urology (6)
   f. Orthopedics (3)
   g. Cardiovascular Physiology and Research (1 to 12)
   h. Lymphvascular System in Health and Disease (6 to 12)
   i. Otorhinolaryngology (3)
   k. Sports Medicine (Section of Orthopedic Surgery) (1 to 6) [Rpt./1]
   l. Orthopedic Bioengineering (3 to 6) P, Nine weeks of surgery clerkship, 803 and/or 807
   m. Trauma (3 to 6)
   r. Clinical Experience in Rehabilitation Medicine (1 to 4)
   t. Emergency Medicine (3 to 12)

891. \textbf{Preceptorship}
   a. Surgery and Subspecialties (1 to 18) [Rpt./3]
MEDIEVAL STUDIES

Committee on Medieval Studies (Graduate)

Professors Sigmund Eisner (English), Chairperson, John Boe (Music)
Associate Professors Jonathan Beck (French and Italian), Alan E. Bernstein (History),
Richard C. Jensen (Classics), Stephen H. West (Oriental Studies)

The Graduate Committee on Medieval Studies does not offer any major at this time. Programs constituting appropriate minors are available for doctoral students with majors in other disciplines. For further information concerning the minor, please see the Graduate Catalog.

METALLURGICAL ENGINEERING
(See Materials Science and Engineering)

MEXICAN AMERICAN STUDIES

Mexican American Studies and Research Center

Professors Jose D. Garcia (Physics), James Officer (Anthropology), Eliana S. Rivera (Spanish and Portuguese), Cecil Robinson (Emeritus, English), Renato I. Rosaldo (Emeritus), Carlos Velez (Anthropology), Thomas Weaver (Anthropology), Roger Yoshino (Sociology)
Associate Professors Macario Saldate IV (Educational Foundations and Administration), Director, Adela Allen (Reading), Manuel Escamilla (Elementary Education), Celestino Fernandez (Sociology), John A. Garcia (Political Science), Juan Garcia (History), Roseanne Gonzalez (English), William Velez (Mathematics)
Assistant Professors Arminda Fuentevilla (Educational Foundations and Administration), Richard Lopez (Elementary Education), Marcello Medina, Jr. (Educational Foundations and Administration), Armando Miguelez (Spanish and Portuguese), Guadalupe Romero (Elementary Education), David Torres (Management and Policy)
Lecturers Adalberto M. Guerrero (Spanish and Portuguese), Martha Fimbres (Medicine)

Under the auspices of the Mexican American Studies and Research Center, the Mexican American studies curriculum is an interdisciplinary exploration of the Mexican American experience. Its general goal is to provide a socially pertinent education with humanistic and practical content which will enrich the total University curriculum as well as prepare students to serve the total community.

The major: Thirty units in M.A.S., including 180a-180b and nine units chosen from 161, 233, 332, and 443 or 477b. At least fifteen units must be in upper-division courses. Group III requirement must be fulfilled in Span.

The minor: A supportive minor in Mexican American studies to augment other academic areas or majors is encouraged. The minor requires 21 units, including 180a-180b and 6 units chosen from 161, 233, 332, and 443 or 477b.

160. Minority Relations and Urban Society (3) I II (Identical with Soc. 160)
161. The Chicano in American Society (3) II (Identical with Soc. 161)
213. Oral Communication in Spanish (4) I II (Identical with Span. 213)
233. History of the Mexican American (3) I (Identical with Hist. 233)
303. Comprehensive Spanish for the Bilingual (4) I II (Identical with Span. 303)
DEPARTMENTS AND COURSES OF INSTRUCTION

319. Mexican American Culture (3) I (Identical with Anth. 319)
325. Foundations of Bilingual Education (3) I (Identical with Ed.F.A. 325)
330. Minority Groups and American Politics (3) I (Identical with Pol. 330)
332. Politics of the Mexican American Community (3) II (Identical with Pol. 332)
368. Colonial Mexico (3) I (Identical with Hist. 368)
369. Mexico Since Independence (3) II (Identical with Hist. 369)
373. Intermediate Grammar for the Bilingual (3) I II (Identical with Span. 373)
404. Sociology of the Southwest (3) GC I (Identical with Soc. 404)
406. Foundations of Reading Instruction in Spanish (2) GC II Student must be registered in the College of Education. (Identical with Rdng. 406)
411.* Public Administration and the Mexican American (3) GC I (Identical with M.A.P. 411)
* Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.
423. Peoples of Mexico (3) GC II (Identical with Anth. 423)
441. Children's Literature in Spanish (3) GC I (Identical with Span. 441)
443. Mexican-American Literature (3) GC II (Identical with Span. 443)
447. Contemporary Mexican Literature (3) GC II S (Identical with Span. 447)
448. Government and Politics of Mexico (3) GC I (Identical with Pol. 448)
453. Mesoamerican Archaeology (3) GC I (Identical with Anth. 453)
460. History of the Hispanic Borderlands (3) GC II (Identical with Hist. 460)
461. Race and Ethnic Relations (3) GC I II (Identical with Soc. 461)
473. Spanish for the Bilingual Classroom Teacher (3) GC II (Identical with Span. 473)
477b. Ethnic Literature (3) (Identical with Engl. 477b)
485. Mexicana/Chicana Women's History (3) GC I CDT Historical survey and sociological analysis of past and present experiences of Mexicanas and Chicanas in the United States (Identical with W.S. 485) Writing-Emphasis Course. P. Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
495. Colloquium c. The Mexican American (3) GC I II (Identical with Hist. 495c, which is home)
508. Bilingual Reading (3) I Student must be registered in the College of Education. (Identical with Rdng. 508)
625. Educating the Bilingual Learner (3) I S (Identical with Ed.F.A. 625)
684. Administration of Bilingual Education Programs (3) S (Identical with Ed.F.A. 684)
695. Colloquium r. Bilingualism in the United States (3) [Rpt./3] S (Identical with Ed.F.A. 695r)

MICROBIOLOGY
(See Microbiology and Immunology)

MICROBIOLOGY AND IMMUNOLOGY

Professors John Spizizen Head, Harris Bernstein, Junetsu Ito, Wayburn S. Jeter (Pharmacology and Toxicology), Rein Kilkson (Physics), Peter P. Ludovici (Emeritus), William Meinke, George B. Olson, Kenneth Ryan (Pathology), Irving Yall (Emeritus)

Associate Professors Charles P. Gerba (Nutrition and Food Science), Robert J. Janssen, David O. Lucas, Norval A. Sinclair, Associate Head, James T. Sinski, J. Glenn Songer (Veterinary Science)

Assistant Professors Richard Friedman, Ruthann Kibler

Lecturers Judith Bradshaw, Vivian Gage, Lee M. Kelley
The University Department of Microbiology and Immunology offers a course of study applicable to general and applied sciences in agriculture, allied health, biology and medicine. The major provides a strong foundation for graduate study in microbiology, immunology, molecular biology and genetics, as well as a preprofessional program for students seeking admission to schools of medicine and dentistry.

The graduate program in microbiology and immunology has three major areas of emphasis: (1) molecular, genetic and physiological microbiology, (2) environmental, pathogenic and industrial microbiology, and (3) immunology. Faculty expertise to direct research in these areas is drawn from many departments and colleges on campus.

The department offers the Bachelor of Science, Master of Science, Specialist in Microbiology, and Doctor of Philosophy degrees with a major in microbiology.

The major: 37 units, including 217, 327R, 417R, 419, 420R, 428R, 429, 495a. The remaining units must be chosen from the following and must include at least four laboratory courses (designated*): 403R, 417L*, 420L*, 423R, 423L*, 425, 427L*, 430, 435*, 438, 450*, 451*, 470, and 471*. Micr. 102, 103, 104 (biology core), Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b and 325 and 326 or 322 and 323, 460 or 462a or 462b or N.F.S. 406a or 406b, Phys. 102a-102b or Phys. 103a-103b and 8 units of math. to include Math. 125a are also required.

102. Fundamentals of Ecology and Evolution (4) I II (Identical with Ecol. 102)
103. Biology of Cells (4) I II (Identical with M.C.B. 103)
104. Organismic Biology (5) I II (Identical with Ecol. 104)
110. Introduction to Microbiology (5) I II Introduction to general, applied, and pathogenic microbiology and immunology. 4R, 4L. Open to nonmajors only.
327R. General Mycology (3) I General mycology, with emphasis on the microfungi. P, 217.
357. Communicable Diseases (3) I II The nature and prevention of communicable diseases. Open to nonmajors only.
403R. Biology of Animal Parasites (3) GC I (Identical with V.Sc. 403R)
417L. Advanced Laboratory Techniques (2) GC II Instrumentation and technology in microbial physiology and immunology. P, 417R, 419.
419. Introductory Immunology (3) GC I Basic concepts of the immune system. Presentation of the roles antigen, immunoglobulins, complement, lymphokines and types of immune cells play in generalization of humoral and cell-mediated immunity. P, 217, Chem. 241b, 243b. (Identical with V.Sc. 419)
420R. Pathogenic Microbiology (3) GC II Characteristics, isolation and identification of microorganisms pathogenic for humans and other animals. P, 217, Chem. 241b, 243b. (Identical with V.Sc. 420R)
420L. Pathogenic Microbiology Laboratory (2) GC II Laboratory methods in pathogenic microbiology. P, CR 420R (Identical with V.Sc. 420L)
423R. General Pathology (3) GC II (Identical with V.Sc. 423R)
423L. General Pathology Laboratory (1) GC II (Identical with V.Sc. 423L)
427L. General Mycology Laboratory (2) GC I General mycology lab., with emphasis on the microfungi. P, CR 327R.
428R. Advanced Microbial Genetics (3) GC II (Identical with M.C.B. 428R)
428L. Advanced Microbial Genetics Laboratory (2) GC I (Identical with M.C.B. 428L)
430. Introduction to Biophysics (2) GC I (Identical with Phys. 430)
370  DEPARTMENTS AND COURSES OF INSTRUCTION

435. Soil Microbiology (3) GC I (Identical with S.W.435)
450. Medical Mycology (4) GC II The isolation and identification of fungi of medical importance. 2R, 6L. P, 217. (Identical with V.Sc. 450)
451. Diagnosis and Control of Plant Diseases (3) GC I (Identical with PI.P. 451)
470. Food Microbiology and Sanitation (3) GC II (Identical with N.F.S. 470)
471. Food Microbiology and Sanitation Laboratory (2) GC II 1986-87 (Identical with N.F.S. 471)
495. Colloquium a. Senior Colloquium (1) [Rpt./1] I II Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).
501. Medical Microbiology (6) I The biological characteristics of microorganisms of importance in human health and disease; the reaction of the host to infectious agents and the mechanisms of host defense; diagnosis and management of infectious disease. Lectures, discussions, and lab. experiments. P, Ecol. 101b, Chem. 241b, Bioc. 501.
530. Biophysical Theory (2) II (Identical with Phys. 530)
550. Molecular Mechanisms of Microbial Pathogenesis (3) II 1986-87 Review of current concepts in specific areas of microbial pathogenesis, including action of exo- and endotoxins, cell surface interactions, phagocytosis and host microbicidal functions. P, Bioc. 460.
551. Environmental Carcinogenesis (3) II 1986-87 (Identical with Radi. 551)
555. Cancer Biology (3) II 1986-87 Fundamental biological aspects of neoplastic growth at the organ, cellular, and molecular levels; emphasis on the etiology, behavior, and therapy of neoplasms. (Identical with Anat. 555, I.Med. 555, and Radi. 555)
570. Molecular Genetics (3) I 1985-86 Molecular genetics and biology of the bacterial viruses; molecular mechanisms of gene regulation, DNA replication, DNA repair, mutation and genetic recombination; current research in bacterial genetics (lysogeny, transduction, conjugation, use of transposons and gene fusions in genetic analysis and transformation); introduction to gene cloning and its uses in analysis of gene structure and regulation.
577. Advanced Microbial Physiology (2) I 1985-86 Studies of metabolic pathways of selected microorganisms with an emphasis on industrial applications. P, 417R.
596. Seminar a. Current Problems in Molecular Biophysics (1) I II (Identical with Phys. 596a, which is home) h. Control of Proliferation in Animal Cells (1 to 2) I (Identical with Radi. 596h, which is home)
630. Immunology of Infectious Disease (4) II 1986-87 Correlation of the roles played by components of humoral and cell-mediated immunity (CMI) in infectious disease. Methods for monitoring changes in humoral and CMI during the disease process. 2R, 6L. P, 419, Bioc. 460. (Identical with V.Sc. 630)
672. Food Safety (2) I 1986-87 (Identical with N.F.S. 672)
695. Colloquium a. Readings in Microbiology (1) [Rpt.] I II b. Immunopathology (1) I II
MILITARY SCIENCE, NAVAL SCIENCE AND MILITARY AEROSPACE STUDIES

Military science (Army), naval science (Navy) and aerospace studies (Air Force) are open to male and female students seeking a commission. ROTC courses can be counted as elective credit toward graduation in most academic majors. Lower-division courses carry no service commitment. Veterans may receive credit for the first two years of the four-year ROTC program. Textbooks and uniforms are provided by the departments. For further information about the four-year ROTC programs, the special two-year ROTC programs, entry requirements for upper-division courses, and ROTC scholarships, see the catalog section on School of Military Science, Naval Science and Aerospace Studies or contact the department.

Military Science

Professor Melvin C. Jenks
Assistant Professors Dave Davenport, Frank Paris, Ray Quesenberry, Charles Stead, Greg Stock
Lecturers Albert Burruel, Kevin Faucett, Joe Vandiver

100a-100b. First Year ROTC (2-2) Role of the Army; customs, traditions and courtesies of the service; basic leadership; fundamentals of map reading; branches of the Army; drill and ceremonies; first aid; small unit tactics; physical training. 1 R, 1 L.

200a-200b. Second Year ROTC (2-2) Principles of War; military briefings, organizations and missions of Army units; OER system, career specialties; physical training; leadership; role of the NCO; drill and ceremonies; first aid. 1R, 1L.

300a-300b. Third Year ROTC (3-3) Land navigation; leadership, ethics and professionalism; tactics; weapons; drill and ceremonies; operation orders; communications; CBR; Soviet Army; intermediate soldier skills; physical training. 3R, 1L.

400a-400b. Fourth Year ROTC (3-3) Command and staff functions; Army personnel system; oral and written communications; Army logistics system; AADP and RREO; counseling; physical training, officer accessions. 3R, 1L.

Military Aerospace Studies

Professor Carl B. Johnson
Assistant Professors Earl C. Kerr, Ralph M. Lentz, Kenneth I. Nonaka, Andrew E. Randles

101a-101b. First Year GMC*, History of Aviation (2-2) Survey of the development of aviation from the advent of the air age to the present, with emphasis on military aviation and its relationship with political and economic aspects of historical world situations. 101a is not prerequisite to 101b.

201a-201b. Second Year GMC*, Air Force Today (2-2) Survey of the doctrine, mission, and organization of the U.S.A.F.; U.S. strategic offensive and defensive forces; U.S. general purpose and aerospace support forces. 201a is not prerequisite to 201b.

300a-300b. Third Year POC**, Leadership and Management (3-3) Theory and application of leadership and management, with emphasis on human relations, motivation, communication for managers, organizational behavior and management processes.
DEPARTMENTS AND COURSES OF INSTRUCTION

400a-400b. Fourth Year POC**, American Defense Policy (3-3) Critical analysis of various aspects of the military in American society and its application and effects on the world political and economic environment.

*General Military Course
**Professional Officer Course

Naval Science

Professor Fred J. Cone
Associate Professor Nelson Paler
Assistant Professors Michael Alfonso, Robert B. Bralliar, Paul Butler, Tim Olivier
Instructors Orba N. Hall, Curt D. Dinge

100a-100b. Naval Laboratory I (1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

101. Introduction to Naval Science (2) I Introduction to the naval profession and to concepts of seapower, with emphasis on mission, organization, and warfare components of the Navy and Marine Corps; naval courtesy and customs, military justice, leadership, and nomenclature.

102. Naval Ship Systems I: Engineering (3) II Ship characteristics and types including ship design, hydrodynamic forces, stability, compartmentation, propulsion, electrical and auxiliary systems, interior communications, ship control, and damage control; basic concepts of the theory and design of steam, gas turbine, and nuclear propulsion.

200a-200b. Naval Laboratory II (1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.


202. Seapower and Maritime Affairs (3) II U.S. Naval history from the American Revolution to the present. Discussion of the theories of Mahan, political issues of merchant marine commerce, and a comparison of U.S. and Soviet naval strategies.

300a-300b. Naval Laboratory III (1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

301. Navigation and Naval Operations I (3) I Theory, principles, and procedures of navigation. Students learn piloting navigation including the use of charts, visual and electronic aids, the theory and operation of magnetic and gyro compasses, and celestial navigation.

302. Navigation and Naval Operations II (3) II International and island rules of the road, relative-motion vector-analysis, formation tactics, and ship employment. Introduction to naval operations and ship handling. P, 301

310. Evolution of Warfare (3) I The development of warfare to present, focusing on theorists, strategists, tacticians, and technological developments. Student acquires sense of strategy and impact of precedent on military actions.

400a-400b. Naval Laboratory IV (1) II Various topics such as drill and ceremonies, physical fitness, cruise preparation, sail training, safety awareness, personal finances, and applied exercises in naval ship systems, navigation, naval operations, naval administration, and military justice. 3L. Field trip.

401. Leadership and Management I (2) I Organizational behavior and management in the context of the naval organization. A survey of management functions of planning, organizing, and controlling; and introduction to individual and group behavior in organizations; motivation and leadership.

402. Leadership Management II (2) II Naval officer responsibilities in naval administration: counseling methods, military justice administration, naval human resources management, directives and correspondence, naval personnel administration, material management and maintenance. P, 401 or M.A.P. 305.
410. Amphibious Warfare (3) II Historical survey of the development of amphibious doctrine and amphibious operations, with emphasis on the evolution of amphibious warfare in the 20th century; present day potential and limitations on amphibious operations, including the rapid deployment force concept.

MINES

The following mines courses are for students who are not necessarily majors in the College of Mines: Ch.E. 102, 201, 202, 445, 485; G.En. 120, 311; M.S.E. 122, 224, 221, 331R, and Mn.E. 120. They are designed to enable the nonengineering student to better understand the role of engineering and mineral technology in modern society. For details regarding these courses, please see the individual departments specified.

MINING AND GEOLOGICAL ENGINEERING

Professors Ian W. Farmer, DeVerle P. Harris, Y. C. Kim, Richard Newcomb, William C. Peters (Emeritus), Michael Rieber
Associate Professors Charles E. Glass, Head, Jaak J. K. Daemen
Assistant Professors Satya Harpalani, Pinnaduwa Kulatilake

Geological Engineering

Geological engineering entails the use of geological principles in the analysis and design of engineering programs and structures in such fields as mineral exploration, mineral economics, mining, ground control and stabilization, earthquake engineering and other applications that are affected by natural geologic forces and processes. Graduates in geological engineering are usually employed in the search for economic mineral deposits, or in the construction engineering field in such areas as foundation design, site examination for dams and power plants, water resource development, and urban planning.

The department offers the Bachelor of Science in Geological Engineering, Master of Science and Doctor of Philosophy degrees with a major in geological engineering.

Undergraduate degree requirements are listed in the College of Mines section of this catalog.

120. Introduction to Geological Engineering (2) II Survey of current geological engineering technology applied to the development of mineral resources and to the interaction of man and the environment.

302. Geostatistics (3) II Introduction to univariate statistical methods and their applications to sampling and analysis of geological data. P, Math. 223. (Identical with Mn.E. 302)

311. Engineering Ethics (1) II Professional responsibilities of mining and geological engineers to employer, client, profession, society and self; conflict of interest situations; professional codes of ethics. (Identical with Mn.E. 311)

325. Principles of Health and Safety in the Mineral Industry (2) I (Identical with Mn.E. 325)

330. Introduction to Remote Sensing (3) I (Identical with Geog. 330)

407. Photogeology (3) GC II Use of aerial photographs in geologic mapping. 1R, 6L. P, Geos. 221. (Identical with Geos. 407) Glass

410. Mining Geology (2) GC II Collection, analysis, and utilization of geologic data in the production of minerals; includes surface and underground mapping. 6L. P, Geos. 410.

420. Geophysical Exploration: Potential Field Methods (4) GC I (Identical with Geos. 420)

422. Geophysical Engineering (3) GC I Applied geophysics as employed in engineering problems, including geophysical methods and interpretation of results in mineral exploration, earthquake studies, and site examination. P, Phys. 103b, Math. 223.

424. Fundamentals of Geotechnics (3) I Fluid, soil and rock mechanics relations to geologic features influencing design, construction, environmental effects, and maintenance of highways, dams, foundations, and underground openings. P, 302, C.E. 217, Geos. 221, CR G.En. 420 or 422.

425. Geotechnical Investigations (3) GC II Investigation and analysis of geologic factors in the design and construction of engineering projects. 1R, 6L. P, 424.

427. Geomechanics (3) GC I (Identical with Mn.E. 427)

428. Ore Search (3) GC I Analysis of guides and techniques leading to location and delimitation of ore bodies. Field trips. 2R, 3L. P, Geos. 303, CR 420 or 422.
DEPARTMENTS AND COURSES OF INSTRUCTION

438. Design of Exploration Programs (3) GC II Geologic and economic principles applied to the design of mineral exploration programs and to the evaluation and development of prospects. P, 428.

460. Health Hazards in the Mine Environment (2) GC II 1985-86 (Identical with Mn.E. 460)

461. Accident Prevention in the Mine Environment (2) GC II 1986-87 (Identical with Mn.E. 461)

507. Applied Multispectral Imagery (3) II Application to mineral exploration, engineering geology, groundwater location, and pollution monitoring. 6L. P, 407. (Identical with Geos. 507) Glass

527. Fundamentals of Geomechanics (4) II (Identical with Mn.E. 527)

528. Subsurface Exploration Methods (3) I 1986-87 Advanced geological and engineering methods applied to the location and delimitation of deep ore bodies from mine workings and boreholes. 1R, 6L. P, 428.

538. Simulation Gaming in Exploration (3) I 1985-86 Integrated approach to ore search involving modeling, decision making, and sequential field operations. 1R, 6L. P, 438.


649. Probabilistic Methods in Geotechnical Engineering (3) II 1985-86. (Identical with C.E. 649)

660a-660b. Estimation of Mineral Resources by Quantitative Methods (3-3) 1985-86 (Identical with Mn.Ec. 660a-660b)

696. Seminar
   a. Research Seminar (1 to 3) [Rpt.] I II

Mineral Economics

Mineral economics is an emerging field of applied economics encompassing the interface of minerals engineering and earth science with the business of mineral production and the welfare of society. Mineral economists are employed in such fields as mineral investment analysis, planning and forecasting for mineral development, mineral commodity supply and demand analysis, and statistical modeling of exploration and mining ventures.

The Master of Science and Doctor of Philosophy degrees are offered with a major in mineral economics. For admission and degree requirements, please see the Graduate Catalog.

418. Mine Investment Analysis (3) GC II (Identical with Mn.E. 418)


550. Economics of the Metal Industries (3) II Reserves, resources, and major deposits, production technologies, market structure, industrial organization, consumption trends, recycling, foreign trade, and geopolitics of selected industries. P, A.Ec. 504.

560. Economics of the Nonmetals (3) II 1986-87 Technology of production, raw materials, uses and markets, industrial organization, market structure, economics of production, pricing, and marketing practices for nonmetallic minerals. P, A.Ec. 504.

584. Economics of Coal, Nuclear, and Alternative Energy Sources (3) I Reserves and resources, economics of production, utilization and conversion, externalities, market structure, policy issues for alternative energy sources such as oil shale, tar sands, coal gasification, and solar. P, A.Ec. 504.

586. Economics of Petroleum and Natural Gas (3) I Reserves and resources of petroleum and natural gas, production technology, market structure, industrial organization, pricing, competitive behavior, consumption trends, and policy issues. P, A.Ec. 504.


600. Readings in Mineral Economics (3) II Selected readings in the economics of mineral resource exploration and exploitation, environmental protection, national mineral policy, world mineral development, and international trade. P, Econ. 361.
650a-650b. Advanced Principles of Mineral Economics (3-3) Risk analysis; optimum production, depletion and exhaustion; productivity and technical change; imperfect competition in mineral markets; resource distribution, trade and mineral policy. P, Econ. 501a or A.Ec. 504.


696. Seminar a. Research Seminar (1 to 3) [Rpt./3 units] III b. Advanced Topics in Mineral Evaluation and Risk Analysis (1 to 3) [Rpt./3 units] III c. Mineral and Energy Policy Analysis (1 to 3) [Rpt./3 units] III d. Advanced Mineral Commodity Analysis (1 to 3) [Rpt./3 units] III e. Topics in Mineral and Energy Supply (1 to 3) [Rpt./3 units] III f. Decision Analysis and Operations Research in Mineral Exploration (1 to 3) [Rpt./3 units] III g. Process Analysis and Costing (1 to 3) [Rpt./3 units] III

Mining Engineering

Mining engineering is that branch of engineering responsible for the planning, design, development and operation of mining facilities for the production of mineral resources. Employment opportunities available to mining engineering graduates may be found in the fields of design and development of both underground and surface mining systems, management of mining operations and heavy construction projects, heavy equipment development and finance.

The degrees of Bachelor of Science in Mining Engineering, Master of Science and Doctor of Philosophy are offered with a major in mining engineering.

Undergraduate degree requirements are listed in the College of Mines section of this catalog.

120. Elements of Mining (2) I II Historical development of mining; unique problems of the extractive industry; introduction to minerals industry technology. Field trip.

203. Underground Mining Systems (2) I Underground development, unit operations, shafts, drifts, raises, stopeing methods, and costs. 1R, 3L. Field trip. P, 120.

210. Mine Surveying (3) II Mine surveying problems and practices; closed traverse of underground mine; shaft plumbing, stope and raise surveying. Includes two-week session at end of second semester. P, 120, C.E. 151.

302. Geostatistics (3) II (Identical with G.En. 302)

304. Mine Atmosphere Control and Safety (3) II Quality and quantity control of respirable air in mining operations. One inspection trip and twelve hours in mine rescue. 2R, 3L.

311. Engineering Ethics (1) I II (Identical with G.En. 311)

315. Rock Fragmentation (2) I Theory, properties, and uses of industrial explosives, blasting devices and nuclear devices for rock fragmentation. Field trips.


325. Principles of Health and Safety in the Mineral Industry (2) I Fundamental concepts of loss control in the mineral industry; includes a review of state and federal regulations and standards and instruction in program management, industrial hygiene, safety, toxicology, fire protection, workers' compensation and mine rescue. All-day field trip. (Identical with G.En. 325 and M.S.E. 325) Garcia


401. Analysis of Mine Operations (2) GC I Use of Operations Research principles and techniques to analyze production, distribution and valuation problems in mine operations, with emphasis on deterministic cases. 1R, 3L. P, 302. Kim

404. Mine Management (2) II Organization and management of mining enterprises. Open to mn.e. and g.en. majors only.

418. Mine Investment Analysis (3) GC II Economic factors, including taxation, mineral depletion allowance, and finance in the mining industry; includes fundamentals of engineering economics, capital budgeting, and risk analysis. P, 430. (Identical with Mn.Ec. 418)

420. Mine Design (3) GC II Design of a modern mine; feasibility study, reserve estimation, mine planning, hoisting, compressed-air distribution and drainage. 2R, 3L. Field trips. P, 304, 321, 430, or CR. Kim

427. Geomechanics (3) GC I Mechanical behavior of rock and rock masses; response to load changes: deformations, failure, discontinuity slip; in situ stress state; rock testing; geomechanical classifications; engineering applications: slopes, pillars, tunnels; reinforcement design. 2R, 3L. P, C.E. 217, Geos. 221. (Identical with G.En. 427) Daemen


437. Geomechanics Applications in Mining (2) GC II 1986-87 Application of geomechanics principles to geotechnical mining problems: rock excavation, subsidence, mine pillar design, tabular excavations, rock bursts. All-day field trip. P, 427.

447. Geomechanics Applications in Construction (2) GC II 1985-86 Application of geomechanics principles to geotechnical engineering problems: tunneling and underground construction, rock slope engineering, foundations on rock. All-day field trip. P, 427.

460. Health Hazards in the Mine Environment (2) GC II 1985-86 Case histories in recognition, evaluation and control of health hazards in mine environments. All-day field trip. P, 325 or consult dept. before enrolling. (Identical with M.S.E. 460 and G.En. 460)

461. Accident Prevention in the Mine Environment (2) GC II 1986-87 Concepts and case histories in recognition, evaluation and control of occupational safety hazards common to the mine environment. All-day field trip. P, 325 or consult dept. before enrolling. (Identical with M.S.E. 461 and G.En. 461)

500. Economics of Mineral Resource Development and Production (4) I (Identical with Mn.Ec. 500)


527. Fundamentals of Geomechanics (4) II Mechanical behavior of geological materials: stress and strain analysis; friction; elasticity, strength and failure; discontinuity slip. Laboratory testing and applications to selected mining or geological problems. 3R, 3L. P, 427 or C.E. 340, Geos. 221. (Identical with G.En. 527) Daemen


696. Seminar a. Research Seminar (1 to 3) [Rpt.] II
The University Department of Molecular and Cellular Biology offers the Bachelor of Science, Master of Science, and Doctor of Philosophy degrees with a major in cellular and developmental biology and the Master of Science and Doctor of Philosophy degrees with a major in molecular biology.

The major: 103, 104, 320, 410a-410b, 495a and at least two units of an upper division laboratory course (such as 413, 473 or 494); Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b or 103a-103b, 180a-180b; Math. 125a-125b. With the assistance of a major adviser, the student must select a minimum of thirty units, including at least eight units of upper-division m.c.b. courses. Majors are strongly advised to include Chem. 480a-480b in their program.

The minor: The department has a structured split minor involving chemistry, physics, and mathematics.

The department has designated courses 494 (practicum) and 495a as writing-emphasis courses.

Honors: The department participates in the Honors Program.

102. Fundamentals of Ecology and Evolution (4) I II (Identical with Ecol. 102)
103. Biology of Cells (4) I II Principles of microbiology, cell biology and molecular biology, with emphasis on cell structure and function. 3R, 3L. P, Chem. 103a, 104a. (Identical with Ecol. 103, Micr. 103)
104. Organismic Biology (5) I II (Identical with Ecol. 104)
320. General Genetics for Majors (4) I II (Identical with Ecol. 320)
404. Contemporary Biology and Human Affairs (3) GC II Advances in biomedical research will be reviewed and their ethical, social and legal implications discussed. P, one course in bioc. or bio.; botany not acceptable.
410a-410b. Advanced Cell Biology (3-3) GC Regulation at the cellular and molecular levels; gene expression; nature, function, and integration of organelles and ultrastructural components of the cell. P, 103 (for majors), Chem. 243a or 480a.
412. Radioisotopes in Biology (3) GC I Advanced techniques in the application of radioactive tracers to problems of molecular biology; kinetics of labeling, fractionation procedures; detection systems and processing of data. 2R, 3L. P, Chem. 103b, 104b, Phys. 102a-102b.
413. Advanced Cell Biology Laboratory (2) GC I Modern lab. techniques for genetic and molecular analyses of mammalian cells in culture. 6L. P, CR 415.
428R. Advanced Microbial Genetics (3) GC II Modern concepts of microbial genetics: basic genetic theory, the molecular architecture, biosynthesis and genetic regulation of bacterial cell structure, control of growth and cell division. P, 103, Micr. 328, Ecol. 320 or 321. (Identical with Ecol. 428R and Micr. 428R)
428L. Advanced Microbial Genetics Laboratory (2) GC I Individual research projects within the framework of microbial genetics, with emphasis on the genetic system of Bacillus subtilis. (Identical with Ecol. 428L and Micr. 428L)
456. Developmental Biology (4) GC I Descriptive aspects of development. 3R, 3L. P, 103. (Identical with Anat. 456)


460. Plant Physiology (4) GC I Introduction to water relations, photosynthesis, respiration, growth and development of higher plants. 3R, 3L. P, Chem. 241a, 243a. (Identical with Ecol. 460)


463. Introduction to Neurobiology (3) GC I Physiology and anatomy of invertebrate and vertebrate nervous systems. P, eight units of bio.

464aR-464bR. Human Physiology (3-3) GC (Identical with Ecol. 464aR-464bR)

464aL-464bL. Human Physiology Laboratory (1-1) GC (Identical with Ecol. 464aL-464bL)

465. Advanced Neurobiology (2) GC II Selected topics in current neuroethological research on vertebrate and invertebrate nervous systems. P, 463, or consult department before enrolling.

467R. Endocrinology (3) GC II (Identical with Anat. 467R)

467L. Endocrinology Laboratory (1) GC II (Identical with Anat. 467L)

473. Recombinant DNA Techniques (3) GC II Relevant techniques for the isolation, purification and cloning of genes in E. Coli hosts. Cloned DNA will be characterized by restriction mapping and hybridization techniques. 1R, 6L. Consult department before enrolling. P, 410a, Bioc. 462a. (Identical with Bioc. 473)

495. Colloquium
   a. Current Subjects in Molecular and Cell Biology (1) I II Open to majors only. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

514. Supramolecular Structure (2) II 1986-87 Application of diffraction techniques in the study of structure and function of biological macromolecules.

530. Current Topics in Eucaryotic Gene Expression (3) II 1986-87 Detailed examination of current literature in selected areas of eucaryotic molecular biology. P, 568b or consult dept. before enrolling.

540. Advances in Mammalian Cell Biology (2) [Rpt./2] II Selected topics in mammalian cell structure and its genetic control. P, 415 or consult dept. before enrolling.

550. Topics in Pigment Cell Biology (2) I (Identical with Anat. 550)

558. Advanced Subjects in Endocrinology (2) [Rpt.] I (Identical with Anat. 558)


563. Plant-Water Relations (3) II Analytic approach to the study of water movement into and through plants; development of internal water deficits and their significance to physiological processes. P, 460. (Identical with WS.M. 563)

564. Plant Growth and Development (3) II 1985-86 Selected topics in growth and development. P, 460. (Identical with PL.S. 564)

568a-568b. Nucleic Acids (3-3) 1985-86 (Identical with Bioc. 568a-568b)

570. Molecular Biology of the Cell Membrane (3) I 1986-87 (Identical with Bioc. 570)

595. Colloquium
   a. Topics in Molecular Biology (1) [Rpt./1] II Open to majors only.
   b. Topics in Electron Microscopy (2) [Rpt./2] II 1985-86 P, Math. 125b, Phys. 102b or 103b. (Identical with Bioc. 595b)

612. Principles of Electron Microscopy (4) I Principles and practice of electron microscopy; specimen preparation, micrograph interpretation, and operation and maintenance of electron microscopes. 2R, 6L.

696. Seminar
   a. Recent Research (1) [Rpt./3] I II

761. Methods in Molecular and Cellular Biology (3) I II Current techniques for qualitative and quantitative studies. 9L. Open to majors only.
The School of Music, a division of the Faculty of Fine Arts, offers course work leading to the following degrees: Bachelor of Music with majors in jazz studies, music education, performance, and theory and composition; Bachelor of Arts in Music; Master of Music; Doctor of Musical Arts; and Doctor of Philosophy. The School of Music participates with the Department of Drama and the Committee on Dance in providing course work for the musical theatre option within the Bachelor of Fine Arts major in general fine arts studies. The musical theatre option is described in the Faculty of Fine Arts section of this catalog. The school is a member of the National Association of Schools of Music and the requirements for entrance and graduation as set forth in this catalog are in accordance with the published standards of that association.

**ENTRANCE REQUIREMENTS:** Entrance examinations in musicianship and the major performance area are required. All freshmen and transfer music majors (except piano and organ performance majors) must audition for placement in class or group piano instruction. These courses must be taken concurrently with 120a-120b and 220a-220b. Students desiring the B.A. in Music or the B.M. with a major other than performance must meet the requirements for registration in Musi. 181 in their major performance area. B.M. students majoring in performance must meet the requirements for registration in Musi. 185 in their major performance area. Admission to the Musi. 181 level requires minimum performance skill equivalent to at least two yrs. of recent private study and/or four yrs. of recent membership in school or community organizations. Admission to the Musi. 185 level requires a minimum of five yrs. of private study or ensemble/solo experience resulting in sufficient advancement that the student shows promise of being at a professional level after completion of four yrs. of undergraduate study. Detailed information regarding entrance and degree requirements is available from the Director of the School of Music (Music Bldg. Room 109).

**RESIDENCY REQUIREMENTS:** Majors must complete a minimum number of units in residence, as specified in the following schedule: performance — 21 units in the major; jazz studies — 22 units in the major; music education — 19 units in the major, plus S.Ed. 493a; and theory and composition — 23 units in the major.

**ENSEMBLE PARTICIPATION:** All students enrolled in performance studies are required to participate in a conducted ensemble (200, 400, 500) unless excused by the Director of the School of Music. (Accompanying or coached ensembles may fulfill this requirement for keyboard majors per the degree requirements.)

**SPECIAL REGULATIONS:** Credit for private or group instruction is granted only to students who are eligible to register for regular University credit. Students registered for
performance studies may be assigned to private or group instruction and required to attend master classes and recitals as arranged by the instructor. Students may, at the discretion of their major adviser or performance instructor, be required to register for Mus. 201 and to appear in and attend performances as arranged by their instructor. Lessons missed by the student will not be rescheduled unless the instructor has been notified by the student 24 hours before the regular time of the lesson. Lessons missed by the instructor will be rescheduled within the semester. Lessons falling on a legal holiday will not be rescheduled.

**DEGREE PROGRAMS:** The curricula for the B.M. include a common core of studies which is intended to coordinate all aspects of musical training in a program of comprehensive musicianship.

*The teaching minor:* 24 units, including 110a-110b, 111, 120a-120b, 130a-130b, 338m, 370 or 371, 451, two units of conducted ensemble.

**BACHELOR OF MUSIC**

**Common First Year Curriculum:** All B.M. majors will complete the following core of courses during the freshman yr.: 110a-110b (except keyboard majors), 120a-120b, 130a-130b, three to eight units in the major instrument or voice, one to four units of conducted ensemble, and twelve to fourteen units of Group Unit requirements, as outlined under the Bachelor of Music degree in the Faculty of Fine Arts section of this catalog.

Students should apply for admission to a specific major field of study prior to registration for sophomore courses.

**Basic Requirements:** All candidates for the B.M. must complete the following basic requirements: (1) Group Units required, as outlined under the Bachelor of Music degree in the Faculty of Fine Arts section of this catalog. (2) 110a-110b, 120a-120b, 130a-130b, 210a-210b, 220a-220b, 320, 330a-330b. (3) One of the majors outlined below.

The **MAJOR IN PERFORMANCE** includes the following five areas of specialization:

**Keyboard Instrument** — major instrument, 28-32 units (minimum entrance level: Musi. 185. Graduation requirement — eight units of Musi. 485); *ensemble — one semester of conducted, four semesters of accompanying, two semesters of coached, one semester of elective; Mus. 410a-410b, 420a-420b, 421, 433a-433b, four units of music electives and a senior recital. Additional general academic electives are also required. **Minimum total units** — 126.

**String Instrument** — major instrument, 28-32 units (minimum entrance level: Musi. 185. Graduation requirement: eight units of conduct, six semesters of coached; Mus. 370, 410a, 421, six units of music electives; a senior recital; additional general academic electives. **Minimum total units** — 126.

**Guitar** — major instrument, 28-32 units (minimum entrance level: Musi. 185. Graduation requirement: eight units of 485); *ensemble — one semester of conducted, seven semesters of guitar ensemble, Mus. 410a-410b, 420a-420b, 434, five units of music electives; a senior recital; additional academic electives. **Minimum total units** — 128.

**Voice** — voice, 28-32 units (minimum entrance level: Musi. 185. Graduation requirement: eight units of Musi. 485); *ensemble — eight semesters of conducted; four units of piano beyond the general requirement listed above; Mus. 211a-211b, 410a-410b, 430a-430b, 431a-431b, three units of music electives; a senior recital; additional general academic electives (foreign language recommended). **Minimum total units** — 130.

**Wind Instrument or Percussion** — major instrument, 28-32 units (minimum entrance level: Musi. 185. Graduation requirement: eight units of Musi. 485); *ensemble — eight semesters of conducted (minimum: three orchestra, three band, two jazz — if appropriate instrument), six semesters of coached; Mus. 370, 410a, eight units of music electives; a senior recital; additional general academic electives. **Minimum total units** — 125.

The **MAJOR IN JAZZ STUDIES** : Major instrument, sixteen units of two units/semester (minimum entrance level: Musi. 181. Graduation requirement: four units of Musi. 385); minor instrument or voice, six units of one unit/semester; *ensemble — six semesters of 200r; four semesters of 200 (excluding 200r), two semesters of 201j, two semesters of coached ensemble electives; Mus. 321a-321b, 331, 421, 422, six units of music electives; additional general academic electives. **Minimum total units** — 127.
The **MAJOR IN MUSIC EDUCATION (CHORAL)**: Voice, eight semesters of two units/semester (minimum entrance level: Musi. 181. Graduation requirement: eight units of 185); keyboard, three semesters beyond 210b; *ensemble — seven semesters of conducted; Mus. 211a-211b, Mus. 250a-250b, 370, 372, 450, 451; Ed.P. 311; S.Ed. 329, 330, 338m, 435, 493a, 494b. Minimum total units — 125.

The **MAJOR IN MUSIC EDUCATION (INSTRUMENTAL)**: Major instrument, seven semesters of two units per semester (minimum entrance level: Musi. 181 Graduation requirement: six units of Musi. 185); *ensemble — seven semesters of conducted (including one unit of 200r, if appropriate instrument), one semester of coached; Mus. 111, 153, 250a-250b, 350, 351, 352, 370, 371, 421, 450, 451; Ed.P. 311; S.Ed. 329, 330, 338m, 435, 493a, 494b. Minimum total units — 133.

The **MAJOR IN THEORY AND COMPOSITION**: Major instrument or voice, seven semesters of two units/semester (minimum entrance level: Musi. 181. Graduation requirement: six units of Musi. 185); *ensemble — six semesters of conducted, two semesters of coached; Mus. 240a-240b, 340a-340b, 370, 420a-420b, 421, 440 (six units), four units of music theory or composition, five units of music electives; additional general academic electives. Minimum total units — 132.

**BACHELOR OF ARTS IN MUSIC**

This degree program is designed for students interested in music history who may wish to pursue a graduate degree in musicology or for those whose interest in music is essentially avocational.

The major: In addition to the Group Units required, as described under the Bachelor of Arts in the Faculty of Fine Arts section of this catalog, the following course work is required: 110a-110b, 120a-120b, 130a-130b, 210a-210b, 220a-220b, 320, 330a-330b, 420a-420b; three units of music electives. The student also must complete six semesters of work in a major instrument or voice (minimum entrance level: Musi. 181. Graduation requirement: two units of Musi. 185) and four semesters of *ensemble (including two semesters of Collegium Musicum). A twenty-unit minor is also required (see Faculty of Fine Arts section of this catalog). To meet the Group Unit requirement in a foreign language, German or French is recommended. Minimum total units — 125.

*In all music degrees the term "semester" in the ensemble requirement indicates that the student is required to register for the number of successive semesters of ensemble listed.*

100. **Basic Musicianship** (3) I II CDT Introduction to the rudiments of musical notation, harmony, rhythm, and melody.

101a-101b. **Class Piano for General College Students** (1-1) 101a: Introduction to basic keyboard skills for the general college student, with emphasis on literature of current interest to students. 101b: [Rpt./J] Development of piano skills with options for emphasis in areas such as playing by ear, improvising, harmonizing, transposing, repertory of different styles or idioms. 101a and 101b are offered both semesters.

102a-102b. **Class Guitar for General College Students** (1-1) 102a: Introduction to basic guitar playing techniques for the general college student, with emphasis on literature and styles of playing of current interest to students. 102b: Development of guitar skills including sightreading, accompanying, tone production and other classical techniques. 102a and 102b are offered both semesters.

103. **Class Voice for General College Students** (1) [Rpt.] Practical training in singing, with emphasis on basic skills of breathing, tone and diction; repertory to include folk, current, and classic songs in English.

107. **Survey of Music I** (3) I II Introductory course which concentrates on developing perceptual skills through a study of many types of music, with emphasis on Western art music of the 18th, 19th and 20th centuries, as well as popular and ethnic musics.

108. **Survey of Music II** (3) I II Continuation of 107, with emphasis on Western art music, particularly that of the Medieval through the Baroque era, and the music of other cultures. 107 is not prerequisite to 108.
110a-110b. Piano Class I (1-1) CDT Introductory development of basic keyboard musicianship and technique through activities including playing by ear, improvising, harmonizing, transposing. Open to mus. majors and minors only. P, CR 120a-120b.

111. Voice Class (1) [Rpt.] Beginning instruction; introduction and development of basic skills, breathing, diction, tone, rhythm, sight-singing, repertory songs in English; practical training in singing without specialization. Open to mus. majors and minors only.


130a-130b. Introduction to Music Literature (2-2) CDT Survey of music literature, with emphasis on structure, period, and style. Open to mus. majors and minors only. P, CR 120a-120b.

145. Composition for the General College Student (2) I II S CDT Designed for majors and nonmajors; explores similarities among the creative arts. P, ability to read music notation.

153. Percussion Instruments Class (1) II Class instruction in all percussion instruments, including materials and procedures for teaching these instruments in the schools.

175. Theatre Dance (1) I II S (Identical with Dnc. 175)

209. Percussion for Dance Students (2) I Rhythmic principles of music for dance majors through study and performance of percussion instruments. Open to dance majors only. (Identical with Dnc. 209)

210a-210b. Piano Class II (1-1) CDT Continuation of 110b, with additional sight-reading, score-reading, and accompanying. Open to mus. majors and minors only. P, 110b.

211a-211b. Diction for Singers (2-2) Training in diction for singers in English, French, German, Italian, Spanish and Ecclesiastical Latin.

220a-220b. Musical Skills and Structure II (3-3) CDT Continuation of 120a-120b, dealing with music from the late medieval period through early 20th-century art music in chronological order. 2R, 3L. P, 120b.

250a-250b. Music Education Observation (1-1) 250a: Observation of music education programs and instruction in the public schools. 250b: Practical field experience in public schools; supervised experience in individual and small group instruction. 3L. Field trips. Open to majors only.

302. Recording Studio Production (3) III Recording studio procedures including the recording chain and pre-post and actual recording production techniques. P, with permission of the School of Music. (Identical with R.T.V. 302)

310a-310b. Functional Piano for Music Education Majors (1-1) 310a: Development of functional piano skills needed for public-school music teaching, with emphasis on improvising, harmonizing, transposing, and accompanying. 310b: Continuation of 310a with materials of increasing difficulty; open-score part-reading and rehearsal techniques. P, 210b.

320. Form and Structure in 20th-Century Music (3) I Intensive analysis of posttonal music, beginning with serial works of Schoenberg through very recent compositions by major composers. Open to mus. majors and minors only. P, 220b.

321a-321b. Jazz Improvisation (2-2) CDT 321a: Background for the art of improvising jazz. Audition required. P, 201j. 321b: Continuation and refinement of the techniques studied in 321a.

330a-330b. History of Western Music (3-3) CDT Detailed study of the history of music in Western civilization from its origins to modern times; its relationship to general cultural development. P, 220b. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

331. Jazz History (3) I CDT Development of jazz in the United States.

338m. The Teaching of Secondary School Music (3) I Carries credit in ed. only. (Identical with S.Ed. 338m)

350. Wind Instrument Techniques and Materials I (3) I Class instruction of flute, clarinet, oboe, and bassoon, including materials and procedures for teaching these instruments in the public schools. Open to majors only.

351. Wind Instrument Techniques and Materials II (3) II Class instruction on trumpet, trombone, horn and saxophone, including materials and procedures for teaching these instruments in the public schools. Open to majors only.

352. String Instrument Techniques and Materials (3) I Class instruction on violin, viola, cello and bass, including materials and procedures for teaching these instruments in the public schools. Open to majors only.
360. **Music for the Elementary Classroom Teacher** (3) I II CDT Basic musical skills, experiences, concepts, and information needed by a classroom teacher prior to studying teaching techniques, curriculum and materials for elementary school music; includes experience with classroom instruments. Not open for credit to mus. majors.

361. **Music Materials and Activities for the Elementary Classroom Teacher** (2) I II Presentation of basic materials and activities for teaching music to children from kindergarten through sixth grade. Not open for credit to mus. majors. P, 360.

370. **Introduction to Conducting** (2) I Conducting choral as well as instrumental ensembles; includes basic beat patterns, transpositions and clefs, and introduction to score study. P, 220b.

371. **Intermediate Instrumental Conducting** (2) II Conducting techniques for instrumental ensembles of varying sizes; instrumental rehearsal techniques, score reading, and score study. P, 370.

372. **Intermediate Choral Conducting** (2) II Conducting techniques for choral ensembles; training the chorus, choral musicianship, continuing work in score reading, basic choral literature and program planning. P, 370.

410a-410b. **Pedagogy** (2-2) GC Study of methods and repertory suitable for studio teaching. Open to mus. majors in their major performance area only.

420a-420b. **Counterpoint** (3-3) Practical study of the counterpoint of the 16th (in 420a) and 18th (in 420b) centuries. P, 220b.

421. **Orchestration** (3) I CDT Instruments of the orchestra together with practical study of the art of symphonic scoring; original work and transcriptions. P, 220b.

422. **Jazz Arranging** (2) GC II Class instruction and practice in writing arrangements for small jazz combos, rock groups, stage bands, and pop-vocal combinations; detailed study of jazz instrumental practices and problems. Open to majors only or by permission of instructor. P, 200r, 201j, 220b.

423. **Band Arranging** (2) GC II 1985-86 CDT Detailed study of band instrumentation; major works transcribed for concert band. P, 421.

435. **Aesthetics of Music** (3) I Exploration of the problems of musical meanings, including a panoramic examination of what philosophers, philosophic musicians and artists, and others of critical intelligence have contributed to comprehensive theory.
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Years</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>521.</td>
<td>Introduction to Graduate Music Theory</td>
<td>3</td>
<td>I II</td>
<td>Introduction to graduate analysis with emphasis on the survey of analytical systems as applied to a number of stylistic periods. Both cognitive and aural procedures will be investigated. Open to majors only.</td>
</tr>
<tr>
<td>530.</td>
<td>Music in the Renaissance</td>
<td>3</td>
<td>I</td>
<td>Vocal and instrumental genres from Dufay through Palestrina. Open to majors only.</td>
</tr>
<tr>
<td>531.</td>
<td>Music in the Baroque</td>
<td>3</td>
<td>I</td>
<td>The age of the basso-continuo; instrumental and vocal genres from Monteverdi through J. S. Bach. Open to majors only.</td>
</tr>
<tr>
<td>532.</td>
<td>Music in the Classical Period</td>
<td>3</td>
<td>II</td>
<td>The Viennese classical tradition from its origins to Beethoven. Open to majors only.</td>
</tr>
<tr>
<td>533.</td>
<td>Music of the Twentieth Century</td>
<td>3</td>
<td>II</td>
<td>Contemporary idiom in music; study of genres, styles, and techniques from post-Romanticism to the present. Open to majors only.</td>
</tr>
<tr>
<td>537.</td>
<td>Survey of Early Music</td>
<td>3</td>
<td>I S</td>
<td>An intensive survey of music history from Gregorian chant to the late Baroque. Open to majors only.</td>
</tr>
<tr>
<td>570.</td>
<td>Advanced Conducting</td>
<td>3</td>
<td>II</td>
<td>Styles of choral, band, and orchestral literature, as they pertain to the problems of the conductor; references to the styles of all periods, with emphasis on the contemporary and modern.</td>
</tr>
<tr>
<td>600.</td>
<td>Introduction to Graduate Study in Music</td>
<td>3</td>
<td>II</td>
<td>Bibliographical materials; research resources, techniques, and problems directed toward grad. study in music. Required of all doctoral candidates in music. (Identical with L.S. 600)</td>
</tr>
<tr>
<td>620a-620b.</td>
<td>History of Speculative Theory</td>
<td>3-3</td>
<td>1985-86</td>
<td>Survey of speculative theory in music, classical Greeks to present.</td>
</tr>
<tr>
<td>621a-621b.</td>
<td>Analysis of Music of the 18th and 19th</td>
<td>3-3</td>
<td>1985-86</td>
<td>Intensive analysis of works written in the larger forms. 621a : 18th century. 621b : 19th century. Open to majors only. 621a is not prerequisite to 621b.</td>
</tr>
<tr>
<td>622.</td>
<td>Theory Pedagogy</td>
<td>3</td>
<td>I</td>
<td>Study of the philosophies, procedures, techniques, and materials used in teaching theory at the college level.</td>
</tr>
<tr>
<td>630.</td>
<td>The Music of Bach</td>
<td>3</td>
<td>II</td>
<td>nof the 20th century.</td>
</tr>
<tr>
<td>631.</td>
<td>The Music of Mozart</td>
<td>3</td>
<td>II</td>
<td>nof the 20th century.</td>
</tr>
<tr>
<td>650.</td>
<td>Foundations and Principles of Music Education</td>
<td>3</td>
<td>I</td>
<td>History and philosophy of music education in the public schools, with emphasis on the basic concepts needed for effective teaching in the field of music.</td>
</tr>
<tr>
<td>651.</td>
<td>Curriculum Development in Music</td>
<td>3</td>
<td>II</td>
<td>Principles and techniques of curriculum construction applied to the field of music.</td>
</tr>
<tr>
<td>652.</td>
<td>The Administration of Music Education</td>
<td>3</td>
<td>II</td>
<td>Financing, scheduling, selecting personnel and equipment, supervising instruction, maintaining desirable public relations, evaluating and administering the total school music program in a school district, city, county, or state. P, 650.</td>
</tr>
<tr>
<td>653.</td>
<td>The Music Cultures of Asia and Oceania</td>
<td>3</td>
<td>I</td>
<td>Study of the musical styles and practices of Oceania and selected cultures in Asia, with emphasis on materials, instruments and ideas appropriate for classroom use.</td>
</tr>
<tr>
<td>672.</td>
<td>Teaching Music in Higher Education</td>
<td>3</td>
<td>II</td>
<td>Contemporary practices in planning, organizing, and evaluating learning experiences in music for college and university students. Open to music majors only.</td>
</tr>
</tbody>
</table>
Seminar
a. Music Education (1 to 6) I II
b. Musicology (1 to 6) I II
c. Music Theory (1 to 6) I II

Ensembles

All courses listed below are offered both first and second semesters and may be repeated. Prerequisite for entrance to all ensembles is by audition or by permission of the School of Music.

Large Conducted Ensembles (200, 400, 500) (1)

- a. Summer Band
- b. Marching Band
- c. Concert Band
- d. Symphonic Band
- e. Wind Ensemble
- h. Summer Chorus
- i. Symphonic Choir
- j. University Singers
- k. University-Community Chorus
- l. Chamber Choir
- m. Choraliers
- o. Symphony Orchestra
- p. Chamber Orchestra
- q. Collegium Musicum
- r. Jazz Ensemble
- s. Honor Choir (not at 500 level)

Coached Ensembles (201, 401, 501) (1) Offering chamber music experience; designed to develop musical independence.

- a. Accompanying
- b. Brass Ensemble
- c. Percussion Ensemble
- d. Guitar Ensemble
- e. Jazz Combo
- f. Saxophone Ensemble
- g. String Ensemble
- h. Woodwind Ensemble

Small Conducted Ensembles (202, 402, 502) (1)

- a. Brass Choir
- b. Contemporary Ensemble
- c. Clarinet Choir
- e. Pep Band
- f. Flute Choir
- d. Musical Theatre

Opera Theatre (205, 405, 605) (1 to 4)

Training in all aspects of operatic production, including major singing roles, minor roles, opera chorus, opera scenes and chamber operas; technical training in set construction, makeup, costumes and lighting. 605 may also include operatic staging techniques. P for 405, two units of 205; P for 605, four units of 405 or permission of the School of Music.

Composition Studies: Individual and Group Instruction

240. Introduction to Composition (3) I II [Rpt./1] Introduction to the basics of music composition, stressing fundamental forms, techniques and procedures. P, 120b or permission of the School of Music.

340. Composition (3) I II [Rpt./1] Pursuit of the more sophisticated aspects of music composition in regard to form; handling of original ideas and searching for a broader and more practical view of music composition as a profession. P, six units of 240 or permission of the School of Music.

440. Compositional Techniques (3) I II [Rpt./15 units] Creative techniques in the fields of modern harmony, counterpoint, orchestration, electronic music, or specific projects in commercial-type composition and arranging. P, six units of 340 or permission of the School of Music.

640. Advanced Composition (2 to 6) I II [Rpt.] Individual projects in composition. Open to theory and composition majors only.

Performance Studies: Individual and Group Instruction*

All of the courses listed below are offered both first and second semester. Please see ENTRANCE REQUIREMENTS at the beginning of this section for information regarding prerequisites for 181 and 185.

PIANO

180-P, 181-P, 182-P (1 to 2)
185-P, 285-P, 385-P, 485-P (1 to 4)
580-P (1 to 2); 685-P, 785-P (1 to 4)

*See schedule of fees below.
### DEPARTMENTS AND COURSES OF INSTRUCTION

**PIANO ACCOMPANYING**

<table>
<thead>
<tr>
<th>Violin</th>
<th>String Bass</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-Vn, 181-Vn, 182-Vn (1 to 2)</td>
<td>180-Sb, 181-Sb, 182-Sb (1 to 2)</td>
</tr>
<tr>
<td>185-Vn, 285-Vn, 385-Vn, 485-Vn (1 to 4)</td>
<td>185-Sb, 285-Sb, 385-Sb, 485-Sb (1 to 4)</td>
</tr>
<tr>
<td>580-Vn (1 to 2); 685-Vn, 785-Vn (1 to 4)</td>
<td>580-Sb (1 to 2); 685-Sb, 785-Sb (1 to 4)</td>
</tr>
</tbody>
</table>

**VOICE**

| 580-V (1 to 2); 685-V, 785-V (1 to 4) |

**VOCAL COACHING**

| Organ | 580-O (1 to 2); 685-O, 785-O (1 to 4) |

**CONDUCTING**

| 685-Cg, 785-Cg (1 to 4) |

**STRING INSTRUMENTS**

<table>
<thead>
<tr>
<th>Violin</th>
<th>String Bass</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-Vn, 181-Vn, 182-Vn (1 to 2)</td>
<td>180-Sb, 181-Sb, 182-Sb (1 to 2)</td>
</tr>
<tr>
<td>185-Vn, 285-Vn, 385-Vn, 485-Vn (1 to 4)</td>
<td>185-Sb, 285-Sb, 385-Sb, 485-Sb (1 to 4)</td>
</tr>
<tr>
<td>580-Vn (1 to 2); 685-Vn, 785-Vn (1 to 4)</td>
<td>580-Sb (1 to 2); 685-Sb, 785-Sb (1 to 4)</td>
</tr>
</tbody>
</table>

**HARPSICHORD**

| 580-V (1 to 2); 685-V, 785-V (1 to 4) |

**WIND INSTRUMENTS**

<table>
<thead>
<tr>
<th>Clarinet</th>
<th>Bassoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-Cl, 181-Cl, 182-Cl (1 to 2)</td>
<td>180-B, 181-B, 182-B (1 to 2)</td>
</tr>
<tr>
<td>185-Cl, 285-Cl, 385-Cl, 485-Cl (1 to 4)</td>
<td>185-B, 285-B, 385-B, 485-B (1 to 4)</td>
</tr>
<tr>
<td>580-Cl (1 to 2); 685-Cl, 785-Cl (1 to 4)</td>
<td>580-B (1 to 2); 685-B, 785-B (1 to 4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flute</th>
<th>Saxophone</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-F, 181-F, 182-F (1 to 2)</td>
<td>180-S, 181-S, 182-S (1 to 2)</td>
</tr>
<tr>
<td>580-F (1 to 2); 685-F, 785-F (1 to 4)</td>
<td>580-S (1 to 2); 685-S, 785-S (1 to 4)</td>
</tr>
</tbody>
</table>

**PERCUSSION INSTRUMENTS**

<table>
<thead>
<tr>
<th>Percussion</th>
<th>580-Pc (1 to 2), 685-Pc, 785-Pc (1 to 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-Pc, 181-Pc, 182-Pc (1 to 2)</td>
<td>180-Pc, 181-Pc, 182-Pc (1 to 2)</td>
</tr>
<tr>
<td>185-Pc, 285-Pc, 385-Pc, 485-Pc (1 to 4)</td>
<td>185-Pc, 285-Pc, 385-Pc, 485-Pc (1 to 4)</td>
</tr>
</tbody>
</table>
MUSIC FEES

All students registering for private or group instruction are charged special fees according to the following schedule. Regular and scholarship students will be assigned to private or group instruction each semester only after a Music Fee Statement has been secured. Rental instruments, practice rooms and lockers are issued upon presentation of this statement.

- Group lesson or one-half hour private lesson: $40.
- One-hour private lesson: $60.
- A music major registering for more than one weekly lesson will pay a maximum fee of $60.

Rentals

Instruments are rented as available for use in regularly scheduled music activities according to the following fee schedule. Any damage beyond normal wear and tear will be paid for by the renter of the instrument. All rental instruments must be returned by the end of the semester or on demand.

- **Piano rental:** Pianos will be rented only to those enrolled in group, private instruction or keyboard class. $4 for one hour practice per day. $8 for two hours practice per day. $12 for three hours practice per day.
- **Organs, Harpsichords, and Synthesizer:** $10 for one hour practice per day. $15 for two hours practice per day. $20 for three hours practice per day.
- **Harps:** $20 for one hour practice per day. $25 for two hours practice per day. $30 for three hours practice per day.
- **Band and Orchestra Instruments:** Rented only to those enrolled in ensembles or techniques and literature classes. $8 per semester.

Refunds will be made according to the refund schedule. No refund will be made on rental charges of $4 or less.

NATURAL RESOURCE RECREATION

*(See Renewable Natural Resources)*

NUCLEAR AND ENERGY ENGINEERING

Professors Robert L. Seale, Head, David L. Hetrick, Norman Hilberry, Richard L. Morse, Roy G. Post, Morton E. Wacks
Associate Professors W. Morris Farr, Rocco A. Fazzolare, William Filippone, Barry D. Ganapol, George W. Nelson
Assistant Professor Leland M. Montierth

The department offers the Bachelor of Science in Nuclear Engineering, Bachelor of Science in Energy Engineering, Master of Science, and Doctor of Philosophy degrees with a major in nuclear engineering.

For undergraduate degree requirements, please see the College of Engineering section of this catalog. For graduate degree requirements, please see the Graduate Catalog.

103. **Introduction to Nuclear and Energy Engineering (1)** I The world's energy resources and their past, present and projected future utilization; review of basic physical principles underlying energy engineering applications; a scan of the available energy utilization systems.

104. **Introduction to Energy Engineering (1)** II Energy conversion processes and applications to fossil-fueled, nuclear fueled and alternate energy utilization systems; economic considerations, resource conservation and environmental effects. P, 103.

105. **Introduction to Nuclear Engineering (1)** II Introduction to nuclear processes, to selected fundamentals of engineering science and to the role of nuclear technology in modern society, including its economic and environmental impacts. P, 103.

120. **Technology and Society: An Historical Perspective (3)** I Significant developments in human history emphasizing the role of technology as an agent for social change; particular attention to the use of energy resources.
DEPARTMENTS AND COURSES OF INSTRUCTION


221. Radiation Detection and Isotopes Laboratory (3) I Introduction to the principles and practices of radiation measurement, experimental techniques and data reduction methods. P, 231.

231. Basic Nuclear Processes (3) I Nuclear structure and stability, radioactive decay and interactions of radiation with matter, with emphasis on momentum and mass energy balance, and process rate definition. P, Chem. 103b, 104b, Math. 125b.

343. Elements of Nuclear Reactor Theory (4) I Neutron diffusion and slowing down theory, as applied to bare and reflected reactors; the effects of core inhomogeneity on neutron behavior. P, 231.

348. Introduction to Nuclear Reactor Engineering (3) I/II The analysis and design of nuclear power stations, with emphasis on central station systems. P, 343.


396. Proseminar
   s. Status of Nuclear Energy (1) I/II

410. Energy System Design (3) GC I/II Modern techniques in synthesis and analysis are reviewed and applied to contemporary energy problems; economic evaluation, system modeling, optimization, and decision analysis. P, 348, A.M.E. 340a or Ch.E. 306.

415. Environmental Analysis of Energy Conversion (3) GC I Engineering analysis, assessment, and resolution of energy-environment interaction, with consideration of power plant siting, emissions, thermal effects, and waste management.

416. Radiation Health Physics and Safety (3) GC I Study of health physics practices and safety responsibilities; analysis of radiation environments and applications of basic shielding methods to provide understanding of accepted working practices.

417. Nuclear Energy and Power (3) GC I Fundamentals of nuclear energy and radiation; engineering applications; the basic concepts of nuclear reactors and power systems. Designed for nonmajors.

420. Nuclear Engineering Laboratory (3) GC I/II Experimental techniques for determining various parameters in nuclear systems; experiments using the critical and subcritical reactors. P, 343.

425. Nuclear Reactor Operations (2) I Application of principles of reactor theory to the operation of a nuclear reactor; reactor instrumentation, control systems, operating procedures, and radiological safety; review of federal regulation governing reactor operation and operator licensing. P, 340 or 343 and 420.


435. Radiation Effects (3) GC II Radiation effects on solids and radiation chemistry of gases and liquids, with emphasis on effects encountered in nuclear reactor, detector, and dosimeter systems. P, 343, CR M.S.E. 331R.

437. Introduction to Radioactive Waste Management (3) GC II Influence of public policy and waste physical form on the design criteria for waste management systems.

441. Contemporary Nuclear Power Systems (3) GC I Analysis of present nuclear power plants, with emphasis on design decisions as they affect performance of individual systems; comparison of different contemporary systems. P, 348 or 417.

445. Direct Energy Conversion (3) GC II Engineering requirements for achieving direct conversion of energy to electrical power; the engineering of thermoelectric and thermionic convertors, fuel cells, magnetohydrodynamic, and photoelectric systems.

450. Introductory Nuclear Physics (3) GC II (Identical with Phys. 450)

453. Air Conditioning Engineering (3) GC I (Identical with A.M.E. 453)

456. Engineering System Simulation (3) GC II Dynamic modeling and simulation of engineering systems, including energy conversion systems, nuclear and chemical reactors, and control systems, using digital continuous-system simulation languages. P, A.M.E. 340a or Ch.E. 306a; Math. 254.

463. Energy from Biomass (3) GC II (Identical with A.En. 463)

465. Current Problems in Energy and Power (1 to 4) [Rpt./6 units] GC II A multidisciplinary course with guest lecturers who are practicing professionals from the energy and power industry; a number of week-long, self-contained minicourses, with topics varying from year to year. (Identical with Ch.E. 465, and E.C.E. 465)

467. Solar Energy Engineering (3) GC I Energy analyses of solar collectors; selective surfaces; solar cells; energy storage; systems for solar heating and cooling; mechanical and electrical power; perspective. P, A.M.E. 340 or Ch.E. 306. (Identical with A.M.E. 467 and E.C.E. 467)

469. Energy Engineering Laboratory (3) GC I Basic measurements of energy quality, quantity, flow, and conversion. Includes active and passive solar as well as other alternative energy sources. 2R, 3L. P, 467 or CR. (Identical with A.M.E. 469). Writing-Emphasis Course for energy engineering students. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

477. Environmental Impact of Energy-Related Systems (3) GC II (Identical with C.E. 477)

496. Proseminar s. Developments in Nuclear Power (1) I II

530. Radiochemistry and Radiation Detection (3) I Radiation detection and measurement, health physics, isotope applications, activation analysis, and instrumentation. 2R, 3L. P, Chem. 480b or Phys. 230. (Identical with Chem. 530)


541. Power Plant Engineering (3) II The application of fluid dynamic heat transfer and mechanical interaction principles to the engineering design of a power plant. P, 441, 540.

554. Nonlinear Reactor Dynamics (3) II Nonlinear dynamics of nuclear reactors; shut-down mechanisms, inertial effects, nonlinear stability criteria, time-dependent neutron transport, neutron waves, and applications to pulsed reactors, start-up transients, reactor stability, and reactor safety. P, 454.

567. Advanced Solar Engineering (3) II Research and development studies related to solar applications: engineering design, analysis, and economics. Course includes invited lectures, literature research, and an original paper. P, A.M.E. 340a, 442. (Identical with A.M.E. 567, Ch.E. 567, and E.C.E. 567)

568. Photovoltaic Cells, Arrays and Systems (3) I (Identical with E.C.E. 568)

569. Energy Use: Analysis and Management (3) I Analysis of energy utilization; methods to evaluate and improve efficiency of energy. (Identical with Ch.E. 569, and E.C.E. 569)

583a-583b. Plasma Physics and Thermonuclear Theory (3-3) 583a : I Fundamentals of the theory of fully ionized plasmas, including wave phenomena and stability of plasma fluids; introduction to plasma kinetic theory. 583b : I Deposition of energy in thermonuclear plasmas; relaxation times and transport coefficients from Fokker-Planch theory; advanced subjects. P, 483b. (Identical with Phys. 583a-583b)

596. Seminar s. Advanced Nuclear Power Activities (1) I II


630. Fuel Cycles for Nuclear Reactors (3) II 1986-87 The design and analysis of fuel cycles for nuclear reactors; the processes and requirements for fuel element design and the limitations of fuel element performance to reactor design; economic factors in fuel cycles. P, 540.

642. Reactor Theory II (3) II Fundamental theory of heterogeneous reactors, integral transport, blackness theory, perturbation theory, and applications; temperature coefficient, changes in reactivity due to fission product accumulation, fuel consumption, and conversion. P, 540.

644. Advanced Reactor System Design and Analysis (3) I 1985-86 Application of design and analysis techniques to advanced nuclear reactor system concepts; utilizes current calculational techniques and system technology to arrive at integrated systems. P, 642.
645. **Nuclear Safety** (3) II Possible incidents involving nuclear materials in critical reactors, chemical processing systems, fuel shipment operations or subcritical arrays, including assessments of the magnitudes and consequences of nuclear incidents; determination of criteria for evaluating nuclear system safety, including plant siting and operational procedures. P, 343.

654. **System Analysis of Nuclear Reactor Dynamics** (3) II 1986-87 Selected topics in nuclear system dynamics, simulation and control; content varies. P, 454.

671. **Numerical Methods In Nuclear Engineering** (3) I 1986-87 Methods for numerical solution of differential and integral equations, with applications to computer modeling of nuclear reactors, power plants, fuel cycles, and basic processes in nuclear fission and fusion.

681a-681b. **Analytical Methods of Transport Theory** (3-3) 1985-86 Application of the Boltzmann equation to neutron and photon transport problems; exact solutions, the method of singular eigenfunctions, spherical harmonic expansions, the moments methods, integral transport theory, invariant embedding, variational techniques, applications to slowing-down problems. P, 642; Math. 422a-422b.

685. **Inertial Confinement Controlled Fusion** (3) I Advanced topics in inertial confinement fusion, including energy absorption and transport phenomena, stability of spherical implosion systems, laser and charged particle drivers and reactor designs. P, 483b, 470b. (Identical with E.C.E. 685)

687. **Magnetic Confinement Controlled Fusion** (3) II Theory and design of magnetic fusion systems; instabilities; transport and reactor design considerations associated with linear magnetic fusion systems; Tokamaks and mirror machines. P, 483b; Phys. 415b, 470b. (Identical with E.C.E. 687)

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**NURSING**

Professors Gladys E. Sorensen, *Dean*, Agnes M. Aamodt, Jan R. Atwood, Eleanor E. Bawens, Pearl P. Coulter (*Emerita*), Ada Sue Hinshaw, Margarita A. Kay, Beverly A. McCord, Arlene M. Putt (*Emerita*)


Assistant Professors Mary Alexander, Jane Byleckie, J. Keenan Casteel, M. Antonia Heilman, Thelma Hostetter, Katherine A. Mason (*Emerita*), Barbara McClure, Carolyn Murdough, Dona Pardo, Linda Phillips, Pamela Reed, Karen Schepp, Rita Snyder-Halpern, Joyce Verran, Anne Woodti

Lecturers Doris Abbott, Jacqueline Barth, Lana Biocca, Jane Cardea, Phyllis L. Dow, Donna Duncan, Victoria Elmore, Rose Gerber, Patricia King, Ela-Joy Lehrman, Karina Mumford, Helen L. Navin, Kaye Ronsman, Julie Schmidt, Evelyn Shaw, E. Jean Snider, Mary C. Winn

Instructors Ruth Becker-Schaller, Donna Dickinson, Marianne Durham, Marcia Hess, Grace Kreulen, Nancy Medenwald, Sue Trevino

Director of Student Affairs Mary E. Henkel

Professional nursing is a service which helps people achieve and maintain health and which requires a body of knowledge in pace with scientific advances. Nursing is based upon the natural and behavioral sciences, and students are encouraged to use these principles, and to include psychological and social as well as physical care in their applied nursing courses.

The degrees offered are the Bachelor of Science in Nursing, Master of Science, Nursing Specialist, and Doctor of Philosophy with a major in nursing. For undergraduate admission and degree requirements, please see the *College of Nursing* section of this catalog. For graduate admission and degree requirements, please see the *Graduate Catalog*.

Starting with the nursing major courses in the junior year, all nursing students are required to provide their own cars for transportation to the clinical areas where they are assigned for patient-care experience. Students wear an official College of Nursing uniform for clinical courses. During these semesters the student must be enrolled for all required courses.

*Honors:* The College participates in the Honors Program.
NURSING 391

340. Nursing Skills in Assessment (3) [Rpt./2] I II Designed to develop skill in interviewing and physical assessment for development of a problem-oriented patient record; basic preparation in health assessment. 2R, 3L. Open only to employed RNs; not open to majors.

341. Women and Health (3) I II Exploration of body processes and body experiences of women throughout the life cycle, through examination of research, traditional and feminist writings; health care consumerism. Not open to majors. (Identical with W.S. 341)

342. Emergency Care of the School Age Child (2) S 1986 GRD Emergency care for school age children and explanation of the nurse’s role. P, R.N.

353. Utilization of the Nursing Process in Meeting Basic Human Needs (6) I II Application of scientific knowledge for assessment of basic human needs in levels of wellness; utilization of nursing process in assisting individuals and groups to meet their health care needs. Open to majors only.

354. Basic Nursing Practice (3) I II Principles of biopsychosocial sciences and selected psychomotor skills practiced by nurses. 2R, 3L. Open to majors only. P, CR 353.

359. Introduction to the Nursing Profession and Research (3) I II Orientation to and socialization into professional nursing, including utilization of intellectual skills to define a problem and to evaluate existing research. Open to majors only. P, 353 or CR. Writing-Emphasis Course.*

363. Nursing of Adults with Health Problems (11) I II Caring for adults experiencing a deviation from their usual levels of wellness, with emphasis on medical-surgical settings. Open to majors only. P, 353, 354, 359; CR Pcol 472.

373a-373b. Maternal-Child Nursing (6-5) 373a: Maternal Health Nursing: Supervised clinical practice and study of nursing concepts and theories applied to the health care of women and families during the childbearing years. Open to majors only. 373b: Child Health Nursing: Supervised clinical practice and study of nursing concepts and theories regarding health care needs of children and adolescents and the impact these needs have on the family. Open to majors only. Both 373a and 373b are offered each semester and must be taken concurrently. P, 363, Pcol 472; CR 375, 379.

375. Nursing Care of Patients with Chronic Health Problems (3) I II Nursing care of chronically ill persons, with emphasis on assisting them to remain independent and functional within the limitations imposed by the illness. Open to majors only. P, 353, 363, Pcol 472.

378. Nursing Care in Death and Dying (3) I Designed to provide students the opportunity to explore feelings regarding death, to consider needs and perceptions of the patient and the patient’s family, and to improve ability to provide nursing care. Open to majors only. Writing-Emphasis Course.*

379. Analysis of Nursing Problems (2) I II Development of analytical skills related to research and professional problems; introduction to research approaches; interrelationship of professionalism and research. Open to majors only. P, 373, 375 or CR.

381. Community Health Nursing (6) I II Principles of public health science and synthesis of nursing practice and community health practice in a variety of community settings. 2R, 12L. Open to majors only. P, 373, 375, 379; CR 382, 388, 389.


387a-387b. The Professional Nurse in the Health Care System (8-8) 387a: Supervised clinical practice with the adult patient with medical-surgical problems leading to multiple systems effects. Open to majors only. P, 381, 382, 388, 389, CR 387b. 387b: A clinical course to enable students to function on the health care system and to apply management and leadership theories in professional nursing practice. Open to majors only. P, 381, 382, 388, 389; CR 387a. Both 387a and 387b are offered each semester.

388. Issues in Nursing and Health Care Delivery (2) I II Nursing, health care and societal issues which impinge upon the practice of professional nursing; nursing role and responsibility in determining directions for change. Open to majors only.

389. Research Methods in Nursing (2) I II Implementation of the research process, evidenced through design of a research proposal. Open to majors only. P, 379.

482. Legal Implications in Nursing (3) GC I II Overview of the nurse's relationship with law, as a practicing nurse, and as an individual; exploration of roles from student to expanded practice, in the community, in the legislative process. Advanced degree credit available for non-Ph.D. majors only. Writing-Emphasis Course.*
392  DEPARTMENTS AND COURSES OF INSTRUCTION

484.  The Health Professions and the Social Sciences (3) GC I Implications of concepts and theories from anthropology, psychology and sociology for health care. Advanced degree credit available for non-Ph.D. majors only. Writing-Emphasis Course.*

487.  Poverty and Health (3) GC II Study of the relationship between poverty and health. Concepts and theories from anthropology, psychology and sociology will be used to analyze problems associated with poverty. Advanced degree credit available for non-Ph.D. majors only. P, six units of soc. sci. (Identical with Anth. 487 and F.C.M. 487) Writing-Emphasis Course.*

488.  School Nurse Practice (3) GC S Analysis and application of nursing in school systems. Communication skills, teaching-learning principles for family, physical, psychological assessment. P, R.N.

495.  Colloquium a. Bilingual Health Communication (3) GC II (Identical with Anth. 495a, which is home.)

588.  Clinical Anthropology (3) I II Application of principles from anthropological theory to the actual practice of patient care, with emphasis on culture content of groups living in the greater Southwest. P, nine units of behavioral sci. (Identical with Anth. 588 and F.C.M. 588)

589.  Health of the Older Adult (3) I Current research of the aging process including physical and mental alterations; emphasis on physiological changes. Consult college before enrolling.

600a-600b-600c.  Nursing Theory and Practice (3-3-3) I II S Maintenance, therapeutic and preventive nursing care of persons in various settings. Student elects practice in one area of nursing: (1) child; (2) community health; (3) gerontology; (4) maternal-newborn; (5) medical-surgical; (6) psychiatric-mental health. Laboratory is required.

602.  Evaluation Process in Nursing (3) II Development and use of models and tools for assessing nursing processes, programs and performances. Approaches to and psychological reactants of evaluation are explored.

620.  Clinical Teaching in Collegiate Schools of Nursing (6) II Curriculum planning and implementation; principles of teaching and learning, formulation of objectives, the selection and organization of learning experiences in the clinical area. Directed practice teaching is included in the area of clinical interest. P, 600a or 600c, CR 600b.

624.  The Administrative Process (6) II Theoretical and practical applications of administration as a decision-making process in formulating a course of action essential to solving patient care and personnel issues in nursing. P, 600a or 600c, CR 600b.

625a-625b.  Physiological Concepts: Nursing (3-3) S 625a: Stressor activated and host defense responses. Includes fever, nutrition, pain, sleep. Offered S 1986 625b: Health states such as hypoxia, perfusion, edema. Physiology of reproduction, menopause, infertility. Offered S 1985 625a is not prerequisite to 625b.

630.  Methods in Nursing Research (3) I Critical examination of selected problems and methods in the nursing research process. P, 600a or CR.

631.  Clinical Phenomena: Theories and Research (3) I Theory and research surrounding common clinical phenomena (e.g., pain, stress), with emphases on description of clinical phenomena and identification of strengths and weaknesses in available knowledge and research. Laboratory is required. P or CR, 630, 600a or 600b or 600c.

680a-680b.  Nursing in a Clinical Subspecialty (4-12) 680a: Clinical physiology, pathophysiology, and nursing skills, as related to a selected subspecialty area; major subspecialty health problems and impact on the individual, the family and society. Laboratory is required. 680b: Integration and application of previous content, including exploration of expanded role at subspecialty level. Laboratory is required. P, master's degree or 600a, 600b, 600c, 602, 620, 624, 630, or 631. Both 680a and 680b are offered fall and spring semesters.

681.  Dynamics of Behavior in Patients with Chronic Disease (3) I S Behavioral problems of individuals with chronic diseases and ways of intervening. Open to majors only.

683.  Primary Care Nursing I (6) S Knowledge and skills in health assessment, health promotion, and anticipatory guidance throughout the lifespan; assessment and management of pediatric and adult common, acute, and chronic health problems. 2R, 12L. P, admission to N.S. Program.

684.  Primary Care Nursing II (6) I Advanced training in health promotion and anticipatory guidance throughout the lifespan; assessment and management of common, acute, and chronic pediatric and adult health problems. 2R, 12L. P, 683 and admission to N.S. program.

685.  Family Health Care Management (2) I Knowledge and skills in family assessment and health care management relevant to their practice as Primary Care Nursing Specialist students; emphasis on application of family theory. 1R, 3L. P, 683 and admission to N.S. program.
705. **Testing Nursing Theory** (3) I Examination of selected theories currently utilized in nursing; testing of theories in practice; provision for an exercise in theory construction. Laboratory is required. P, 600a-600b-600c, 602, 630, six units of adv. human physiology, six units of an adv. social science.

710. **Clinical Nursing Research** (3) II Investigation of selected strategies appropriate to researching problems in clinical nursing. P, 600a-600b-600c, 602, 705, 630.

771. **Methods in Clinical Nursing Research** (3) I Application of research methods from the physical and social sciences to clinical nursing; experimental and nonexperimental designs; collection, analysis and interpretation of data; computer use. P, 705, 710, 630.

775. **Study of Social Influences** (3) S 1986 In-depth examination of social forces affecting the health care system.


782a-782b-782c. **Field Work in Nursing Research** (3-3-3) S I II Individualized course of study incorporating research and clinical knowledge in a selected area of nursing practice in the laboratory and field setting. P, 600a-600b-600c, 602, 630, 705, 710.

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

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**NUTRITION AND FOOD SCIENCE**


Associate Professors Don P. Bourque, Charles P. Gerba, K. Y. Lei, Ralph L. Price, Edward T. Sheehan, Norval A. Sinclair, Alice B. Stanfield (Emerita), Ann M. Tinsley

Assistant Professors Ronald E. Allen, Patsy M. Brannon, James F. Deatherage, Roger A. Sunde

Lecturer Barbara J. Zeches

The Department of Nutrition and Food Science provides instructional programs in all areas of nutrition and food science. These programs prepare students for careers in various phases of the food industry, governmental regulatory and consumer agencies, health care delivery systems, and for graduate study or professional schools of medicine or nursing.

The department offers the degree of Bachelor of Science in Agriculture with majors in food science, food service management, and nutritional sciences.

The Master of Science is offered with majors in food science or in dietetics. The department also participates with the Committee on Nutritional Sciences, the Department of Biochemistry, the Committee on Genetics, and the Department of Microbiology and Immunology in offering the Master of Science and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

Undergraduate students will select one curriculum from Section I and one specialization from the majors offered in Section II.

I. **CURRICULA REQUIREMENTS:**

**Agriculture:** Micr. 110; N.F.S. 101, 201, 251 and courses specified under College of Agriculture requirements.

**Agricultural Science:** Micr. 110, N.F.S. 101, 201, 251; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Phys. 102a-102b; and courses specified under College of Agriculture requirements.

**Agricultural Business:** Micr. 110, N.F.S. 101, 201, 251; Chem. 103a-103b, 104a-104b, 241a-241b, and courses specified under College of Agriculture requirements.
II. MAJORS:

A. **The major in food science**: Students must take the following courses applicable to their area of specialization:

**Consumer food science**: 340, 350, 459, 470, 493d; C.S. 446; Art (three units); Jour. 205, 206, 208, 364; R.T.V. (three units); Mktg. 361, 450, M.A.P. 320, 330. An internship is required in the junior or senior year. Specialization in consumer food science prepares the student for employment in food company research and consumer product test facilities, regulatory agencies and the media.

**Food technology**: 360, 468, 470, and at least two additional units at the 400 level; Chem. 322, 323; Math. 123 or 125a, 160 or 263. Specialization in food technology prepares the student for employment in the food industry in areas of analysis, product development, quality assurance, regulation, marketing or management or as preparation for a related advanced degree study.

B. **The major in food service management**: Students must take 180, 258, 358, 458, 470; Chem. 101a-101b, 102a-102b, or 103a-103b, 104a-104b and 241a-241b; M.A.P. 305, 320, 330; M.I.S. 111; and the following courses applicable to their major area of specialization:

**Administrative dietetics**: (Approved Plan IV ADA) 340, 394d; Ecol. 159a-159b; Ed.P. 310; Acct. 472 and 200 or 272; A.Ec. 439 or Math. 160; Psyc. 101; Soc. 100; Econ. 201a-201b and Math. 117e; Specialization in administrative dietetics leads to application for internship and credentials from the American Dietetic Association.

**Hospitality**: 350; C.T. 284R, C.T. 304; Psyc. 300 recommended; Mktg. 361 or 364 or 366; Acct. (three units); and M.I.S. 111 recommended. Specialization in hospitality prepares the student for a food and beverage management position in the hotel and restaurant industry.

C. **The major in nutritional science**: Students must take 406a-406b, 408, 441; Ecol. 159a-159b, Ecol. 464aR-464bR; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Math. 117e, 263; and the following courses applicable to their areas of specialization:

**Dietetics**: (Approved Plan IV ADA) 258, 340, 442, 443, 449, 458; Engl. 308; Psyc. 101 or Soc. 100; Anth. 102 or 200; Ed.P. 310; M.A.P. 330; and M.I.S. 111, Phys. 102a, 180 recommended. Specialization in dietetics leads to application for internship and credentials from the American Dietetic Association. The department maintains cooperative arrangements with the University Medical Center and other health care and educational facilities.

**Nutrition**: Chem. 322, 323; Phys. 180a-180b; Math. 118, 125a; and 340 recommended. Specialization in nutrition provides an excellent background for graduate study in nutrition, biochemistry, or other health related fields. It is not intended as a terminal degree.

**Nutrition/exercise physiology**: same requirements as nutrition with the addition of 26-27 units in Group V to include ex.s.s. (4 activity units), Ex.S.S. 276, 279, 370, 373, 374, 377, 380, 393b, 394d, 394e. This specialization is valuable for students interested in health care fields. It requires 136-137 units for graduation.

The major in nutritional sciences is a viable preparation for professional schools of medicine, dentistry, nursing or veterinary medicine.

**Honors**: The department participates in the Honors Program.

101. **Nutrition, Food, and You (2)** I II Current concepts and controversies in nutrition and food safety; practical applications. Designed for nonmajors and for majors with no previous work in nutrition. **Price**

180. **Science of Meat and Meat Products (3)** I II (Identical with An.S. 180)

201. **Nutrition and the Life Cycle (3)** I II Nutrient uptake and requirements for pregnancy, lactation, and infancy, and for adolescents, adults, and the aged. P, 101, Chem. 101b or CR; Chem. 241a (required of majors and recommended for nonmajors). **Lai**

251. **Food Study (3)** I II Application of scientific principles in handling food for enhancement or preservation of quality. 2R, 3L. P, Chem. 101b or CR; Chem. 241a (required of majors, recommended for nonmajors). **Zechar**
258. **Institution Food Management (1) II** Quantity food preparation and service, menu planning for institutions, management of time and labor and use of institution equipment. P. 251. 3L *Tinsley*


310. **Principles of Human Nutrition in Health and Disease (3) I II** Application of basic nutritional principles in the selection of normal and therapeutic diets; designed for students in the health sciences. P. Chem. 101b, 102b. *Sheehan*

338. **Theories of Biological Aging (2) II** Introduction to aging in man and lower animals; nutritional, immunologic, neurologic and genetic effects on the aging process. P, beginning course in biology. (Identical with Gero. 338) *McCaughey*

340. **Introduction to Diet Therapy (3) (3)** Food composition, principles of interviewing and counseling, cultural aspects of diets, energy requirements, major diseases requiring diet therapy. P. 201; Chem. 103b, 104b; Ecol. 159b.

350. **Consumer Decisions In Food (3) I** Economic, nutritional, aesthetic and management considerations affecting decision-making in food selection, preparation and service; individual and group projects related to current consumer problems in food. 2R, 4L. P, 101, 251. *Zeches*

358. **Purchase of Foods and Food Service Equipment for Institutions (3) II** Factors affecting food purchasing, storage, inventory, equipment selection, maintenance, design of food-preparation areas for food service organization. 2R, 3L. P. 251. *Tinsley*

360. **Food Chemistry (3) I** The chemical composition and physiochemical properties of food products. P. Chem. 241b. *Berry*

394. **Practicum**
   d. **Food Service Systems Management (3) I II** 1R, 6L. Field trips. P. 201, 258, 340, M.A.P. 305, 330; CR 458.

406a-406b. **Nutritional Biochemistry (3-3) GC** The biochemical aspects of nutrient metabolism in animals, with emphasis on nutrient interrelations. P. Chem. 241a-241b. *McCaughey*

408. **Human Nutrition (3) GC I** Concepts of the physiology and biochemistry of nutrients and nutrient homeostasis in humans. P, 406a-406b or Bioc. 460, Ecol. 159a-159b, CR 464a. *Lei*

410. **General Human Nutrition (3) GC II** Advanced principles of nutrition: digestion, absorption and utilization of nutrients. Open to non-majors only. P. Chem. 112 or Micr. 103 or consult department before enrolling.

430. **Principles of Nutrition (3) GC I II** (Identical with An.S. 430)

441. **Therapeutic Nutrition (4) GC II** Therapeutic principles of nutrient acquisition and utilization, including modification of the diet, for selected disease and/or deficiency states; factors of importance in client/patient care, rehabilitation and education. CR 408.

442. **Clinical Biochemical Evaluations (2) I** Review, analysis and critique of the literature covering current research methodology and information related to clinical biochemical evaluations as applied to nutritional status assessment; oral reports, group projects, and discussion. CR 408. *Sheehan*

443. **Community Nutrition (2) II** Nutritional status assessment in the community setting; review of ongoing community programs in government and private agencies; analysis of requirements and role of community nutritionist; nutrition projects and grant writing. Field trips. *Sheehan*

447. **Perspectives in Geriatrics Laboratory (1)** (Identical with Ph.Pr. 447)

448. **Perspectives in Geriatrics (2)** (Identical with Ph.Pr. 448)

449. **Nutritional Care Management (2)** I Management methods applied to the administration of nutritional care in health care delivery systems for individuals in various life situations. 1R, 3L. Field trips. CR 408, 442.

455. **Food Product Development (3) GC I II** Flavor, color, texture, temperature and appearance, as related to acceptability of food products; analysis of change during storage, preservation and preparation, as related to food composition and quality. 1R, 6L. P. 251, 360. *Tinsley*

458. **Food Service Organization and Management (3) GC I** Organization and management of food service systems; responsibilities of management for leadership, sanitation, maintenance, and care of food service plant and its equipment. P. 258. *Tinsley*

459. **Sensory Evaluation of Food (3) GC II** 1985-86 Fundamentals of taste, odor, color, and rheology perception as related to food; design and methodology of small-panel and consumer-panel testing. 2R, 3L.
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>460</td>
<td>General Biochemistry (5) GC I (Identical with Bioc. 460)</td>
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<tr>
<td>463</td>
<td>Food Analysis (3) GC II 1986-87 Lab. procedures for chemical and physiochemical analysis of food products. 1R, 6L, P, 360, 406a. (Identical with An.S. 463)</td>
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<tr>
<td>466</td>
<td>Postharvest Physiology (3) GC II 1985-86 (Identical with PLS. 466)</td>
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<tr>
<td>468</td>
<td>Food Processing (3) GC I Refrigeration, freezing, dehydration, heating, fermentation and pickling, irradiation and addition of chemicals, as they apply to food preservation and processing, retention of nutritive value, flavor, appearance and safety. P, Chem. 241b, Micr. 110. Price</td>
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<tr>
<td>470</td>
<td>Food Microbiology and Sanitation (3) GC II Microbiology in processing and handling of foods; relation of microorganisms, insects, and rodents to design and function of processing and handling equipment. P, Micr. 120 or 217. (Identical with Micr. 470) Gerba</td>
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<tr>
<td>471</td>
<td>Food Microbiology and Sanitation Laboratory (2) GC II 1986-87 Lab. procedures for assessment of sanitary quality of foods. P, 470 or CR. (Identical with Micr. 471) Gerba</td>
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<td>480</td>
<td>Composition and Structure of Meat (2) GC II 1985-86 (Identical with An.S. 480)</td>
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<td>485</td>
<td>Dairy Products Processing (3) GC I 1985-86 Principles of processing butter, cheese, condensed milk, dehydrated milks, frozen desserts, and special products; selection and preparation of materials.</td>
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<tr>
<td>493</td>
<td>Internship</td>
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<td>538</td>
<td>Problems In the Biochemistry of Aging (2) I 1986-87 Current topics in the biochemistry of mammalian aging; examination of the metabolic, hormonal, immunologic and neural aspects of aging in lower mammals and humans. P, 406a-406b or Chem. 460 or 462b. McCaughey</td>
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<tr>
<td>549</td>
<td>Interdisciplinary Approaches to Health Care of the Aged (3) S (Identical with Ph.Pr. 549).</td>
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<tr>
<td>560</td>
<td>Advanced Food Chemistry (3) I 1985-86 Chemical and physical structure and functions of food constituents, additives, and food properties. P, 360, CR 406a. Berry</td>
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<tr>
<td>568a-568b</td>
<td>Nucleic Acids (3-3) 1985-86 (Identical with Bioc. 568a-568b)</td>
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<tr>
<td>596</td>
<td>Seminar</td>
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<tr>
<td>601</td>
<td>Bioenergetics (2) I Energy utilization and nutrient interactions in higher animals. Efficiency of energy use in body processes. P, 408. (Identical with An.S. 601) Reid</td>
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<tr>
<td>602</td>
<td>Metabolic Integration (2) II Food intake, transport, protein and amino acid utilization in higher animals. P, 408. Sunde</td>
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<tr>
<td>609</td>
<td>Nutritional Biochemistry Techniques (3) I Biochemical methods for evaluating metabolic functions of nutrients. 1R, 6L, P, 408, Chem. 324 or 325, and 323 or 326. (Identical with An.S. 609) Reid</td>
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<tr>
<td>615</td>
<td>Chemistry and Metabolism of Lipids (3) I 1985-86 Chemistry and structure of lipids and their digestion, adsorption, transport and utilization; current research in lipid metabolism and the role of lipids in certain disease states. P, 406a-406b. Marchello</td>
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<tr>
<td>617</td>
<td>Steroid Chemistry and Biochemistry (3) I 1986-87 Occurrence, biosynthesis and function of steroids in animals, plants and microorganisms; chemical reactions and metabolism; chromatographic analysis. P, 406a-406b or Chem. 460 and 241a-241b. (Identical with Bioc. 617 and Chem. 617)</td>
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<tr>
<td>620</td>
<td>Vitamins (2) I 1986-87 The chemistry and metabolism of vitamins. P, 408. Weber</td>
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<td>630</td>
<td>Developmental Nutrition (3) II Role of nutrients in development and growth; changes in maternal and child nutritional requirements due to development and growth; current research in developmental nutrition. P, 408. Brannon</td>
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<tr>
<td>640a-640b</td>
<td>Field Methods in Human Nutrition (3-3) Case-oriented approach to nutritional assessment, diagnosis, prescription, plan and prognosis; application of dietary, clinical and biochemical methods. 2R, 3L. Open to majors in N.F.S. and other health sciences areas only. Kight</td>
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<tr>
<td>645</td>
<td>Nutritional Pathology (2) I Identification of nutrient-based lesions; diagnosis of causative factors, using clinical, biochemical and dietary data. Sheehan</td>
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<td>663</td>
<td>Chemistry of Food Carbohydrates (2) II 1986-87 Chemical and physical properties of carbohydrates important to their presence in food. P, Bioc. 462a, 460 or N.F.S. 406a-406b Berry</td>
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665. Chemistry of Food Proteins (3) II 1985-86 The chemical and physical properties of proteins important to their use as food; analysis and purification of proteins; biochemical properties of proteins in muscle, milk, eggs, cereals, and other foods. P, Bioc. 462a preferred, Bioc. 460 or N.F.S. 406a-406b acceptable. (Identical with Bioc. 665) Goll

672. Food Safety (2) I 1985-86 Significance and control of foodborne hazards associated with pathogenic microorganisms, microbial toxins, industrial chemicals, and other environmental contaminants. P, 471, Chem. 241b. (Identical with Micr. 672) Gerba

693. Internship
a. Dietetic Internship, ADA Accredited (1 to 6) [Rpt./2] III Field trips. Consult dept. before enrolling. Open to majors only. P, Course work equivalent to American Dietetic Association Plan IV.

696. Seminar
b. Nutrition (1) I II (Identical with Nu.Sc. 696b)
c. Food Science (1) I II

NUTRITIONAL SCIENCES

Committee on Nutritional Sciences (Graduate)

Professors James W. Berry (Nutrition and Food Science), William H. Brown (Animal Sciences), Herbert Carter (Emeritus, Biochemistry), Milos Chvapil (Surgery), David L. Earnest (Internal Medicine), Darrel E. Goll (Nutrition and Food Science; Biochemistry), William H. Hale (Animal Sciences), Mark Haussler (Biochemistry), J. Tai Huber (Animal Sciences), Wayburn S. Jeter (Microbiology and Immunology), Mary Ann Kight (Nutrition and Food Science), Otakar Koldovsky (Pediatrics), John A. Marchello (Animal Sciences; Nutrition and Food Science), W. F. McCaughey (Nutrition and Food Science), Donald J. McNamara (Nutrition and Food Science), Bobby L. Reid (Animal Sciences; Nutrition and Food Science), Richard W. Rice (Animal Sciences), Frank D. Rollins (Animal Sciences; Nutrition and Food Science), William A. Stini (Anthropology), J. Warren Stull (Nutrition and Food Science), Brent Theurer (Animal Sciences), Hugo V. Villar (Surgery), Charles W. Weber (Nutrition and Food Science; Animal Sciences), Michael A. Wells (Biochemistry), Frank M. Whiting (Animals Sciences), Jack H. Wilmore (Exercise and Sport Sciences)

Associate Professors Gail G. Harrison (Family and Community Medicine; Pediatrics; Nutrition and Food Science) Chairperson, Ronald E. Allen (Animal Sciences; Nutrition and Food Science), James Blanchard (Pharmaceutical Sciences), Sergio Bustamante (Pediatrics), K. Y. Lei (Nutrition and Food Science), Frank L. Meyskens (Internal Medicine), Ralph L. Price (Nutrition and Food Science), Edward T. Sheehan (Nutrition and Food Science), Spencer Swingle (Animal Sciences)

Assistant Professors Patsy M. Brannon (Nutrition and Food Science), Murray Korc (Internal Medicine), W.A. Schurg (Animal Sciences), Roger A. Sunde (Nutrition and Food Science), Ann M. Tinsley (Nutrition and Food Science), Marc E. Tischler (Biochemistry)

The interdepartmental Committee on Nutritional Sciences offers research direction in all areas of nutrition, including nutritional biochemistry, human nutrition, clinical and community nutrition, and animal nutrition.

The committee offers graduate work leading to the Master of Science and the Doctor of Philosophy degrees with a major in nutritional sciences. Options in nutritional biochemistry, human nutrition (clinical or community), or animal nutrition may be selected within this major. For admission and degree requirements, please see the Graduate Catalog.

696. Seminar
b. Nutrition (1) I II (Identical with N.F.S. 696b, which is home)

OCCUPATIONAL SAFETY AND HEALTH

(See Health-Related Professions)
DEPARTMENTS AND COURSES OF INSTRUCTION

OFFICE EDUCATION
(See Business and Career Education)

OPERATIONS MANAGEMENT
(See Management and Policy)

OPTICAL SCIENCES

Committee on Optical Sciences (Graduate)


Associate Professor Eustace L. Dereniak Assistant Professors Ursula J. Gibson, William M. Hetherington III (Chemistry), Chris L. Koliopoulos, Nasser Peyghambarian (Research), Robin N. Strickland (Electrical and Computer Engineering)

Lecturers James M. Palmer, Robert E. Parks (Adjunct)

Qualified applicants holding undergraduate degrees in engineering, mathematics or physics are admitted to undertake graduate programs in optical sciences. Current active research areas include electro-optics, image formation, image processing, laser physics, materials. medical optics, non-linear optics, optical bistability, optical design, optical fabrication and testing, optical properties of materials, pattern recognition, quantum optics, remote sensing, spectroscopy, surface physics, and thin-film technology. Interdisciplinary programs in progress involve the departments of Astronomy, Chemistry, Civil Engineering and Engineering Mechanics, Electrical and Computer Engineering, Microbiology and Immunology, Physics, Physiology, Planetary Sciences, and Radiology, as well as the Microelectronics Laboratory, Arizona Research Laboratory and the Optical Circuity Cooperative.

The degrees of Master of Science and Doctor of Philosophy are offered with a major in optical sciences. For admission and degree requirements, please see the Graduate Catalog.

434. Electrical, Magnetic and Optical Properties of Materials (3) GC 1 1986-87 (Identical with M.S.E. 434)

440a-440b. Atomic and Molecular Spectroscopy for Experimentalists (3-3) GC (Identical with Phys. 440a-440b)

501. Electromagnetic Foundations of Optics (3) I Gauss' law; Coulomb's law; dipole moment; polarizability; Faraday's law; Maxwell's equations; the wave equations; plane waves; spherical waves; Fresnel's formulas; dipole radiation; magneto-optic effects; electro-optic effects. P, Phys. 116, Math. 422b.

502. Introduction to Fourier Optics (3) I Harmonic analysis; linear systems; impulse response; convolution; Fourier transform; transfer function; diffraction; image formation; holography; optical data processing. P, Math. 223.

503. First-Order Optical Design (3) I Rays and wavefronts; Fermat's principle; Snell's law; dispersion; systems of plane mirrors; Gaussian imagery; paraxial imagery; paraxial design methods; Delano diagram; introduction to aberrations.

503L. First-Order Optical Design Laboratory (1) I Lab. in support of 503. P, CR 503.

504. Introduction to Quantum Optics (3) II Quantum background; interaction of radiation with matter; dipole moments; line broadening; quantization of radiation fields; spontaneous emission; stimulated emission; lasers. P, 501, Phys. 230. (Identical with Phys. 504)
505. **Interference and Interferometry (3)** II Wave equations; energy flow; polarization; interference; coherence; interferometers; optical testing; heterodyne interferometry; holography; speckle interferometry. P, 501, 502.

505L. **Interference and Interferometry Laboratory (1)** II Lab. in support of 505. P, CR 505.

506. **Principles of Optical Systems Design (3)** II Sources of aberrations; aberration control; aberrations in simple systems; vision; color; mechanical design principles. P, 503, 503L.

507. **Introduction to Solid-State Optics (3)** I Solid-state background; lattice vibrations; energy bands; energy gaps; optical properties of metals, insulators and semiconductors; measurement techniques; modulators; light-emitting diodes. P, 504.

508. **Probability and Statistics in Optics (3)** II Probability; random variables; stochastic processes; autocorrelation; Wiener spectrum; noise; applications in photography; atmospheric turbulence; analysis of random data. P, 502.

509. **Radiometry, Sources, Materials and Detectors (3)** II Radiometry; sources; materials and components for optical systems; imaging and non-imaging detectors. P, 502, 503, 503L.

513. **Optical Testing (3)** I 1985-86 Metrology of components; aspheric surface testing; assembly and alignment of systems; system evaluation. P, 505.


514. **Aberration Theory (3)** II 1986-87 Aberration theory; geometrical image formation; diffraction; pupil, spread, and transfer functions; random wavefront perturbations; system effects; image evaluation; image processing. P, 503.

517. **Lens Design (4)** I Fundamentals of optical system layout and design; exact and paraxial ray tracing; aberration theory; chromatic and monochromatic aberrations. 2R, 6L. P, 506.

524. **Optical Data Processing (3)** II 1985-86 Inverse filtering; matched filtering; frequency-domain synthesis; the Vander Lugt filter; shadow-casting correlators; OTF synthesis; coded-aperture imaging. P, 505.

527. **Holography (3)** II 1986-87 Historical background; the Gabor hologram; the hologram as a zone plate; Fresnel, image, Fourier-transform, and reflection holograms; practical holography; limitations. P, 505.

531. **Image Processing Laboratory (3)** I (Identical with E.C.E. 531)

533. **Image Processing: Devices, Systems and Applications (3)** II 1985-86 Image formation; resolution; noise; linear processing; display; discrete images; sampling; coding; maximum efficiency codes; nonlinear computer processing; coherent processing. P, 502 or background in theory of linear systems. (Identical with E.C.E. 533)


541. **Introduction to Lasers (3)** I Laser theory; properties of lasers; stimulated emission; dispersion theory; gain saturation and rate equation; optical resonators; survey of laser types and mechanisms. P, Phys. 103b.

541L. **Introduction to Lasers Laboratory (1)** I Lab. in support of 541. P, CR 541.

543. **Laser Physics (3)** II 1986-87 Density matrix formulation of interaction of radiation with matter; semiclassical laser theory; single and multimode scalar fields; moving atoms; ring and Zeeman lasers; pressure effects. P, 504. (Identical with Phys. 543)

544. **Advanced Electrodynamics (3)** I 1985-86 Normal modes of matter; macroscopic electrodynamics; optical activity; crystal optics; electro-optics; magneto optics; bulk acousto-optics; scattering. P, 501.

545. **Nonlinear Optics (3)** II 1985-86 Scattering of light; parametric amplification; Brillouin, Raman, Rayleigh scattering; stimulated and spontaneous interactions; frequency multiplication; intense field effects; materials damage theory. P, 501.

550. **Fundamentals of Remote Sensing (3)** I Physics and methodology of remote sensing; radiometry; data collection systems; photointerpretation; photogrammetry; image enhancement and classification; applications in the earth sciences.
552. **Optical Properties of the Atmosphere and Ocean (3)** I 1986-87 Fluctuations in modulus, phase, and coherence caused by turbulence and scattering; polarization; absorption; dispersion; visibility; transfer function; resolution; experimental data. P, CR 508.

558. **Radiometry (3)** I 1985-86 Units and nomenclature; Planck's law; black bodies; gray bodies; spectral emitters; Kirchhoff's law; flux concepts; axial and off-axis irradiance; radiative transfer; normalization; coherent illumination; radiometric instruments. P, 501.

559. **Infrared Techniques (3)** I 1986-87 The radiant environment; atmospheric properties; optical materials and systems; detector description and use; data processing; displays, systems design and analysis. P, 558.

563. **Photoelectronic Imaging Devices (3)** II 1985-86 Intensifiers; camera tubes; electronography; storage tubes; specifications; evaluation; applications. P, Phys. 116.


566. **Optical Detectors (3)** II 1986-87 Photoconductors; semiconductors; signal and noise mechanisms; figures of merit; limitations on the sensitivity of detectors; photoemitters; detectors of ionizing radiation. P, 507.


568. **Solid-State Imaging Devices (2)** I 1986-87 Charge transfer devices; monolithic and hybrid focal planes, figures of merit; time-delay integration; fat zero; transfer efficiency; double-correlated sampling; buried-channel and surface-channel devices. P, 507.

570. **Advanced Optics Laboratory (2)** II Hands-on experience in current optics research areas. Emphasis is device-oriented. Guided waves; acousto-optics; optical bistability; diode lasers; nonlinear optics; optical phase conjugation. 1R, 3L. P, Phys. 121.


577. **Optics of Thin Films (3)** II 1986-87 Dielectric interference films; semiconductor and metallic films; planar wave guide films; design methods for multilayer interference filter coatings; thin film components for integrated optical circuits. P, 505.

595. **Colloquium**
   a. Current Subjects in Optical Sciences (1) I II

596. **Seminar**
   a. Introduction to Thin-Film Techniques (2) I 1985-86 P, Phys. 330

597. **Workshop**
   a. Optical Shop Practices (3) II 1R, 6L. P, 513, 513L.


643. **Quantum Optics (3)** II 1986-87 Quantum theory of electromagnetic radiation; spontaneous emission; Dicke superradiance; optical coherence and noise; quantum theory of the laser; superconductivity and Josephson radiation. P, 543. (Identical with Phys. 643)

656a-656b. **Atmospheric Optics and Radiation (3-3)** 1986-87 (Identical with Atmo. 656a-656b)

680. **Microcomputer Interfacing in the Optics Laboratory (3)** I Design and construction of interfaces between microcomputer systems and a variety of devices in the optics laboratory, including switches, motors, optical sensors, displays and terminals. Hardware and assembly language software drivers. 1R, 6L. P, C.Sc. 122 or E.C.E. 171.

696. **Seminar**
   a. Advanced Optical Design (1 to 3) II P, 517.

### ORIENTAL STUDIES

Associate Professors Michael E. Bonine, Constance Cronin (Anthropology), Richard M. Eaton, Leslie A. Flemming, Charles H. Hedtke, Chisato Kitagawa, Peter Machinist, Ronald C. Miao, Michael Schaller (History), William J. Wilson, Norman Yoffee (Anthropology)

Assistant Professors Marie Chan, John Y. Hou, Daniel Swetschinski

Lecturer Edward D. Putzar

The Department of Oriental Studies offers instruction in the languages, cultures and civilizations of Asia and North Africa. Programs of study may emphasize the language and literature, history, thought, or society, ancient or modern, of one or more cultural areas.

The department offers the Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees with a major in Oriental studies. The Master of Education with a teaching major in Oriental studies is also available. Undergraduate majors may specialize in China, Japan, India-Pakistan, the Middle East, Judaic studies, or general Oriental studies. For courses concerning Ancient Near East Studies, see sections on Judaic Studies and the Middle East below.

The major: A minimum of 35 units from one of the following areas of specialization (listed with their additional specific requirements): (1) China: 100a-100b, 375a-375b, 400a-400b. (2) Japan: 102a-102b, 402a-402b. (3) India-Pakistan: 101a-101b and 408a-408b, or 105a-105b and 405a-405b. (4) Middle East: 477a-477b, 478, and two yrs. or equivalent of Arabic, Persian, Hebrew, Akkadian, or other language approved by the adviser. (5) Judaic Studies: 103a-103b, 403a-403b or 409a-409b, two courses selected from 370a-370b and 372a-372b. (6) General Oriental Studies: program of study to be planned with and approved by general Oriental studies adviser.

The supporting minor may be chosen, with the consent of the adviser, from outside the department or from another area of specialization within the department (except for the student with a specialization in general Oriental studies, who must seek a minor outside the department).

The teaching minor: 171, 172 and/or 170a-170b, and twelve additional units selected in consultation with departmental advisers (see the social studies teaching major in the College of Education section of this catalog).

For information regarding the East Asia Study Center and the Near Eastern Center, see the College of Arts and Sciences section of this catalog.

Honors: The department participates in the Honors Program.

The courses listed below are grouped by areas of specialization within the Oriental studies major.

**General Oriental Studies**

130. **Asian Religions** (3) I II Religions of India and the Far East. (Identical with Reli. 130)

140a-140b. **Oriental Humanities** (3-3) Major trends and traditions in the arts, literatures and languages, religions and philosophies of Asia. 140a: The Middle East, India and Pakistan. 140b: China and Japan. (Identical with Reli. 140a-140b)

170a-170b. **Introduction to Asian Civilizations** (3-3) Survey of the traditional and contemporary social, political, and thought patterns of China, Japan, and India. 170a: The Traditional Period. 170b: The Modern Period. (Identical with Hist. 170a-170b)

333. **Buddhist Meditation Traditions** (3) I Major forms of Buddhist meditation from both the South Asian and East Asian traditions, with emphasis on the nature of meditation as a variety of religious experience. (Identical with Reli. 333)

421a-421b. **East Asian Buddhism** (3-3) GC Buddhism in China, Korea and Japan with emphasis on the relationship between East Asian Buddhist thought and practice and the various historical contexts in which they emerged. P, 330a or consult department before enrolling. (Identical with Reli. 421a-421b)


432. **Islamic Mysticism** (3) GC II 1986-87 Origin and development of Sufism and its impact on the Muslim and non-Muslim worlds. (Identical with Reli. 432)
The United States and East Asia: 1840 to the Present (3) GC II 1986-87 (Identical with Hist. 451a-451b)

Marxism in East Asia (3) GC I Evolution of Marxist thought in China and Japan. (Identical with Hist. 463)

International Relations of East Asia (3) GC II (Identical with Pol. 464)

Asia and the West (3) GC I Processes of interaction between Europeans and the peoples and cultures of the Middle East, South Asia, and East Asia, from the Portuguese explorations to the present. (Identical with Hist. 468) Writing-Emphasis Course for general major.*

Women in East Asia (3) GC I Women in traditional China and Japan; analysis of changes occurring in the modern period. (Identical with Hist. 489 and W.S. 489)

Proseminar
a. Special Topics in Asian Studies (3) [Rpt./4] GC
j. The Prehistory of East Asia (3) I (Identical with Anth. 496j, which is home.)

596.

Seminar
c. East Asian Societies (3) [Rpt.] II

Writing-Emphasis Course. P, Satisfaction of the upper division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

China

100a-100b. Elementary Chinese (5-5) CDT Introduction to modern spoken and written Chinese (Mandarin).


331. Taoist Traditions of China (3) I 1985-86 Intellectual foundations of Taoism in its two scriptural sources, the Lao Tzu and the Chuang Tzu, and a sampling of some of the varieties of religious practice which developed upon these foundations. (Identical with Reli. 331)


375a-375b. History of China (3-3) Historical development of China. 375a: To 750 A.D. 375b: 750 to 1900 A.D. (Identical with Hist. 375a-375b)

400a-400b. Intermediate Modern Chinese (5-5) GC CDT Grammar, reading, and conversation in the modern (Mandarin) language. P. 100b.

410a-410b. Advanced Modern Chinese (5-5) GC Study of advanced modern (Mandarin) Chinese through readings in modern literature and newspapers. P. 400b.

Classical Confucianism (3) GC I Formative, classical period in the history of the Confucian tradition, up to 200 A.D.; emphasis on the thought of Confucius, Mencius, and Hsun Tzu. P, 330a or consult department before enrolling. (Identical with Reli. 418) Writing-Emphasis Course for China specialization.*

419. Neo-Confucianism (3) GC II Major figures and themes in the Revival Confucianism from the 11th century through recent times; emphasis on the thought of Chu Hsi and Wang Yang-ming. P, 330b or consult department before enrolling. (Identical with Reli. 419)

420a-420b. Linguistic Structure of Modern Chinese (3-3) GC Linguistic study of the phonological, morphological, and syntactic systems of modern Chinese, with particular attention to linguistic analysis. (Identical with Ling. 420a-420b)

440. Chinese Calligraphy (2) GC [Rpt.] I 1985-86 Theory, practice, and aesthetics of Chinese brush writing, with emphasis on individual training and development.

443. Chinese Aesthetics (2) GC II Survey of traditional Chinese aesthetic concepts in language, literature, painting, calligraphy, and design.

460. Modern Chinese Foreign Relations (3) GC II (Identical with Pol. 460)

461a-461b. Chinese Politics, 1911-Present (3-3) GC (Identical with Pol. 461a-461b)

475a-475b-475c-475d-475e. Periods in Chinese History (3-3-3-3-3) GC In-depth treatment of major premodern eras. 475a: Ancient and classical, to 200 B.C. 475b: Early Empire, 200 B.C.-200 A.D. 475c: Medieval, 200-750 A.D. 475d: New Empire, 750-1350 A.D. 475e: Late Empire, 1350-1800 A.D. May be taken in any order and CR. (Identical with Hist. 475a-475b-475c-475d-475e)
476. Modern Chinese History (3) GC Historical survey of the period since 1911 which examines the revolutionary developments shaping contemporary China. (Identical with Hist. 476) Writing-Emphasis Course for China specialization.*

482. Social History of China (3) GC Formation of ancient Chinese society; organization of families and clans; social stratification, mobility, conflict, and control in traditional China; and transformation from traditional to modern society. (Identical with Hist. 482)

495. Colloquium
a. Revolution in Chinese History (3) GC II (Identical with Hist. 495a)
d. Modern Chinese Frontier Areas (3) GC I 1985-86 (Identical with Hist. 495d)

496. Seminar
g. The Archaeology of Pre-Han China (3) GC II (Identical with Anth. 496g, which is home)


510a-510b. Chinese Historical Linguistics (3-3) II 1986-87 Historical survey of the development of the Chinese language, with particular attention to linguistic changes in phonology, morphology, and syntax. P, 400b and a course in general ling.

520. Resources and Methods in Sinology (3) II 1985-86 Introduction to and exercises in the use of standard Sinological reference and research resources. P, 500b.

550. Studies in Modern Chinese (3) [Rpt./1] S Grammar, conversation, and readings in modern Chinese texts, with emphasis on oral and written comprehension and expression. P, 410b.


553. Readings in Classical Chinese Prose (3) [Rpt./2] I 1985-86 Readings in selected texts from literary, philosophical, and historical traditions; includes selections from the Five Classics and the great prose masters of the Han-Qing. Variable content. P, 500b.


595. Colloquium
a. China (3) [Rpt.] I II

596. Seminar
f. Classical Chinese Literature (3) [Rpt.] I II
g. Modern Chinese Literature (3) [Rpt.] I II
h. Premodern Chinese History and Politics (3) [Rpt.] I II
i. Modern Chinese History and Politics (3) [Rpt.] I II

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

India-Pakistan

101a-101b. Elementary Hindi-Urdu (5-5) CDT Conversation, reading, and composition in the major national language of northern India and Pakistan.

408a-408b. Intermediate Hindi-Urdu (4-4) GC CDT Advanced grammar, reading, and conversation in the major national language of northern India and Pakistan, with separate sections for written Urdu and written Hindi. P, 101b.

417a-417b. Sanskrit Grammar and Texts (3-3) GC 1986-87 CDT Study of the classical language of India, with emphasis on reading and translation, including selections from the Gita, Vedas, Mahabharata, Hitopadesha, Kathasaritsagara, and Laws of Manu. (Identical with Clas. 417a-417b and Ling. 417a-417b)

431. Indian Religion and Thought (3) GC II 1985-86 Traditional religious and philosophical thought of India. (Identical with Reli. 431)
404a-444b. Literature of India (3-3) GC 444a: Ancient and classical literature; philosophical, epic, dramatic, and poetic literature until 1200 A.D. 444b: Modern literature; lyric poetry, short stories and novels by contemporary writers. In Engl. 444a is not prerequisite to 444b.

445. Hindu Mysticism (3) GC II 1986-87 Introduction to the major concepts and practices of Hindu mysticism, including yoga techniques, rites, symbols, and myths. (Identical with Reli. 445)

471. Introduction to Indic Civilization (3) GC I Social and political institutions, arts and philosophy of traditional society from prehistoric times to c. 1000 A.D. with emphasis on Hindu religion and its interrelations with the social order. (Identical with Anth. 471 and Hist. 471) Writing-Emphasis Course for India-Pakistan specialization.*

472. History of Medieval India (3) GC I 1985-86 Survey of Indian history from the 7th century to 1750. (Identical with Hist. 472)

473. History of Modern India and Pakistan: 1750-Present (3) GC II 1985-86 Survey of political, social and economic developments in South Asia from the mid-18th century to the present. (Identical with Hist. 473) Writing-Emphasis Course for India-Pakistan specialization.*

474a-474b-474c. History of Japan (3-3-3) GC Social, cultural and political history of Japan. 474a: From earliest times to 1500. 474b: 1500-1800. 474c: 1800-present. (Identical with Hist. 474a-474b-474c) 474a and 474c are Writing-Emphasis Courses for Japan specialization.*

495. Colloquium b. Japan (3) GC [Rpt./2] I II

Japan

Prior to registering in any Japanese language course other than 102a, the student must demonstrate the minimum knowledge of Japanese recommended by the instructor.

102a-102b. Elementary Japanese (5-5) CDT Conversation and readings in modern Japanese. 102a: [Rpt./6 units].

402a-402b. Intermediate Japanese (5-5) GC CDT Grammar, reading, and conversation in the modern language.

411a-411b. Modern Japanese Grammar (3-3) GC Introduction to Japanese linguistics: morphology, syntax, semantics, and pragmatics. (Identical with Ling. 411a-411b)

412a-412b. Advanced Japanese (5-5) GC CDT Reading from modern scholarship, fiction, and essays, with attention to grammatical analysis.


437. Japanese Religion (3) GC I Japanese Buddhism, Shinto, new religions, with emphasis on the period since 1600. Reading is in English; basic knowledge of Japanese history required. (Identical with Reli. 437)


474a-474b-474c. History of Japan (3-3-3) GC Social, cultural and political history of Japan. 474a: From earliest times to 1500. 474b: 1500-1800. 474c: 1800-present. (Identical with Hist. 474a-474b-474c) 474a and 474c are Writing-Emphasis Courses for Japan specialization.*

495. Colloquium b. Japan (3) GC [Rpt./2] I II
502. Literary Japanese (3) Introduction to the varieties of writing styles used from the 8th century to modern times, including Sino-Japanese, documentary, epistolary and purely literary styles.

595. Colloquium
b. Japan (3) [Rpt.] I II

596. Seminar
r. Japanese History (3) [Rpt.] I II
s. Japanese Literature (3) [Rpt.] I II

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

Judaic Studies

103a-103b. Elementary Modern Hebrew (5-5) CDT Intensive introduction to basic oral skills, reading and writing in class and language lab.; leads to an understanding of Biblical and modern Hebrew.

332a-332b. Judaic Thought and Culture (3-3) Survey of intellectual currents in post-Talmudic Jewish history. 332a: Medieval Jewish philosophy, mysticism, and popular culture. 332b: Modern Jewish thought. (Identical with Reli. 332a-332b)

345. Yiddish Literature in Translation (3) I (Identical with Ger. 345)


372a-372b. History and Religion of Israel in Ancient Times (3-3) Survey of the history and religion of ancient Israel. 372a: Biblical period through the Babylonian Exile; introduction to the Hebrew Bible. 372b: Ezra-Nehemiah to the Roman Empire, with emphasis on the formation of rabbinic Judaism. (Identical with Hist. 372a-372b and Reli. 372a-372b)

374. The Holocaust (3) II 1986-87 Socio-economic and intellectual roots of modern antisemitism, evolution of Nazi policy, the world of death camps, responses of Axis and Allied governments, and responses of the Jews. (Identical with Hist. 374 and Reli. 374)

382. Archaeology and the Bible (3) II Discussion of areas of common interest to Biblical studies and archaeology, with a survey of the major discoveries which illuminate the Old and New Testaments. (Identical with Reli. 382)

401. Ancient Mesopotamia (3) GC I 1986-87 (Identical with Anth. 401) Writing-Emphasis Course for Judaic studies specialization.*

403a-403b. Intermediate Modern Hebrew (5-5) GC CDT Intermediate grammar, reading, conversation, and extensive presentation of the syntax and vocabulary of modern Hebrew, leading to a firm foundation in the language. P, 103b.


427. Religion and Mythology of Mesopotamia (3) GC II 1986-87 (Identical with Anth. 427)

428. Anthropology of Law (3) GC II 1986-87 (Identical with Anth. 428)

430. Prophecy in Ancient Israel (3) GC II Nature and origins of Biblical prophecy and its ancient Near-Eastern analogues, including intensive study of several major Biblical prophets. (Identical with Reli. 430)


436. Modern Jewish Political Thought (3) GC I 1985-86 Analysis of the various forms of modern Jewish nationalism (e.g., Zionism, Bundism, Diaspora nationalism), their intellectual roots and socioeconomic settings. Writing-Emphasis Course for Judaic studies specialization.*

453. Advanced Hebrew (3) GC [Rpt.] Advanced topics in Biblical, Rabbinic, and/or modern Hebrew language and literature. P, 403b or 409b.

455. Introduction to Rabbinic Literature (3) GC II Reading in translation and interpretation of Hellenistic, Jewish, Rabbinic, and related literatures including legal, ethical, moral, and social interpretation of Scripture and oral traditions (Identical with Reli. 455)

495. Colloquium
g. Judaic Studies (3) [Rpt./4] GC Consult department before enrolling.
595. Colloquium
  g. Judaic Studies (3) [Rpt./4] Consult department before enrolling.

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing Emphasis Courses" in the Academic Guidelines section of this catalog.

### Middle East

104a-104b. Elementary Arabic (5-5) CDT Conversation and readings in modern standard Arabic.

105a-105b. Elementary Persian (5-5) CDT Conversation, reading, and composition in modern Persian.

171. Ancient Civilizations of the Near East (3) I Survey of pre-Islamic cultures of Persia, Mesopotamia, Syria-Palestine, Anatolia and Egypt, with emphasis on unifying themes and institutions. (Identical with Anth. 171 and Hist. 171)

172. Islamic Civilization: Traditional and Modern Middle East (3) II Survey of the traditional and contemporary social, political, and economic institutions of Islamic civilizations in the Middle East. (Identical with Anth. 172 and Hist. 172)


405a-405b. Intermediate Persian (4-4) GC CDT Conversation in the dialect of contemporary Iran; extensive readings in classical and modern literature. P, 105b.

414a-414b. Advanced Arabic (3-3) GC Continuation of 404b, with emphasis on oral and written comprehension and expression. P, 404b. 414a is not prerequisite to 414b.

415a-415b. Advanced Persian (4-4) GC CDT Readings in Persian, with the objective of preparing the student for independent research. 415a: Contemporary prose. 415b: Poetry and prose. P, two yrs. of Persian. 415a is not prerequisite to 415b.

424a-424b. Conversational Levantine Arabic (3-3) GC 1985-86 Extensive oral drill, with emphasis on the acquisition of facility in normal conversation and comprehension. P, 104a.

425a-425b. Conversational Gulf Arabic (3-3) GC 1986-87 Extensive oral drill, with emphasis on the acquisition of facility in normal conversation and comprehension. P, 104a.

426. Introduction to Arabic Linguistics (3) GC II History and structure of the Arabic language in its various forms. P, 104b, Ling. 101. (identical with Ling. 426)

434. Islamic Thought (3) GC II Traditional ideological systems of Islamic countries and their evolutionary transformations. (Identical with Reli. 434)

442. Transformation of Agrarian Societies in the Middle East (3) GC II Dynamics, processes, and implications of rural change in the Middle East; focus on changes in peasant communities, nomadic pastoralists, rural-urban relations, and planned change. (Identical with A.Ec. 442, Pol. 442, Soc. 442)

448. Arabic Literature in English Historical survey of Arabic literature of the Middle East and Mediterranean world, with readings in English translations.

449. Persian Literature in English (3) GC II 1986-87 Historical survey of Persian literary traditions, with readings in English translations.

457. Prehistoric Mesopotamia (3) GC I 1985-86 (Identical with Anth. 457)

458. Government and Politics of the Middle East (3) GC II Government and politics of the Middle East, combining study of Islamic institutions with a view to their applicability in the contemporary Middle East. (Identical with Pol. 458)

459. Topics in Economic Geography of the Middle East (3) GC II (Identical with Geog. 459)

469. Geography of the Middle East (3) GC I Physical environments and cultural areas of Southwest Asia, with emphasis on man-environment interrelationships, settlement systems and impact of Islam. (Identical with Geog. 469)

477a-477b. History of the Middle East (3-3) GC History of civilization in the Middle East from the rise of Islam to the 18th century. 477a: Period of Arab dominance. 477b: Period of Turkish dominance. 477a is not prerequisite to 477b. (Identical with Hist. 477a-477b) 477a is Writing-Emphasis Course for Middle East specialization.*

478. Modern History of the Middle East (3) GC I Near and Middle Eastern history since the late 18th century, with special emphasis on Egypt and areas to the east. (Identical with Hist. 478) Writing-Emphasis Course for Middle East specialization.*
479. **The Ottoman Empire to 1800** (3) GC II 1986-87 Great age of the Ottoman state, its origins and decline. (Identical with Hist. 479)

480a-480b. **History of Iran and Central Asia** (3-3) GC 480a: History of Iran from 226 A.D. to 1722. 480b: 18th, 19th and 20th century Iran. (Identical with Hist. 480a-480b)

481a-481b. **Archaeology of Syria-Palestine in the Bronze and Iron Ages** (3-3) GC Survey of the Bronze and Iron Age cultures of Syria-Palestine, ca. 3500-500 B.C., with emphasis on the use of archaeological materials in historical reconstruction. (Identical with Anth. 481a-481b)

484a-484b. **Akkadian Linguistics** (3-3) GC 1985-86 (Identical with Anth. 484a-484b)

495. **Colloquium**
   - h. Middle East (3) [Rpt.] GC Consult department before enrolling.
   - n. Modern Arabic Prose (3) [Rpt.] GC P; Two years of Arabic.
   - c. Classical Arabic Prose (3) [Rpt.] GC P; Two years of Arabic.

584a-584b. **Readings In Akkadian** (3-3) 1985-86 (Identical with Anth. 584a-584b)

595. **Colloquium**
   - d. Middle East (3) [Rpt.] I II
   - f. Ancient Near East (3) [Rpt.] GC Consult department before enrolling.

596. **Seminar**
   - m. Middle East: Topics in History and Civilization (3) [Rpt.] I II
   - p. Middle Eastern Urbanism (3) [Rpt.] I II
   - q. Near Eastern Archaeology (3) [Rpt.] I II (Identical with Anth. 596q)

* Writing-Emphasis Course. P. Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

**PERSIAN**
(See Oriental Studies)

**PERSONNEL MANAGEMENT**
(See Management and Policy)

**PHARMACEUTICAL SCIENCES**

Professors Arnold R. Martin, Acting Head, Willis R. Brewer (Emeritus), Jack R. Cole, Michael B. Mayersohn, William A. Remers, Samuel H. Yalkowsky, Joseph A. Zapotocky (Emeritus)

Associate Professors James Blanchard, Joseph J. Hoffman (Arid Lands Resource Sciences), Karl H. Schram

Assistant Professor Michael D. Karol

The Department of Pharmaceutical Sciences includes the academic disciplines of pharmaceutical chemistry, pharmaceutics, and pharmacognosy. Courses pertinent to the Bachelor of Science in Pharmacy are offered. Please consult the College of Pharmacy section of this catalog for undergraduate admission and degree requirements.

The Master of Science and Doctor of Philosophy degrees with a major in pharmacy, and the Doctor of Philosophy degree with a major in pharmaceutical chemistry, are available. For admission and degree requirements, please see the Graduate Catalog.

A student must be enrolled in the College of Pharmacy before taking any pharmaceutical science course required in the professional curriculum, except as approved by the department. A breakage deposit of $10 is required for each lab. course.

**Honors:** The department participates in the Honors Program.

302a-302b. **Pharmaceutics** (4-4) Application of physical-chemical principles to pharmaceutical dosage forms, including a discussion of the biopharmaceutical considerations which influence the efficacy of pharmaceutical formulations. 3R, 3L. 302a: P, Phys. 102b, 180b, Chem. 103b, 104b. 302b: P, Ph.Pr. 300.

DEPARTMENTS AND COURSES OF INSTRUCTION


424. Antibiotics (2) GC I Principles of antibiotic chemotherapy and the properties of the antibiotics employed in therapeutics. P, 437b, Micr. 110, Pcol. 471b (Identical with Ph.Pr. 424)

427. Antineoplastic Drugs (2) GC II Discovery and development of natural and synthetic anti-neoplastic drugs; preclinical screening and toxicity evaluation; phase I, II, and III clinical studies in humans. P, 437b or CR.

430a-430b. Medical Radiopharmaceuticals (3-3) GC Medical applications, safe handling, measurement and preparation of radiopharmaceuticals. 2R, 3L. P, Math. 123, 263, Phys. 102b, 180b, Chem. 103b, 104b.

437a-437b. Medicinal Chemistry and Pharmacognosy (4-4) GC Relationships between the chemical structure and physiological activity, incompatibilities and stability of the organic and inorganic compounds obtained from natural and synthetic sources; essentials of pharmacognosy, including biologicals. P, 302b, Chem. 241b, 243b.

438. Pharmaceutical Analysis (2) GC II Modern methods and instrumentation used for qualitative and quantitative determination of drugs and metabolites. P, Chem. 323.

439. Pharmaceutical Analysis Laboratory (1) GC I Instrumental methods for identification and quantitation of drugs and their metabolites from biological samples using GC, HPLC and other modern instruments. 3L. P, 438 or CR.

475a-475b-475c. Pharmacotherapeutics (2-3-6) GC (Identical with Ph.Pr. 475a-475b-475c)

575. Advanced Pharmacotherapeutics (6) II (Identical with Ph.Pr. 575)

596. Seminar
   a. Pharmaceutical Sciences (1) [Rpt./5] I II
   b. Pharmaceutical Chemistry Research (1) [Rpt./5] I II
   c. Pharmaceutics Research (1 to 2) [Rpt./5] I II Open to majors only.

601. Advanced Physical Pharmacy (3) II 1986-87 Applications of physical chemistry to pharmacy. P, physical pharmacy or physical chemistry course.

602. Physical-Chemical Properties Influencing Drug Action (4) II 1986-87 Study of physical-chemical properties that influence the design of drug molecules, the formulation of these molecules into suitable delivery systems, and their release into the biological system. P, 302b.


630a-630b. Advanced Organic Medicinals (3-3) 1985-86 Rational drug design, receptor site theories, mechanism of drug action, and metabolic pathways of medicinal agents; chemical and enzymatic synthesis of important pharmaceuticals. P, 437b, Pcol. 471b.


634. Biomedical Applications of Mass Spectrometry (3) I 1986-87 Principles of mass spectrometry including instrumental design, interpretation of spectra, and applications to biomedical and related problems. P, Chem. 241b

875. Advanced Pharmacotherapeutics (Pharmacy) (6) (Identical with Ph.Pr. 875)

PHARMACOLOGY

(Department, College of Medicine)

Professors Thomas F. Burks, Head, David S. Alberts (Internal Medicine), H. Vasken Aposhian (Molecular and Cellular Biology), Klaus Brendel, Rubin Bressler (Internal Medicine), Burnell R. Brown (Anesthesiology), Ryan J. Huxtable, David G. Johnson (Internal Medicine), Eugene Morkin (Internal Medicine), Diane H. Russell, I. Glenn Sipes (Pharmacology and Toxicology), Henry I. Yamamura
Pharmacology is a broad discipline involving the investigation of the actions of chemicals upon living material at all levels of organization. The discipline occupies an important interface between the basic medical sciences and the clinical sciences, drawing strongly upon the former for its contribution to the latter. In the health professions, pharmacologic knowledge is applied to the diagnosis, prevention, cure or relief of symptoms of disease, and to the promotion of optimal health.

In conjunction with the Department of Pharmacology and Toxicology in the College of Pharmacy, the department offers a joint program of instruction leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology. Students work under the administration of the Committee on Pharmacology and Toxicology (Graduate).

501. The Pharmacological Basis of Therapeutics (6) II Actions of chemical agents upon living material at all levels of organization, with emphasis on mechanisms of action of prototype drugs; foundation for a rational approach to human therapeutics and toxicology. P, Psio. 601, Bioc. 501. (Identical with Tox. 501)

520. Clinical Pharmacology (2) I Effects of drugs on natural history of disease; drug-drug interactions; drug testing designs; drug abuse; drug literature evaluation; aspects of clinical toxicology. P, 501.

550. Drug Disposition and Metabolism (2) II Principles of absorption, distribution and excretion of drugs, with emphasis on mechanisms of drug metabolism and pharmacokinetics. P, 462a-462b or 501; Bioc. 501, Tox. 602a. (Identical with Tox. 550)


561a-561b. Introduction to Pharmacological and Toxicological Literature (1-1) Designed to broaden the background of students in pharmacology and toxicology, and to improve scientific communication skills. P, 501. (Identical with Pcol. 561a-561b)

576. Environmental Toxicology (3) I (Identical with Tox. 576)

586a-586b. Introduction to Pharmacology and Toxicology Research (1-1) Introduction to basic research techniques in pharmacology and toxicology through supervised laboratory rotations; student-initiated and faculty-structured lab. exercises in modern pharmacological and toxicological techniques. P, CR 501, Bioc. 565, Psio. 601.

596. Seminar
   a. Advanced Graduate Research (1 to 3) [Rpt./3] I II P, 561b. (Identical with Pcol. 596a)

601. Analytical Instrumentation and Techniques (4) I (Identical with Tox. 601)

602a-602b. Biotoxicology (3-1) (Identical with Tox. 602a-602b)

653. Neuropharmacology (2) II 1986-87 (Identical with Pcol. 653)

654. Psychopharmacology (3) 1985-86 (Identical with Pcol. 654)

695. Colloquium
   a. Cellular/Molecular Pharmacology (1 to 3) [Rpt./4 units] I II P, Bioc. 462a-462b; Bioc. 568a-568b and/or Phcl. 551.

800. Research (1 to 6) Yr.

801. The Pharmacological Basis of Therapeutics (6) II

815. Subspecialty
DEPARTMENTS AND COURSES OF INSTRUCTION

PHARMACOLOGY AND TOXICOLOGY

(Department, College of Pharmacy)

Professors I. Glenn Sipes, Head, Lincoln Chin, J. Wesley Clayton, Paul F. Consroe, Albert L. Picchioni, Findlay E. Russell
Associate Professors G. Timothy Bowden, Dean E. Carter, A. Jay Gandolfi, Hugh E. Laird, II, David L. Nelson
Assistant Professor James R. Halpert

Pharmacology is the science concerned with all aspects of the action of drugs on living systems. Its primary aim is the development and evaluation of drugs for the treatment of human disease. The broad scope of interests of pharmacology ranges from the study of intermolecular reactions of chemical constituents of cells with drugs to the effects of chemicals in our environment on entire populations. In conjunction with the Department of Pharmacology in the College of Medicine, the department offers a joint program of instruction leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology. For admission and degree requirements, please see the Graduate Catalog.

Toxicology is the science concerned with the harmful effects of chemicals (including drugs) on living systems. The toxicology program offers a curriculum leading to the Master of Science degree with a major in toxicology. The program prepares students for careers in hospital laboratories, police crime laboratories, medical examiners' offices, industrial hygiene laboratories, and toxicology laboratories in industry, government, and universities. For admission and degree requirements, please see the Graduate Catalog.

Honors: The department participates in the Honors Program.

Pharmacology

401. Human Gross Anatomy (3) II (Identical with Anat. 401)

471a-471b. Fundamentals of Pharmacology (4-4) GC Comprehensive study of the biochemical, physiological, and therapeutic effects of drugs, including mechanisms of drug action and drug toxicity, and drug literature evaluation. 4R, 3L, P, Anat. 401, Bioc. 460 Psio. 480, 481; CR Ph.Pr. 475a-475b and Ph.Sc. 437a-437b (Identical with Tox. 471a-471b)

472. Applied Pharmacology (3) GC I II Pharmacodynamics, pharmacology, and adverse effects of commonly used drugs, with emphasis on clinical applications. Not available for elective credit in the College of Pharmacy or graduate credit in pharmacology-toxicology doctoral programs. P, Ecol. 159b.

474. Clinical Toxicology (2) GC II Prevention, characteristics, diagnosis and rational management of diseases caused by drug overdose, toxic household products, poisonous plants, venomous animals, environmental and industrial toxins. P, 472 or 471b, Ph.Pr. 475, Ph.Sc. 407. (Identical with Tox. 474)

475a-475b-475c. Pharmacotherapeutics (2-3-6) GC (Identical with Ph.Pr. 475a-475b-475c)

561a-561b. Introduction to Pharmacological and Toxicological Literature (1-1) (Identical with Phcl. 561a-561b)

575. Advanced Pharmacotherapeutics (6) II (Identical with Ph.Pr. 575)

596. Seminar
   a. Advanced Graduate Research (1 to 3) [Rpt./3] I II (Identical with Phcl. 596a, which is home)

653. Neuropharmacology (2) II Role of various neurochemicals in the autonomic and central nervous systems and the effect of drugs on the nervous system, including their influence on synthesis, storage, and release of neurochemicals. P, Phcl. 501 or Pcol. 471b, 561a, 596. (Identical with Phcl. 653 and Tox. 653)


695. Colloquium
   a. Research Conference (1 to 4) [Rpt.] I II

875. Advanced Pharmacotherapeutics (Pharmacy) (6) (Identical with Ph.Pr. 875)
Toxicology

423R. General Pathology (3) GC II (Identical with V.Sc. 423R)

423L. General Pathology Laboratory (1) GC II (Identical with V.Sc. 423L)


462a-462b. Biochemistry (4-3) GC (Identical with Bioc. 462a-462b)

464a-R-464bR. Human Physiology (3-3) GC (Identical with Ecol. 464aR-464bR)

464aL-464bL. Human Physiology Laboratory (1-1) GC (Identical with Ecol. 464aL-464bL)

465. Statistics for the Medical Sciences (4) GC I (Identical with Stat. 465)

471a-471b. Fundamentals of Pharmacology (4-4) GC (Identical with Pcol. 471a-471b)

474. Clinical Toxicology (2) GC II (Identical with Pcol. 474)

480. Human Physiology (4) GC I (Identical with Psio. 480)

481. Physiology Laboratory (1) GC I (Identical with Psio. 481)

486. Fundamentals of Industrial Hygiene (3) GC I (Identical with O.S.H. 486)

487. Advanced Industrial Hygiene and Safety (3) GC II (Identical with O.S.H. 487)

501. The Pharmacological Basis of Therapeutics (6) II (Identical with Phcl. 501)

508. Insect Toxicology (3) II 1985-86 (Identical with Ento. 508)

550. Drug Disposition and Metabolism (2) II (Identical with Phcl. 550)

551. Molecular Biology of Pharmacological Agents (3) I 1985-86 (Identical with Phcl. 551)

554. Industrial Toxicology and Chemical Exposures (4) I Principles of toxicology related to industry, dose response; mechanisms of toxicity; hazard evaluation principles; toxicology of major classes of industrial compounds. P, six units each of bio. sci. and organic chem.

576. Environmental Toxicology (3) I Toxicity of natural toxins and of agricultural and industrial chemicals, with emphasis on air and water pollutants; decision-making in environmental issues. P, 6 units of bio and of organic chem.; Chem. 325, 326. (Identical with Ento. 576 and Phcl. 576)

601. Seminar
   a. Advanced Toxicology (1 to 2) [Rpt./3] I
   b. Current Concepts in Toxicology (1 to 2) [Rpt./3] II

601. Analytical Instrumentation and Techniques (4) I Lecture and lab. in the qualitative and quantitative determination of toxic substances in the environment and body fluids. Modern instrumental techniques will be employed whenever appropriate. Lecture may be taken separately by non-majors. 2R, 6L. P. Chem. 400a. (Identical with Phcl. 601)

602a-602b. Biotoxicology (3-1) 602a: Lecture. Mechanisms of organ directed toxicities in animals. Chemical carcinogenesis, teratogenesis and mutagenesis. Open to non-majors. P, two semesters of ecol. 602b: Laboratory. Proper use of animals in toxicology and pharmacology research and focuses on organ specific toxicities. (Identical with Phcl. 602)

610. Topics in Advanced Toxicology (1 to 3) I II Current developments in toxicology including: chemical carcinogenesis, mutagenesis and teratogenesis; behavioral toxicology; inhalation toxicology; toxicokinetics; metabolism and environmental toxicology. P, 471b, 474.

653. Neuropharmacology (2) II (Identical with Pcol. 653)

PHARMACOLOGY AND TOXICOLOGY

Committee on Pharmacology and Toxicology (Graduate)

Professors I. Glenn Sipes, Chairperson, Klaus Brendel, Thomas F. Burks, Diane H. Russell
Associate Professors Dean E. Carter, David L. Kreulen, Hugh E. Laird, II, David L. Nelson

The Department of Pharmacology in the College of Medicine and the Department of Pharmacology and Toxicology in the College of Pharmacy cooperate, through the Committee
on Pharmacology and Toxicology, in offering programs leading to the Master of Science degree with a major in pharmacology and the Doctor of Philosophy degree with a major in pharmacology and toxicology.

For course descriptions, please see entries in this catalog for Pharmacology (Department, College of Medicine) and Pharmacology and Toxicology (College of Pharmacy). For information on graduate programs and admission requirements, please see the Graduate Catalog.

PHARMACY PRACTICE

Professor Theodore G. Tong
Associate Professors J. Lyle Bootman, Head, Alan D. Barreuther, William F. Fritz (Adjunct), James R. Guidry (Adjunct), William F. McGhan, Gary H. Smith
Instructors Victor A. Elsberry, J. C. Poe (Adjunct), Richard P. Stitt (Adjunct)
Lecturers Jack A. Arndt, James R. Morse

The Department of Pharmacy Practice offers courses leading to the degrees of Bachelor of Science in Pharmacy, Doctor of Pharmacy, and Master of Science with a major in pharmacy with concentrations available in the areas of hospital pharmacy and pharmacy administration. Graduate study in pharmacy administration leading to a Doctor of Philosophy degree with a major in pharmacy is also available. For information regarding undergraduate admission and degree requirements, please consult the College of Pharmacy section of this catalog; for graduate admission and degree requirements, please see the Graduate Catalog.

A student must be enrolled in the College of Pharmacy before taking any pharmacy practice course at the 300 level or above, except as approved by the department. A breakage deposit of $10 is required for Ph.Pr. 410.

Honors: The department participates in the Honors Program.

201. Introduction to Medications and Their Use for the Consumer (3) II Therapeutic uses of medications, emphasizing non-prescription products and common prescription drugs. For non-pharmacy majors only.

300. Pharmaceutical Calculations (2) I Pharmaceutical calculations pertinent to the selection, formulation, preparation, dosage and administration of drugs and their dosage forms.

303. Clinical Clerkship Pharmacy Practice and Communications Skills. Must be completed in sequence.
   a. Introductory Practice (1) I Field trips.
   b. Long-Term Care (1) II Field trips.
   c. Patient Counseling and Medical Devices (1) I Field trips.
   d. Interviewing and Counseling Skills (1) II Field trips.
   e. Dispensing Practice (1) I Field trips.

343. Pharmacy Laws (2) I Legal concepts covering professionalism, negligence, liability, legal processes and semantics; pertinent federal, state and local statutes and regulations.


403. Clinical Clerkship
   a. Institutional Clerkship (4 to 10) II S P, 475.
   b. Ambulatory Clerkship (4 to 10) II S P, 475.
   c. Externship (4 to 10) II S P, 410, 475.

Note: 403a-c are six-week courses.

412. **Nonprescription Drugs (2)** GC Presentation on nonprescription drugs, remedies sold over-the-counter (O.T.C.), designed to guide the pharmacist in providing better professional advice to the self-medicating public. P, 303c, Ph.Sc. 302b.

419. **Parenteral Preparations** (2) GC Principles and procedures in the preparation, stability, and administration of parenteral products. 1R, 3L. P, Ph.Sc. 302b or CR.

424. **Antibiotics (2)** GC I (Identical with Ph.Sc. 424)

440. **Perspectives in Health Care Services (3)** GC I Consumers, providers, financers, and regulators of health care in the U.S. and exploration of medication usage in relation to these components. (Identical with Rhab. 440)

442. **Professional Practice Management (3)** I Management of professional situations and the interaction among patients, colleagues, and other health-care providers, with application to institutional, community, and clinical pharmacy practice. P, 445.

445. **Nonpharmacological Issues of Medicines (3)** GC I An overview of the drug-use process, including an examination of social, behavioral, and economic factors associated with the prescribing, dispensing, and use of drugs. (Identical with Coun. 445)

447. **Perspectives in Geriatrics Laboratory (1)** GC II Open to nonmajors. P, CR 448. (Identical with Gero. 447 and N.F.S. 447)

448. **Perspectives in Geriatrics (2)** GC II Multidisciplinary approach to the health-care needs of the elderly, including medication use and nutrition, through didactic training, a team project, and clerkship experiences. Open to nonmajors. P, CR 447 for nonmajors. (Identical with Gero. 448 and N.F.S. 448)

475a-475b-475c. **Pharmacotherapeutics (2-3-6)** GC Common diseases that afflict humans. Their management based on pharmacotherapeutic considerations of epidemiology, etiology, diagnosis, pathophysiology, and prognosis. P, Bioc. 460, Psio. 480 (Identical with Pcol. 475a-475b-475c and Ph.Sc. 475a-475b-475c)

489. **Clinical Pharmacotherapy of Mental Disorders (3)** GC I For description, see 889. (Identical with Coun. 489)

496. **Proseminar**

a. Clinical (1) II For pharmacy majors only. P, 403a or 403b, and 403c.

503. **Clinical Clerkship**

a. Externship (4) II S P, grad. students consult dept. before enrolling.

b. Adult Pharmacy Practice (4) II S P, grad. students consult dept. before enrolling.

c. Ambulatory Pharmacy Practice (4) II S P, grad. students consult dept. before enrolling.

d. Drug/Poison Information (4) II S P, grad. students consult dept. before enrolling.

Note: 503a-d are six-week courses.

511. **Hospital Pharmacy Administration (3)** I History, organization and administration of pharmaceutical services within the institutional environment.

512. **Applied Hospital Pharmacy Management (3)** II Application of management principles to problem-solving and decision-making techniques in the provision of pharmaceutical services within the institutional environment. Field trips. Open to majors only. P, 511.

549. **Interdisciplinary Approaches to Health Care of the Aged (2)** S A team approach to problems faced by the chronically ill elderly 3R 4.5L P, consult department before enrolling (Identical with F.C.M. 549, H.R.P. 549, N.F.S. 549)

557. **Physical Parameters for Monitoring Drug Therapy (1)** I For description, see 885. (Identical with Coun. 557)

561. **Research Methodology and Drug Literature Evaluation (3)** II Skills and principles of clinical research design and biostatistics needed for evaluation of the medical literature and writing of research proposals. P, CR 575.

575. **Advanced Pharmacotherapeutics (6)** II Advanced concepts for the rational use of drugs in the management of diseases based on pathophysiological, pharmacokinetic, or pharmacologic and toxicologic considerations. 4R, 6L. P, 303e, 410, 475, CR 557. (Identical with Ph.Sc. 575 and Pcol. 575)

585. **Advanced Clinical Pharmacokinetics (3)** II For description, see 885.

596. **Seminar**

a. Pharmacy Practice (1) [Rpt./5] II

b. Pharmacy Practice (Hospital) (1) [Rpt./5] II
611a-611b. Pharmacy and Its Environment (3-3) 1985-86 Cultural, social, behavioral, and organizational foundations of pharmacy, including the development of the present state of practice.

612a-612b. Issues in Pharmacy Practice Research (3-3) 1986-87 Survey of research methodology for studying social and behavioral aspects of health care and pharmacy practice; strategy for selecting and modifying existing research tools for particular purposes.

621. Pharmaceutical Marketing (3) I II Socioeconomic factors in the development, production, and distribution of drugs.

694. Practicum
   a. Clinical Clerkship (1 to 15) [Rpt.] I II
   b. Administrative Clerkship (1 to 15) [Rpt.] I II

800. Pharmacy Practice Research (2) II Individual pharmacy practice research not related to a thesis or dissertation. Open only to students enrolled in Doctor of Pharmacy program.

803. Pharmacy Clinical Clerkship

Note: 803a-d are six-week courses.

810. Pharmacy Clerkship
   a. Internal Medicine (2 to 4) I II S P, 803a, 803b.
   b. Surgery (2 to 4) I II S P, 803a, 803b.
   c. Pediatrics (2 to 4) I II S P, 803a, 803b.
   d. Geriatrics/Gerontology (2 to 4) I II S P, 803a, 803b.
   e. Outpatient Practice (2 to 4) I II S P, 803a, 803b.
   f. Emergency Services (2 to 4) I II S P, 803a, 803b.
   g. Acute Care (2 to 4) I II S P, 803a, 803b.
   h. Clinical Pharmacokinetics (2 to 4) I II P, 803a, 803b.
   i. Psychopharmacy/Neurology (2 to 4) I II S P, 803a, 803b.

Note: 810a-i are three to six week courses.

815. Pharmacy Subspecialty
   a. Hematology/Oncology (2 to 4) I II S P, eight units of 810 or CR.
   b. Cardiology (2 to 4) I II S P, eight units of 810 or CR.
   c. Pulmonary (2 to 4) I II S P, eight units of 810 or CR.
   d. Endocrine (2 to 4) I II S P, eight units of 810 or CR.
   e. GI/Renal (2 to 4) I II S P, eight units of 810 or CR.
   f. OB/GYN/Neonatal (2 to 4) I II S P, eight units of 810 or CR.
   g. Infectious Disease (2 to 4) I II S P, eight units of 810 or CR.
   h. Rheumatology/Immunology (2 to 4) I II S P, eight units of 810 or CR.
   i. Dermatology (2 to 4) I II S P, eight units of 810 or CR.
   j. Poison Information/Toxicology (2 to 4) I II S P, eight units of 810 or CR.

Note: 815a-j are three to six week courses.


875. Advanced Pharmacotherapeutics (Pharmacy) (8) P, 303e, 410, 475, CR 857. (Identical with Ph.Sc. 875 and Pcol. 875)

885. Advanced Clinical Pharmacokinetics (3) II Advanced pharmacokinetic principles emphasizing the application of mathematical relationships to patient care situations. P, Ph.Sc. 407, Ph.Sc. 409, or consult department before enrolling.

889. Clinical Pharmacotherapy of Mental Disorders (3) GC I A multidisciplinary approach to clinical psychopharmacology, therapeutics, and diagnosis of mental disorders for health professionals.

896. Seminar
   a. Pharmacy Practice (1) I
   b. Pharmacy Practice Research (1) II
PHILOSOPHY


Associate Professors Henry C. Byerly, Holly M. Smith

Philosophy attempts to answer analytic and speculative questions that perplex reflective people when they examine their basic concepts, goals, and ideals. Some of these questions arise naturally in the course of work in the various sciences and humanities. Hence philosophy has a natural border with all other academic disciplines, and lends itself to joint studies and collaborations.

The Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees are available with a major in philosophy. The department also encourages joint majors in such related fields as psychology, political science, and linguistics, among others. In addition, the department is currently developing undergraduate majors with a specialization in the philosophy of law and in philosophy and medicine; for details, the student should enquire at the departmental office.

The major: thirty units, including 111, 112, 260 or 470, 344 and 262 or 471 or 479. At least fifteen units must be in upper-division work. Students who contemplate using an undergraduate major in philosophy as a background for graduate or professional work may want to plan a more specialized program in consultation with the department's undergraduate adviser.

The supporting minor should be chosen after consultation with the undergraduate adviser.

Honors: The department participates in the Honors Program.

110. Critical Thinking (3) I II Designed to improve ability to reason and think critically; emphasis on evaluating and presenting arguments.

111. Introduction to Philosophy (3) I II Selected basic philosophical areas and problems: knowledge, belief and truth; the world and God; nature of persons; action and free will; the good life; the ideal community.

112. Introduction to Logic (3) I II Basic introduction to symbolic logic; construction and critical analysis of arguments.

113. Introduction to Moral and Social Philosophy (3) I II Practical and frequently encountered moral problems; readings from representative moral and social philosophers.

145. Science, Technology and Human Values (3) I Nature of science, technology, pseudo-science, and their relation to philosophy and culture; impact of science and technology on society and its values and religion.

202. Symbolic Logic (3) Truth-functional logic and quantification theory; semantic concepts; deductive techniques and translation into symbolic notation. (Identical with Math. 202)

233. Philosophy of Religion (3) I Nature of religion; existence and nature of God; religion and meaning, values and knowledge. (Identical with Reli. 233)

238. Philosophy in Literature (3) I Philosophical analysis of selected literary works.

245. Existential Problems (3) II 1985-86 Exploration of central problems of the human condition, such as meaning of life; death; self-deception; authenticity, integrity and responsibility; guilt and shame; love and sexuality.

260. Ancient Philosophy (3) I Survey of Greek philosophy, with emphasis on the pre-Socratic philosophers, Plato, and Aristotle. (Identical with Clas. 260)

262. Modern Philosophy (3) II Principal European systems of thought from Descartes to Kant.

263. From Hegel to Nietzsche: Man and Society in 19th Century Philosophy (3) Survey of influential 19th century philosophers, including Hegel, Marx, J.S. Mill, Kierkegaard, and Nietzsche. Their views on the individual and society, and human nature.

305. Introduction to the Philosophy of Science (3) Basic issues in the logic of science: scientific concepts and their meaning, testing of hypotheses, explanation, measurement, role of mathematics, truth versus convention, limits of science.
310. History of Ethics (3) I 1985-86 Reading and critical analysis of main ethical theories from the Greeks to the present.

321. Medical Ethics (3) GC Ethical issues that arise in relation to medicine and health care: abortion, euthanasia, the allocation of scarce medical resources, socialized medicine, doctor-patient confidentiality, paternalism, etc.

344. Issues and Methods in Analytic Philosophy (3) Designed to improve ability to think analytically, with emphasis on analytic methodology. Selected readings on the nature of mental states, the analytic/synthetic distinction, personal identity, the concept of knowledge and justified belief, the theory of reference, and the distinction between science and pseudo-science. Writing-Emphasis Course. P: Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

376. Introduction to the Philosophy of Language (3) I 1986-87 A survey of basic issues in the philosophy of language. (Identical with Ling. 376)

403. Foundations of Mathematics (3) GC II 1986-87 (Identical with Math. 403)


414. Philosophical Logic (3) GC 1985-86 Introduction to modal logic; problems of interpretation and application; extensions to such areas as tense logic, epistemic logic, deontic logic.

419. Induction and Probability (3) GC 1986-87 Basic philosophical problems concerning justification of induction, confirmation of scientific hypotheses, and meaning of probability concepts.

421. Philosophy of the Biological Sciences (3) GC 1985-86 Laws and models in biology, structure of evolutionary theory, teleological explanations, reductionism, sociobiology. (Identical with Ecol. 421)

422. Linguistic Semantics and Lexicology (3) GC II 1986-87 (Identical with Ling. 422)

423. Philosophy of the Physical Sciences (3) GC Philosophical problems regarding space, time, motion, relativity, causality, measurement, theoretical entities.

430a-430b. Ethical Theory (3-3) GC 1985-86 430a: Meta-ethics—meaning of moral terms, relativism, subjectivism, ethics and science, social contract theory; 430b: Normative ethics—Utilitarianism, egoism, rights, natural law, justice, deontological duties, blameworthiness and excuses.

433. Aesthetics (3) Classical and contemporary theories of art; the esthetic experience, form and content, meaning, problems in interpretation and criticism of works of art.

434. Social and Political Philosophy (3) GC Fundamental concepts of politics; leading social and political theories, such as anarchism, social contract, Marxism.

438a-438b. Philosophy of Law (3-3) GC 438a Nature and limits of law; law and morality; compensation, contracts, and property; 438b problems about liberty, justice, responsibility, and criminal punishment. (Identical with Pol. 438a-438b)

440. Metaphysics (3) GC Topics include free will and determinism; causation; personal identity; necessity and essence; truth, realism and ontology.

441. Theory of Knowledge (3) GC Critical examination of some of the major problems concerning evidence, justification, knowledge, memory, perception and Induction.

450. Philosophy of Mind (3) GC Topics include the nature of mental states; the relation between mind and brain; and analysis of perception, emotion, memory and action.

451. Philosophy of Psychology (3) GC 1985-86 Investigation of philosophical issues arising from current work in psychology including perception, reasoning, memory, motivation and action.

452. Philosophy of Action (3) GC Topics include the explanation of human action; the nature of intentional action; practical reason and deliberation; and the mental antecedents to action, especially desire and belief.

453. Minds and Machines (3) GC 1985-86 Philosophical problems arising from current work in artificial intelligence and cognitive psychology.

463. Philosophy of Language (3) GC Survey of basic issues in the philosophy of language such as: speech acts, reference, meaning, logical form.

464. Semantics (3) GC 1985-86 An investigation of the formal tradition in semantic analysis from Frege, through Tarski to Davidson, Montague and recent trends. (Identical with Ling. 464)

465. Pragmatics (3) GC 1985-86 (Identical with Ling. 465)
470. **Greek Philosophy** (3) GC [Rpt.] Topics in Greek philosophy, to be selected from the pre-Socratics, Plato (Earlier or Later Dialogues) and Aristotle. (Identical with Clas. 470).


473. **Natural Language Processing** (3) GC II 1986-87 (Identical with Ling. 473)

596. **Seminar**
   a. Ethics (3)
   b. Metaphysics (3)
   c. Epistemology (3)
   d. Logical Theory (3)
   e. Esthetics (3)
   f. Social and Political Philosophy (3)
   g. Philosophy of Law (3)
   h. Philosophy of the Physical Sciences (3)
   i. Philosophy of the Behavioral Sciences (3)
   j. Philosophy of the Biological Sciences (3)
   k. Philosophy of Mind (3)
   I. Philosophy of Language (3)
   m. Theory of Value (3)
   n. Philosophy of Religion (3)
   o. Philosophy of History (3)
   p. History of Philosophy: Classical (3)
   q. History of Philosophy: Recent (3)
   r. Philosophical Psychology (3)
   s. Philosophy of Mathematics (3)
   t. Special Problems (3)
   u. Philosophy and Cognitive Science (3) [Rpt./2]

**PHYSICAL EDUCATION**

(See Exercise and Sport Sciences)

**PHYSICS**


Associate Professors Ke-Chiang Hsieh, Jay E. Treat (Emeritus), Richard A. Young

The department offers the degrees of Bachelor of Science, Master of Science and Doctor of Philosophy with a major in physics. A Bachelor of Science in Education and Master of Education are available with a teaching major in physics. The Bachelor of Science in Engineering Physics is offered through the College of Engineering. Students should consult the department concerning areas in which research is being conducted.

**The major:** Thirty-six units, including 110, 116, 121, 330, 410, 415a, 420, 425, 435, and 480a-480b. Under special circumstances 102a-102b and 180a-180b, or 103a-103b and 180a-180b may be substituted for 110, 116, and 121. The following courses are strongly recommended: 415b, 470a-470b, 481a-481b; Chem. 103a-103b, 104a-104b, or 105aH-105bH. Math. 254 is recommended as a prerequisite for upper-division physics.

For the major in engineering physics, please see the College of Engineering section of this catalog. An engineering physics major who intends to do graduate work in physics should discuss his or her plans with the adviser.

**The teaching major:** 30 units, including 103a-103b and 180a-180b (or 110, 116, and 121), 330, 433, 480a-480b. Courses in related fields, such as astronomy, may be chosen in consultation with the departmental adviser.

**The teaching minor:** Eighteen units, including 102a-102b and 180a-180b (or 103a-103b and 180a-180b, or 110, 116, and 121), 433, 480a, and other courses chosen in consultation with the departmental adviser.

**Honors:** The department participates in the Honors Program.
102a-102b. * Introductory Physics (3-3) CDT Designed for liberal arts and life science majors with no calculus background. Survey of the basic fields of physics, with emphasis on applications to other fields and historical development. P, h.s. algebra, geometry, and trigonometry. Both 102a and 102b are offered each semester. Those wishing to take this course as a lecture-lab. course should register concurrently for 180a or 180b.

103a-103b. * Introductory Physics with Calculus (3-3) CDT Fundamental principles of mechanical, thermal, acoustical, electrical, optical, atomic and nuclear phenomena. P, CR Math. 125b. Both 103a and 103b are offered each semester. Those wishing to take this course as a lecture-lab. course should register concurrently for 180a or 180b.

105. Elements of Physics (3) I II CDT Designed for nurs. majors. Physical measurement, kinematics, laws of motion, gravitation, work and energy, heat and thermometry, electromagnetism, light, sound, molecules, atoms, X-rays and nuclear radiations. 3R, 2L. Not to be used for Group VI requirements in the College of Arts and Sciences. P, Math. 117e.

106. Physics for Architects (3) II CDT Introduction to physics, with special emphasis on topics and concepts of interest to architects.

107. The Physics of Music (4) I CDT Sound production, musical instruments, frequency analysis, physics of hearing, psychological and physiological effects, harmony and scales, hall acoustics, electronic production and recording. 3R, 3L.

108. Physics of Sound (4) II CDT Introduction to physics principles important to acoustics; statics, dynamics, conservation laws, electricity, harmonic motion, waves, complex wave analysis, and sound transmission. 3R, 3L.

110. * Introductory Mechanics (4) I II CDT Vector concepts; kinematics, statics, and dynamics for point masses, particle systems, and rigid bodies; conservation laws of energy, momentum, and angular momentum. 4R, 2L. P, Math. 125a, CR 125b.

112. ** Foundations of Science: Physics (3) I II CDT Basic concepts of physics, with emphasis on modern physics; major topics: mechanics, wave motion, properties of light, nuclear and atomic physics, and astronomy. No previous physics or math. background assumed. 2R, 3L.

*Credit will be allowed for only one of the following sequences of courses: 102a-102b and 180a-180b; 103a-103b and 180a-180b; 110, 116, and 121.


*Credit will be allowed for only one of the following sequences of courses: 102a-102b and 180a-180b; 103a-103b and 180a-180b; 110, 116, and 121.

180a-180b. Introductory Laboratory (1-1) Quantitative experiments in physics, both illustrative and exploratory. Designed to accompany 102a-102b and 103a-103b; sections are established corresponding to each course. 3L. P, CR 102a-102b or 103a-103b. Both 180a and 180b are offered each semester.
425. Thermodynamics (3) GC I II CDT Basic laws of thermal equilibrium; heat engines; ideal and non-ideal gases; phase transitions; introduction to irreversible processes, kinetic theory, and statistical mechanics. P, 110, 121, Math. 223.

430. Introduction to Biophysics (2) GC I CDT Concepts and experimental techniques of molecular biophysics; physical properties of biological macromolecules and cell organelles, optical interactions, macromolecular transitions, molecular mechanism or regulation. P, 102b, Chem. 103a-103b. (Identical with Micr. 430)

433. Physics Demonstrations (1 to 3) GC II Introduction to teaching materials and lab. demonstrations illustrating principles of classical and modern physics, with emphasis on inexpensive techniques and direct experience. Advanced degree credit available for nonmajors only. P, two semesters of phys.

435. Introductory Quantum Theory and Atomic Spectra (3) GC I II CDT Introductory quantum mechanics; solutions of the Schrödinger equation for hydrogen-like atoms; perturbation theory; atomic structure; spectra of one and many electron systems; Zeeman-Paschen-Bach effects; hyperfine structure. P, 330, 410, Math. 254; CR 470a or Math. 413 recommended.

436. Applications of Introductory Quantum Theory (3) GC II CDT Applications of quantum theory to molecules, atomic nuclei, elementary particles and simple solids. P, 435.

440a-440b. Atomic and Molecular Spectroscopy for Experimentalists (3-3) GC CDT Experimental techniques to generate, analyze and detect photons from X-ray to IR; interpretation of spectra from gases, liquids, solids and biological macromolecules; light scattering, polarization. P, 330. (Identical with Opti. 440a-440b)

450. Introductory Nuclear Physics (3) GC II CDT Basic concepts of nuclear physics; structure and stability of the nucleus and its components, nuclear forces, nuclear reactions; energy loss of nuclear radiations. P, 330, Math. 254. (Identical with N.E.E. 450)

460. Introductory Solid-State Physics (3) GC I II CDT Properties of solids from molecular, atomic, and electronic theory; electric, magnetic, and thermal properties of metals, insulators, and semiconductors; free electron and band theories. P, 330.

470a-470b. Methods of Mathematical Physics (3-3) GC CDT Vector and tensor analysis; differential and integral equations; Green's functions; variational techniques; linear operator theory, with emphasis on physical applications. P, 410, Math. 254, CR 415a-415b.

480a-480b. Methods of Experimental Physics I (1 to 3 - 1 to 3) Designed to develop experimental skills and to demonstrate important concepts in classical and modern physics. 3L. P, two upper-division courses in phys. or CR. Both 480a and 480b are offered each semester, but students are encouraged not to enroll simultaneously. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

481a-481b. Methods of Experimental Physics II (1 to 3 - 1 to 3) Continuation of 480a-480b, with emphasis on individual work. 3 or 6L. P, 480b; ten units of upper-division phys. Both 481a and 481b are offered each semester, but students are encouraged not to enroll simultaneously.

504. Introduction to Quantum Optics (3) I (Identical with Opti. 504)

511. Analytical Mechanics (3) I Laws of motion as developed by Newton, d'Alembert, Lagrange and Hamilton; dynamics of particles and rigid bodies. P, 410.


525. Advanced Thermodynamics and Kinetic Theory (3) II 1985-86 First and second laws of thermodynamics and their applications; Boltzmann transport equation; H-theorem; mean free path methods applied to viscosity, thermal conductivity, and diffusion. P, 425.

528. Statistical Mechanics (3) I Physical statistics; the connection between the thermodynamic properties of a macroscopic system and the statistics of the fundamental components; Maxwell-Boltzmann, Fermi-Dirac, Einstein-Bose statistics. P, 470b.

530. Biophysical Theory (2) II Physical concepts and theories describing biomolecular structure and function, molecular evolution, limits to structure, symmetry, oligomer and virus structure, organelle structure and function. (Identical with Micr. 530)

535. Advanced Atomic Physics (3) II 1986-87 Details of atomic structure; interactions of atoms with electromagnetic fields, electrons and ions; techniques for calculating unperturbed and perturbed energy levels, transition probabilities, and atomic interaction cross sections. P, 511, 515b, 570b.
543. Laser Physics (3) I 1986-87 (Identical with Opti. 543)


551. Satellite and Planetary Perturbation Theory (3) II (Identical with Pty.S. 551)


556a-556b. Electrodynamics of Conducting Fluids and Plasmas (3-3) 1986-87 (Identical with Pty.S. 556a-556b)


570a-570b. Quantum Mechanics (3-3) Principles of quantum mechanics; wave mechanics and matrix mechanics; applications to atomic structure and spectroscopy. P, 470a-470b suggested but not required.

575. Advanced Mathematical Methods in Physics (3) I 1986-87 Selections from topics such as functions of complex variables, dispersion relations, group theory, distributions, integral transforms, numerical analysis, approximation theory. P, 470b.

577a-577b. Theory of Relativity (3-3) 1985-86 Special theory of relativity and its application to mechanics and electrodynamics; tensor calculus and general relativity; relativistic astrophysics and cosmology. P, 470b.

579a-579b. Advanced Relativistic Quantum Mechanics (3-3) 1986-87 Continuous groups; scattering theory; relativistic wave equations; quantum electrodynamics, Feynman diagrams, dispersion theory, renormalization; strong and weak interactions. P, 515b, 570b.


581. Elementary Particle Physics (3) II 1985-86 Production, interaction, and decay of mesons, baryons and leptons; high energy scattering of elementary particles; particle classification and symmetries; theoretical interpretation. P, 436.

583a-583b. Thermonuclear Theory (3-3) 583a : II. 583b : I (Identical with N.E.E. 583a-583b)

585. Stellar Pulsation (1 to 3) [Rpt./5] I II Stellar pulsation, the solar atmosphere, solar seismology and long-term solar variability related to climate.

596. Seminar
   a. Current Problems in Molecular Biophysics (1 to 3) I II (1) [Rpt.] (Identical with Micr. 596a)

643. Quantum Optics (3) II 1986-87 (Identical with Opti. 643)

685. Graduate Physics Laboratory (3) [Rpt./2] II Introduction to modern research methods and experiments. Problems in low-temperature physics; solid-state, atomic, and nuclear spectroscopy; computer-based data acquisition and analysis; solar-energy physics; and others.

695. Colloquium
   a. Current Problems in Physics (1) II [Rpt.]

PHYSIOLOGY

(College of Medicine)

Professors Paul C. Johnson, Head, William H. Dantzler, Robert W. Gore, Raphael P. Gruener, Otakar Koldovsky (Pediatrics), Douglas G. Stuart

Associate Professors Eldon J. Braun, Andrew M. Goldner

Assistant Professors Janis M. Burt (Research, Surgery), Ziaul Hasan, Patricia B. Hoyer, Richard J. Lemen (Pediatrics), Timothy W. Secomb (Research, Arizona Research Laboratories), Stephen H. Wright

The Department of Physiology offers a program of instruction leading to the degree of Doctor of Philosophy with a major in physiology. For admission and degree requirements,
please see the Graduate Catalog. A Master of Science degree is offered only in rare instances when individuals qualified to study for the Ph.D. are forced to terminate their graduate education.

In addition to the courses listed below, the Department of Physiology offers temporary courses in the following areas, subject to faculty availability and student interest: neurophysiology, renal physiology, physiology of muscle, endocrinology, peripheral vascular physiology, respiratory physiology, gastrointestinal and developmental physiology, membrane transport processes in physiology, and cardiac physiology.

418. Physiology for Engineers (4) GC I Designed to bring to engineering students an awareness of the structure and function of whole organisms, their component organs, and organ systems. Open to nonmajors only. (Identical with A.M.E. 418, Ch.E. 418 and E.C.E. 418

419. Physiology Laboratory (2) GC I Lab. experiments in physiology intended to provide experience with organ systems and measurement techniques. Designed for engineering students enrolled in the clinical engineering and biomedical engineering options. 6L. Open to nonmajors only. P, 418 or CR. (Identical with A.M.E. 419, Ch.E. 419 and E.C.E. 419

480. Human Physiology (4) GC II Principles of physiology with emphasis on the human; designed primarily for students in pharmacy and health related sciences. Open to pharmacy majors; others consult dept. before enrolling. P, Chem. 243b, Math. 123, Phys. 102b, CR 481. (Identical with Tox. 480

481. Physiology Laboratory (1) GC II Experiments intended to reinforce principles of physiological phenomena; designed primarily for students in pharmacy and health related sciences. Open to pharmacy majors; others consult dept. before enrolling. P, Chem. 243b, Math. 123, Phys. 102b, CR 480. (Identical with Tox. 481

495. Colloquium
a. Introduction to the Neurosciences I (2) GC (Identical with Med. 495a, which is home
b. Introduction to the Neurosciences II (2) GC (Identical with Med. 495b, which is home

600. Mathematical Techniques in Physiology (3) I Application of quantitative and analytical mathematical techniques to selected areas of physiology; introduction to mathematical approaches commonly used in physiology. Open to majors and minors; others consult department before enrolling. P, Math. 125a-125b, 160.

601. Human Physiology (8) II Principles of physiology, with emphasis on that of the human. P, Chem. 103b, 104b, 241b, 243b; Phys. 102b Consult department before enrolling.

602. Readings in Physiology (2) II Designed to provide students with more detailed consideration of various organ systems than can be provided in 601. Open to majors and minors only. P, Chem. 103b, 104b, 241b, 243b, Phys. 102b, CR Psio. 601.

605. Neurosciences (6) II (Identical with Anat. 605

606. Readings in Neuroscience (2) II Essentials of mammalian neural structure and function. Open to majors and minors only. Not recommended for students whose major interests lie in the neurosciences.

610. Research Methods in Physiology (1 to 3) [Rpt.] I II Lab. course stressing the principles of physiological research.

696. Seminar
a. Advanced Mammalian Physiology (1 to 4) [Rpt./1] I II Open to majors and minors only. P, 600, 601, 602; 606 or Anat. 605.

b. Literature (1) [Rpt./5] I II Open to majors only. P, 600, 601, 602; 606 or Anat. 605.

801. Human Physiology (8) II

805. Neurosciences (6) II (Identical with Anat. 805

PLANETARY SCIENCES

DEPARTMENTS AND COURSES OF INSTRUCTION

Associate Professors William V. Boynton, H. Jay Melosh, Martin G. Tomasko (Research, Lunar and Planetary Laboratory), Benjamin H. Zellner (Research, Lunar and Planetary Laboratory)

Participating Scientists from the Lunar and Planetary Laboratory:

Senior Research Scientists Lyle A. Broadfoot, Donald E. Shemansky
Associate Research Scientists Shailendra Kumar, Larry A. Lebofsky, Bill R. Sandefur, Ewen A. Whitaker
Assistant Research Scientists Jay B. Holberg, Lonnie L. Hood

The Department of Planetary Sciences offers a multidisciplinary program leading to the degrees of Master of Science and Doctor of Philosophy with a major in planetary sciences.

For admission and degree requirements, please see the Graduate Catalog.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>105.</td>
<td>The Universe and Humanity: Origin and Destiny</td>
<td>Formation and evolution of the Universe, the solar system, and life; events which led to our existence; the future for life in the solar system; life elsewhere. Designed for nonscientists. (Identical with Astr. 105)</td>
</tr>
<tr>
<td>106.</td>
<td>Survey of the Solar System</td>
<td>Interdisciplinary synthesis of planetary and space science; the sun, planets, satellites, interplanetary gas, comets, small bodies, space missions. Designed for nonscientists. 3R, 3L. (Identical with Astr. 106 and Geos. 106)</td>
</tr>
<tr>
<td>311.</td>
<td>Introduction to Planetary Geology</td>
<td>Survey of planetology; origin of planets; asteroids; meteorites; interplanetary dust and gas; planetary interiors; geophysics; planetary atmospheres; origin of life. Advanced degree credit available only with departmental permission. P, Phys. 103a-103b. (Identical with Astr. 403 and Geos. 403)</td>
</tr>
<tr>
<td>403.</td>
<td>Exploration of the Solar System</td>
<td>Primitive astronomy to modern space exploration; planetary science fundamentals, solar system physical properties; planetarium demonstrations, classroom projects. Field trip. Advanced degree credit available only with departmental permission. (Identical with Astr. 404)</td>
</tr>
<tr>
<td>419.</td>
<td>Physics of the Earth</td>
<td>(Identical with Geos. 419)</td>
</tr>
<tr>
<td>510.</td>
<td>Principles of Cosmochemistry</td>
<td>Chemical compositions of solar system objects; equilibrium and nonequilibrium chemical processes applied to planets; cosmochronology. P, 403, Chem. 480a-480b.</td>
</tr>
<tr>
<td>517.</td>
<td>Planetary Atmospheres</td>
<td>Survey of compositions, temperature and density profiles, chemistry, condensation products, spectroscopic evidence; circulations and heat budgets; evolution and origin of planetary atmospheres. P, 403.</td>
</tr>
<tr>
<td>518.</td>
<td>Experimental Methods of Planetary Science</td>
<td>Nature and detection of radiant energy; remote optical methods and direct sampling techniques; error analysis and ultimate limits to system performance; numerical procedures; laboratory experiments in cosmochemistry, absorption spectroscopy and IR detector technology. 2R, 3L. P, introductory physics and calculus. (Identical with Atmo. 518 and Astr. 518)</td>
</tr>
<tr>
<td>520.</td>
<td>Meteorites</td>
<td>Classification; chemical, mineralogical and isotopic composition; cosmic abundances; ages; interaction with solar and cosmic radiation; relation to comets and asteroids. P, 510. (Identical with Geos. 520)</td>
</tr>
<tr>
<td>527.</td>
<td>Advanced Geochemistry</td>
<td>(Identical with Geos. 527)</td>
</tr>
<tr>
<td>528.</td>
<td>Nuclear Geology</td>
<td>(Identical with Geos. 528)</td>
</tr>
<tr>
<td>544.</td>
<td>Physics of the High Atmosphere</td>
<td>Physical properties of the upper atmosphere, including gaseous composition, temperature and density, ozonosphere, and ionosphere, with emphasis on chemical transformations and eddy transport. (Identical with Atmo. 544)</td>
</tr>
</tbody>
</table>
554. Evolution of Planetary Surfaces (3) II 1986-87 The geologic processes and evolution of terrestrial planet and satellite surfaces including the Galilean and Saturnian satellites; implications for the early history of the Earth. P, 311, 403. (Identical with Geos. 554)


565. Jovian Planets and Satellites (3) I 1986-87 Observational data; atmospheric structure and composition; thermal balance; mass, radius, flattening; physics of light elements at high pressures; structure of rotating planets; origin of magnetic fields. P, 403.

567. Inverse Problems in Geophysics (3) I 1986-87 (Identical with Geos. 567)

571. Constitution and Evolution of the Terrestrial Planets (3) I 1985-86 Composition and evolution of terrestrial planets; includes the Moon, asteroids, meteorites, other evolved rocky satellites; geophysical/geochemical techniques used to deduce histories. (Identical with Geos. 571)


PLANNING

Committee on Planning (Graduate)

Professors Arthur L. Silvers (Management and Policy), Chairperson, Lay J. Gibson (Geography), Robert Giebner (Architecture), Frank Gregg (Renewable Natural Resources), David A. King (Renewable Natural Resources), James S. Lincoln (Management and Policy), Kirby W. Lockard (Architecture), Lawrence D. Mann (Geography), Fred S. Matter (Architecture), Thomas F. Saarinen (Geography), Norman Williams, Jr. (Geography)

Associate Professors Stanley K. Brickler (Renewable Natural Resources), Harry der Boghian (Architecture), Theodore H. Koff (Management and Policy), Gordon F. Mulligan (Geography), Ronald J. Vogel (Management and Policy)

Assistant Professors Robert Itami (Renewable Natural Resources), David Plane (Geography)

Lecturer Reid H. Ewing (Management and Policy)

Programs are offered in the fields of policy and planning (Management and Policy; College of Business and Public Administration) and in regional planning (Geography; Faculty of Social and Behavioral Sciences). Additional programs currently under development are in community design (College of Architecture) and in natural resources planning (School of Renewable Natural Resources).

The program in policy and planning provides training for a variety of staff-level careers in state and local government. Areas of specialization are land use and the environment, health care, services for the elderly, and public facility planning. The program in regional planning provides a strong grounding in location and spatial analysis, environmental behavior, and in legal/political institutions for regional infrastructure and development planning. Areas of specialization are land use and the environment, regional development, techniques of regional analysis, and transportation and human interaction.

The Master of Science degree is available with a major in planning. Upper-division undergraduates and graduate students may take work in planning complementary to their major fields.

110. Regional Land Use (3) I II (Identical with Geog. 110)

300. * Introduction to Policy and Planning (3) I II (Identical with M.A.P. 300)

301. Introduction to Regional Planning (3) I II (Identical with Geog. 301)

359. Land Use and Growth Regulation (3) I II (Identical with Geog. 359)

373. Water Resources in Energy Engineering (3) I (Identical with C.E. 373)

453. Industrial Location Analysis (3) GC I I (Identical with Geog. 453)
DEPARTMENTS AND COURSES OF INSTRUCTION

456. Urban Geography (3) GC I (Identical with Geog. 456)
457. Statistical Techniques in Geography and Planning (3) GC I (Identical with Geog. 457)
461. Population and Resources (3) GC I (Identical with Geog. 461)
463.* Program Planning for Human Services (3) GC II (Identical with M.A.P. 463)
468. Urban Transportation Planning (3) GC II CDT. (Identical with C.E. 468)
471. Problems in Regional Development (3) GC I II (Identical with Geog. 471)
474. Geology and the Urban Environment (3) GC I II (Identical with Geos. 474)
481. Computer Cartography (3) GC II (Identical with Geog. 481)
483. Geographic Applications of Remote Sensing (3) GC II (Identical with Geog. 483)
485.* Zoning Fundamentals (3) GC I (Identical with M.A.P. 485)

*Open only to students who meet requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog.

456. Fundamentals of Physical Planning (3) I (Identical with M.A.P. 506)
457. Social Service Planning (3) I (Identical with M.A.P. 507)
510. Development of Regional Planning (3) I (Identical with Geog. 510)
511. Metropolitan and Regional Planning (3) I (Identical with Geog. 511)
556. Urban Systems Analysis (3) II (Identical with Geog. 556)
557. Spatial Analysis (3) II (Identical with Geog. 557)
561. Resource Management (3) I (Identical with Geog. 561)
563. Perception of Environment (3) I II (Identical with Geog. 563)
565. Quick Response Transportation Planning Methods (3) I 1985-86 (Identical with C.E. 565)
568. Urban Public Transportation Systems (3) I 1986-87 (Identical with C.E. 568)
575. Housing and Residential Areas (3) II (Identical with M.A.P. 575)

596. Seminar u. Interdisciplinary Environment-Behavior-Design (3) I (Identical with Idis. 596u, which is home)

602. Analytic Methods in Planning and Management (3) II Methods and models for program planning and policy analysis; forecasting, service demand, facility location in capital investment programming, task sequencing, program analysis and evaluation. P, 457 or M.A.P. 552. (Identical with M.A.P. 602)

605. Planning Theories and Perspectives (3) I (Identical with Geog. 605)
608. Planning Law (3) II (Identical with Geog. 608)
609. Policy Problems in Structure and Change (3) II (Identical with M.A.P. 609)
611. Projects in Regional Planning (1 to 5) [Rpt./5 units] II (Identical with Geog. 611)

612a-612b. Projects in Policy and Planning (2-3) (Identical with M.A.P. 612a-612b)

651. Health and Public Policy (3) II (Identical with M.A.P. 651)
655. Efficiency Analysis in Health Administration (3) II (Identical with M.A.P. 655)
659. Growth Controls (3) II (Identical with Geog. 659)
662. Aging and Public Policy (3) I (Identical with M.A.P. 662)
669. Preservation of Historic Environments (3) II 1985-86 Current planning and legal methods to enhance the preservation of historic urban areas and structures; concentrated analysis of selected case studies. Field trips. (Identical with Law 669)

693. Internship g. Policy and Planning (1 to 4) S (Identical with M.A.P. 693g, which is home)

696. Seminar h. Land-Use Regulation (3) I II (Identical with M.A.P. 696h, which is home)
   i. Legal Inquiry in Policy and Planning (3) II (Identical with M.A.P. 696i, which is home)
   j. Environmental Planning (3) I II/Identical with M.A.P. 696j, which is home)
   k. Planning Administration (3) I II (Identical with M.A.P. 696k, which is home)
   o. The General Plan (3) [Rpt./6 units] II (Identical with Geog. 696o, which is home)
   p. Alternative Urban Futures (3) [Rpt./6 units] II (Identical with Geog. 696p, which is home)
PLANT PATHOLOGY

The department offers the degrees of Bachelor of Science in Agriculture, Master of Science and Doctor of Philosophy with a major in plant pathology. Courses are designed to acquaint students with causal agents of plant diseases, techniques used to manipulate pathogens, epidemiological and physiological aspects of plant-pathogen interactions and procedures used to control or prevent diseases of plants.

The major: In addition to meeting the requirements of the agricultural science curriculum, as outlined in the College of Agriculture section of this catalog, students must take PL.P. 205, 206, 402, 407, 451, Micr. 110. The suggested program includes Ecol. 104 or PL.S. 100 and V.Sc. 250; Ecol. 321 or PL.S. 312; M.C.B. 460; Chem. 241a-241b, 243a-243b; Math. 117e, 118 and 263 or PL.S. 421; Phys. 102a or 102b. Calculus and computer science are also recommended.

120. Recognition and Control of Plant Diseases (2) I Diagnosis and control of plant diseases. Designed primarily for home gardeners and nurserymen. Not open to plant pathology or plant protection majors. Credit allowed for this course or 205, but not for both.

205. General Plant Pathology (3) I Detailed study of representative plant diseases, with emphasis on basic concepts of diagnosis, cause, epidemiology, and control. Credit allowed for this course or 120, but not for both. P, Ecol. 104 or PL.S. 100.

206. General Plant Pathology Laboratory (1) I Lab. exercises in plant pathology. P, 205 or CR.

250. Forest Pathology (3) II Basic principles of plant pathology, with emphasis on diseases of forest trees and associated vegetation. Designed for majors in natural resources. 2R, 3L. P, PL.S. 100. (Identical with We.M. 250)

402. Introduction to Pesticides and Their Use (2) GC II Overview of pesticide use, with emphasis on interaction of technical, societal, individual, and regulatory aspects of the choices; specific control recommendations not stressed. (Identical with Ento. 402, PL.S. 402, and S.W. 402)

407. Methods in Plant Pathology (4) GC I Techniques used in the study of bacterial, fungal, nematode, and virus diseases of plants. 2R, 6L. P, 205 or CR.

451. Diagnosis and Control of Plant Diseases (3) GC I Field and lab. course designed to give students familiarity with diagnosis of plant diseases and plant disease control concepts. 2R, 3L. All-day field trips. P, 206. (Identical with Micr. 451)

516. Plant Nematology (3) II 1986-87 Comprehensive course in plant nematology, including the nature, ecology, and classification of plant parasitic nematodes. Diagnosis and control of nematode diseases of plants. 2R, 3L. P, 205.

520. Analytical Techniques for Phytopathological Research (4) II Techniques, including chromatography, electrophoresis, spectroscopy, and immunology. 2R, 6L. P, 206.

575a-575b. General Mycology (3-3) 1986-87 Comprehensive study of fungi, including their structure, function, classification, genetics, and ecological importance. 575a: Basidiomycetes and Fungi Imperfecti. 575b: Myxomycetes, Phycomycetes, and Ascomycetes. 2R, 3L. P, Ecol. 104 or PL.S. 100. 575a is not prerequisite to 575b.

596. Seminar a. Current Research (1 to 3) I II


694. **Practicum**

**PLANT PROTECTION**

*Committee on Plant Protection (Graduate)*

The Committee on Plant Protection, an interdepartmental committee in the College of Agriculture, offers a program leading to the Master of Science degree with a major in plant protection. For admission and degree requirements, please see the Graduate Catalog.

**PLANT SCIENCES**


Associate Professors Paul M. Bessey, Koaru Matsuda, Hiroshi Muramoto


The Department of Plant Sciences offers a broad spectrum of principles and practices related to agronomy, horticulture, production physiology, plant breeding, and genetics. The academic training prepares a student for a wide range of opportunities in plant-related sciences and agriculture.

The Bachelor of Science in Agriculture degree is available to undergraduate students with majors in agronomy and in horticulture. A third major designated as plant sciences is available to undergraduates preparing for entrance to a graduate school. The Master of Science and Doctor of Philosophy degrees are available with majors in either agronomy and plant genetics or horticulture.

Undergraduate students majoring in agronomy or horticulture will follow the agriculture curriculum as specified below. Majors in plant sciences will follow the agricultural science curriculum. The agricultural business curriculum may be elected with majors in agronomy or horticulture. Consult adviser.

**The agriculture curriculum:** Students following this curriculum must fulfill the requirements specified in the *College of Agriculture* section of this catalog, including in their programs 100, 110; 312 or Ecol. 320 or 321; PI.S. 405; Ento. 151 or 201R; P.L.P. 205; Chem. 103a-103b, 104a-104b; Ecol. 260 or M.C.B. 460; S.W. 200, 201.

*The major in agronomy:* For the concentration in general agronomy, it is suggested that students take 212, 315, 296a, plus nine additional units in pl.s and six units from s.w. For the concentration in seed industry management, 212, 315, Acct. 204 or 200a-200b, Econ. 201a, M.A.P. 320, 330, and Mktg. 361 are required.

*The major in horticulture:* Students in this major selecting the concentration in general horticulture are required to complete 230, 339, 361, 332 or 334a, 342 or 343, and one from the following: 357, 358, 359, or 362. For the concentration in environmental and landscape horticulture, the following are required: 230, 339, 355 or 354, 332 or 334a, 342 or 343, and 353. For the concentration in fruit and vegetable production, the following are required: 212, 230, 361, plus at least two of the following: 357, 358, 359, 362.
The agricultural science curriculum: Students following this curriculum must meet the requirements specified in the college section, including in their programs 100, 312 or Ecol. 320 or 321; Chem. 103a-103b, 104a-104b, 241a-241b, 243a-243b; Ecol. 260 or M.C.B. 460.

The major in plant sciences: For the concentration in botany, the student must complete Ecol. 102 or 436; 450, 470, 472, M.C.B. 460. For the concentration in plant breeding and genetics, the following courses are suggested: 315, 405, 421, 516; Ento. 151 or 201R; P.I.P. 205; S.W. 200, 201; Ecol. 470. For the concentration in production physiology, the following courses are suggested: 212, 405, 408; three additional units in p.l.s.; S.W. 200, 201; 314 or 316; 404 or 497c; Ento. 151 or 201R; P.I.P. 205.

The agricultural business curriculum: In addition to the requirements specified in the college section, students following this curriculum must complete the agriculture curriculum, excepting any two of the following: Ento. 151, P.I.P. 205, or P.I.S. 405. In addition, ten additional units of p.l.s. within one of the areas of concentration within the agronomy or horticulture major must be chosen in consultation with a major adviser.

100. Plant Science (3) I II Germination, emergence, growth, and reproduction of important economic plant species; how these plant processes are influenced by the environment. Dobrenz

110. Agronomic and Horticultural Crop Science (3) I II Principles underlying the distribution, culture, improvement, and utilization of agronomic and horticultural crops useful to man. 2R, 3L. Field trips. P, 100, or three units of bio.

130. Home Gardening (2) I II Care and maintenance of trees, shrubs, hedges, and flowers; principles of transplanting, pruning, and plant protection.

212. Principles of the Seed Industry (3) I Seed industry management principles, federal and state seed laws, seed certification, varietal release, and identification of crop and weed seeds. 2R, 3L. P, 100. Williams

230. Plant Propagation (3) I Principles and practices of plant propagation, including use of growth regulators, rooting media, misting systems and controlled light; budding and grafting of fruit trees and ornamentals. 2R, 3L. P, 110.

280. Production Skills (1) I Field and greenhouse experience in horticulture and agronomic crop production, tractor and power equipment operation, irrigation practice, crop culture. Field trips. 3L. Open only to majors with no farming experience. Bessey

296. Proseminar
a. Crops and Soils (1) I II Identical with S.W. 296a )

312. Plant Genetics (3) II Critical examination of the various theories of heredity and their application to plant breeding, including demonstrations illustrating genetic factors in economic plants. P, 100.


332. Arid Landscape Plants (3) II Plants adapted to arid environments for landscape and revegetation of disturbed land areas. 1R, 6L. Field trips. P, 110.

334a-334b. Plant Materials (3-3) II I (Identical with L.Ar. 334a-334b )

339. Greenhouse Management (3) I Principles and practices of greenhouse operation; control of environmental factors and cultural practices affecting the production of greenhouse crops. 2R, 3L. P, 110, S.W. 200. Lee


343. Indoor Foliage Plants (3) I Environmental and nutritional requirements of foliage plants used for interior decoration; uses, identification, nomenclature. 2R, 3L. Field trip. P, 339 or CR.


354. Landscape Management (3) I Installing, establishing and maintaining plants in the landscape; synthesis of cultural practices and environmental management techniques. 2R, 3L. Field trip. P, 100 or 110.

355. Turfgrass Management (3) I Species, use and establishment, equipment, and cultural practices for recreational, industrial and home lawn turfgrass. 2R, 3L. P, 110, S.W. 200.


359. Citriculture (3) Citrus growth in desert regions, including climatic requirements, cultivars, varieties, rootstocks, physiology, fruit development, and orchard management. P, 110.

360. Vegetable Production (3) Vegetable production in the Southwest, including climatic requirements, varieties, and cultural practices related to the vegetable industry. P, 110, S.W. 200.

361. Tropical and Subtropical Horticulture (3) Horticultural plants of the world, with emphasis on crops outside the continental U.S., their botany, climatic adaptation, and culture. P, six units of pl.s.

362. Forage Production (3) Adaptation, culture, and growth of legumes, grasses, and other forage plants, with emphasis on a critical examination of literature pertaining to forage crop improvement. All-day field trip. P, 100 or 110, S.W. 200.

363. Cotton and Other Fiber Crops (3) Principles and practices of growing and harvesting cotton and other fiber crops, with emphasis on cotton production, fiber technology, and utilization. All-day field trip. P, 110, S.W. 200. Muramoto


402. Introduction to Pesticides and Their Use (2) GC II (Identical with PI.P. 402)

405. Weed Control (3) GC I Principles and effects of controlling agronomic, horticultural, and range weeds, with emphasis on chemical control methods; weed identification. 2R, 3L. P, 6 units of pl.s. Hamilton

408. Crop Ecology (3) GC II Physical and biotic environment of crops in relation to crop culture, production, and geographical distribution; relations among the human population, crop productivity, and man's environment. P, 110 Briggs

421. Field Plot Research (3) GC I Principles of field plot research, with emphasis on procedures in small plot experimentation, such as the laying out of experiments, size and shape of plots, border effects, collection of data, and the summarization and publication of results. 2R, 3L P, Math. 117e.

422. Advanced Vegetable Crops (3) GC II 1986-87 Environmental and genetic factors affecting germination, growth, development, maturation, and quality of vegetable crops; presentation and interpretation of recent research progress. P, 361, Ecol. 260 or M.C.B. 460.

466. Postharvest Physiology (3) GC II 1985-86 Postharvest physiology, grading, packing, storage, transportation and handling of fruits, vegetables and other horticultural products. P, Chem. 241a, Ecol. 260 or M.C.B. 460. (Identical with N.F.S. 466)

482. Plant Cell and Tissue Culture (3) GC II Principles and theory of callus induction, embryoid and plantlet regeneration, nutrient transport, protoplast culture and fusion and cell suspension. 2R, 3L. P, Ecol. 260. Ketterman

516. Genetic Principles of Hybrid Seed Production (3) II Genetic and cytogenetic principles applied to the development and maintenance of inbreds and to the production of hybrid seed. P, 312 or Ecol. 320 or 321.

528. Plant Microtechnique (4) II Theory and practice of plant histological technique, including the use of light and electron microscopes and accessory equipment. P, twelve units of plant sciences or biology. Bartels


562. Plant Intermediary Metabolism (3) II 1984-85 (Identical with M.C.B. 562)

564. Plant Growth and Development (3) II 1985-86 (Identical with M.C.B. 564)

627. Advanced Genetics (3) I Strand and tetrad analysis; chromosome structure and organization; recombination at the molecular level and gene conversion; mutation classifications and origins; genetic complementation and its relation to a genetic unit and its function. P, 312 or Ecol. 320 or 321. Endrizzi
631. **Crop Physiology (3)** I Plant processes and environmental interactions in relation to growth and production of crop communities, with emphasis on recent advances and research techniques. P, Ecol. 260 or M.C.B. 460.


634. **Quantitative Genetics and Selection (3)** II 1985-86 Biological approach to the principles of quantitative inheritance as applied to the selection of quantitative characters in breeding experiments, with emphasis on the methods of measuring, analyzing, and interpreting quantitative data. P, three units of gene.; Agri. 539.

635. **Advanced Cytogenetics (4)** II Fundamental principles that illustrate the correlation of genetic and cytological features involving intra- and interchromosomal structural changes, heterploidy and species hybrids. 3R, 3L. P, 6 units of gene. Endrizzi

696. **Seminar**
   a. Agronomy (1) [Rpt./2] I II
   b. Horticulture (1) [Rpt./2] I II

**POLITICAL SCIENCE**


Assistant Professors Thomas M. Holm, Lyn Ragsdale

The Department of Political Science offers the degrees of Bachelor of Arts, Master of Arts and Doctor of Philosophy with a major in political science. A Bachelor of Arts in Education and a Master of Education are available with a teaching major in political science.

**The major:** Thirty units, including 102 and at least one of the following: 140, 150, 220. At least 21 units must be selected from the fields listed below, including at least three units in each of any five fields. Individual study may not be applied to the 21-unit requirement.

**The teaching minor:** Twenty units, including 102, and either 103 or 214a (110 is not applicable to the teaching minor), and three units in each of any three fields of study listed below.

**Teacher certification:** The U.S. and Arizona Constitutions requirement for a teacher's certificate may be satisfied by three course options: 102, 103; 102, 214a; or 110. An additional option is the Constitutions examination, which carries no University credit.


**Special programs:** Majors interested in law, civil service or foreign service should consult the department's career advisers regarding an appropriate course of study. Internships are offered in connection with the State Legislature, the Public Defender, the Juvenile Court, administrative agencies of the City of Tucson and Pima County, and the U.S. Congress. Prelaw students interested in legal problems of American Indians may combine prelaw and American Indian policy courses in the Department of Political Science with the minor in American Indian studies.

**Honors:** The department participates in the Honors Program.

101. **Introduction to Politics (3)** I II Issues in contemporary political analysis; human values and political goals; how governments differ and why they change; how nations influence one another. Not open to students with previous credit in 220, 140 or 150.
102. **American National Government (3)** I II General survey of the constitutional bases, organization, and functioning of the American national government; recent and current trends. Credit allowed for this course or 110, but not for both.

103. **American State and Local Government (3)** I II General survey of state and local government; recent and current trends.

110. * **National and State Constitutions (3)** I II Meets the state requirement for a teacher's certificate. Designed for seniors intending to teach. Credit allowed for this course or 102, but not for both.

*The state requirement for a teacher's certificate may be taken through correspondence.*

140. **Introduction to Comparative Politics (3)** I II Survey of the major political systems and analysis of comparative political concepts, with a view to preparation for more advanced study.

150. **Introduction to International Relations (3)** I II Study of the international system, its actors and their capabilities; ends and means of foreign policy; international tension, conflict and cooperation.

205. **The American Presidency (3)** I II Political dynamics of the executive office and its relationship to the competitive branches of government within the American political system.

206. **Public Policy and Administration (3)** I II Theory and practice of executive agencies, including policy making and other functions, processes, personnel and fiscal management, and administrative law.

214a-214b. **Arizona Government (3-1)** 214a: I History, structure, powers and processes of state and local government. May be used for state teacher certification. 214b: Arizona constitution. Offered through correspondence only. 214a is not prerequisite to 214b.

220. **Introduction to Political Ideas (3)** I II Basic issues in political thought, with emphasis on contemporary problems of democracy, liberty, authority, obligation, and ideology.

227. **Nuclear Age (3)** I 1985-86 (Identical with Hist. 227)

231. **Political Parties in an Age of Media and Money (3)** I II American two-party system; party organization and activists: party roles in media, money, nominations, elections, and campaigns; party influence in government; the future of parties.

240. **Canadian Government and Politics (3)** I Canada as a North American alternative: political culture, English-French relations, structures and processes, problems of federalism, environmental policies, Canadian-U.S. relations.

242a-242b. **Western European Political Systems (3-3)** Examination of the ideological framework, political culture, functions and processes of the Western European political systems. 242a: Britain, Ireland, Scandinavia and the Low Countries. 242b: France, Italy, West Germany and Spain. 242a is not prerequisite to 242b.

247. **Introduction to Latin-American Politics (3)** I II Survey of the political forces and social groups important in shaping contemporary Latin America; examination of Indians, slaves, peasants, landlords, labor, the middle sectors, and the military; discussion of theories of instability.

250. **Contemporary International Politics (3)** I II Analysis of conflicts of national interests; decision making in the present international system; role-playing and simulation experience.

251. **The United Nations (3)** I The United Nations and its agencies, with emphasis on major issues confronting the organization.

297. **Workshop**

a. U.N. (1 to 3) I II Open to participants in Model U.N. programs only.

d. Election Law (3) I II All-day field trips.

309. **The Judicial Process (3)** I II Structure, function, and processes of the "third branch" of the American government.

315. **Political Sociology (3)** I II (Identical with Soc. 315)

328. **Problems In Contemporary Political Theory (3)** I II Intensive examination of selected problems and concepts in political theory.

330. **Minority Groups and American Politics (3)** I II Political problems of the poor; analysis of systematic poverty in the U.S. and theories of causation; selected policy problems: education, housing, job training, enforcement of antidiscrimination statutes; future of "power" movements. (Identical with Bl.S. 330 and M.A.S. 330)

332. **Politics of the Mexican-American Community (3)** I II Political structure and processes of the Mexican-American community, with emphasis on history, schooling, political behavior, and class; future trends; bibliography. (Identical with M.A.S. 332)
333. Political Research and Methodology (3) I Introduction to research design and methods, with attention to philosophical foundations of modern political science.

334. Politics and American Indians (3) II Examination of public policy on American Indians and analysis of the political culture of American Indian communities. (Identical with A.In.S. 334)

393. Internship
   b. Public Defender (1 to 6) I II
   c. County Attorney (1 to 6) I II
   d. Senatorial Internship (1 to 12) I II Open to majors only.
   e. Congressional Internship (1 to 12) I II Open to majors only.
   f. Legal (1 to 6) [Rpt./6 units] I II

396. Proseminar
   a. Honors (3) [Rpt./2] I II

406. Bureaucracy (3) GC I Analyses of legal, political, cultural and behavioral aspects of public organizations, bureaucratic typologies and methods of public control.

407. Congress and American Politics (3) GC I II Examination of election politics, personalities and career patterns of Congress members, the organization and structure of Congress, and the role of Congress in policy leadership and representation of the public.

408. Parliamentary Procedure (3) II (Identical with Sp.C. 408)

409. Struggle for the Presidency (3) GC I Examination of the campaign strategies and tactics of those seeking the nation's most powerful office from 1960 to the present through films and readings.

412. Local Government and Administration (3) GC I II Examination and analysis of local decision-making structures and their policy outputs. P, 103.

421. Ancient and Medieval Political Theory (3) GC I Development of Western political theory from the Greeks to Machiavelli.

422. Early Modern Political Theory (3) GC II Western political theory from Machiavelli to Marx.

423. Recent Political Thought (3) GC I II Political theory from Marx to the present. Writing-Emphasis Course.

426. American Political Thought (3) GC II American political ideas from colonial times to the present.

431. Political Culture and the Dynamics of Change in American Society (3) GC I Examination of the manner in which attitudes about politics and political problems are acquired from exposure to music and television, and the manner in which such attitudes lead to political action.

432. Pressure Groups (3) GC I II Formation, structure, and place of pressure groups in the democratic society; the function of interest groups in the political process; problems of leadership, internal organization, and membership loyalties. Writing-Emphasis Course.

434. Quantitative Analysis of Political Problems (3) GC I Introduction to the use of statistics on political data, with emphasis on statistical manipulation; evaluation and interpretation of statistical explanations of political phenomena.

435. Public Opinion and Voting Behavior (3) GC I II Attitude and opinion formation and socialization; public opinion in the political process; the relationship between attitudes, opinion and voting behavior in American politics. (Identical with Soc. 435)

436. Personality and Politics (3) GC II Examination of the theories and concepts associated with the psychological basis of various types of political behavior. Writing-Emphasis Course.

437. Democracies, Emerging and Evolving (3) GC I Causal analysis of conditions of stability and breakdown of democratic regimes with particular emphasis on the developing democracies of the third world.

438a-438b. Philosophy of Law (3-3) GC (Identical with Phil. 438a-438b)


442. Transformation of Agrarian Societies in the Middle East (3) GC II (Identical with Or.S. 442)

443. Soviet Politics (3) GC I Revolution and contemporary ideology: state, party and mass organizations; economic and social planning; civil liberties; models of autocracy and pluralism. Writing-Emphasis Course.
444. East European Politics (3) GC II Divergent models of Communist development, from East Germany to Yugoslavia; political, economic, social and cultural reform.

445. Comparative Political Revolution (3) GC I Examination of the causes and consequences of 20th-century revolutions and the revolutionary process, with emphasis on contemporary events. Writing-Emphasis Course. **

446. Politics of Developing Areas (3) GC II Survey of politics and problems in Asia, Africa, and Latin America, including political violence, elections, bargaining, elites, parties, the military and ideology.

447. Latin-American Political Development (3) GC II Presentation of strategies for development in Latin America; examination of case studies from Cuba, Brazil, Chile, Guatemala, and other countries.

448. Government and Politics of Mexico (3) GC I Description and analysis of Mexico's political economy, its political system, and its foreign policy, with emphasis on Mexican-U.S. relations. (Identical with M.A.S. 448)

449. The Politics of Cultural Conflict (3) GC II Comparative examination of the approaches of different types of political systems to domestic conflict of a racial, religious, lingual and/or ethnic nature.

451. Soviet Foreign Policy (3) GC I Ends and means of Soviet foreign policy; the decision-making process; Soviet relations with the West and developing nations.

452. Communist Foreign Relations (3) GC II Interrelations of fourteen Communist-party states, with emphasis on cooperation and conflict in such organizations as the Comecon and the Warsaw Pact.

453. Theories of International Relations (3) GC I Introduction to theories of international relations on the levels of man, the nation-state, and the international system, with a logical and empirical evaluation of approaches and theories.

454. American Foreign Policy (3) GC II Analysis of the Cold War; Congressional-Executive clashes over foreign policy control; approaches to policy analysis.

456a-456b. International Law (3-3) GC 456a: The international state system; legal-political problems, including territory, environment, seas. 456b: The international system and the individual; the war system, including use of force, laws of war. 456a is not prerequisite to 456b. Writing-Emphasis Course (456a). **

457. Inter-American Politics (3) GC I Survey and analysis of the leading political and economic issues at controversy between the United States and Latin America.

458. Government and Politics of the Middle East (3) GC II (Identical with Or.S. 458)

459. Problems of World Order (3) GC II Analysis of complex, interrelated global problems, threats to survival, quality of life and exploration of past and present policies and future worlds. Course is value-oriented and prescriptive.

460. Modern Chinese Foreign Relations (3) GC II Survey of the developments and trends in Chinese foreign relations in the modern period, focusing mainly on the relationship between the theoretical and actual objectives of China's foreign policies from 1949 to the present. (Identical with Or.S. 460)

461a-461b. Chinese Politics, 1911-Present (3-3) GC Analysis of the political, economic, and social structure in China, with particular emphasis on the role the Communist party plays in society. 461a: 1911-1949. 461b: 1949-present. (Identical with OR-S/I/461a-461b)

464. International Relations of East Asia (3) GC II National interests, issues and conflicts, relations, and influence of domestic politics in interstate relations in East Asia. (Identical with Or.S. 464)

468. Government and Politics of Africa (3) II Government and politics of African nations south of the Sahara; emphasis on processes of political and economic development. (Identical with Bl.S. 468)


471. Constitutional Law: Civil Liberties (3) GC I II Analysis of the constitutional guarantees of civil liberties in the U.S.

474. Administrative Law (3) GC I Law governing the organization, powers, and procedures of the executive and administrative establishment, with emphasis on the limitations imposed by the American constitutional system.
475. Concepts in Criminal Law (3) GC II Focus on questions such as what constitutes a crime; when is killing murder; what makes punishment just; what distinctions exist between justifiable and excusable crimes.

476. Women and the Law (3) GC I 1986-87 Legal status of women in America, including constitutional protections, marriage and family relationships, educational and vocational opportunities, political rights, criminal law. (Identical with W.S. 476)

480. Formation of Public Policy (3) GC I Needs and demands for public action on policy issues; organization and nature of political support; processes and problems of decision making in the formation of public policy at the national, state, and local levels. Writing-Emphasis Course.**

481. Environmental Policy (3) GC II Role of government in management of energy, natural resources and environment; process and policy alternatives; special attention to the Southwest. (Identical with W.R.A. 481)

483. Urban Public Policy (3) GC I II Analysis and discussion of social, economic, and political problems and proposed solutions in changing urban environments.

484a-484b. Development of Federal Indian Policy (3-3) GC 484a: European colonial precedents through the treaty-making period. 484b: End of treaty-making to the present. 484a is not prerequisite to 484b. (Identical with A.In.S. 484a-484b)

485. National Security Policy (3) GC I Decision-making structures, processes and outcomes relevant to American security policy; comparison with major foreign powers.

486. Political Systems of India and Pakistan (3) GC II (Identical with Or.S. 486)


489. The Politics of National Policymaking (3) GC I II Analysis of institutional and political basis for cooperation and conflict between Congress, the president, and the Court in different policy areas.

579. Research Design (3) I Introduction to experimental and quasi-experimental research design; survey research; the use of aggregate statistics; historical documents and life-history materials; participant observation; unobtrusive methods.

580. Methods of Political Inquiry (3) I II Systematic examination of problems of scope and methods of inquiry in the discipline of political science; intended to acquaint students with the discipline and to prepare them for scholarly research in the field.

582. Research and Methodology (4) II Quantitative techniques and computer applications in political science.

595. Political Risk and Intelligence Analysis (3) II Examination of political risk and intelligence analysis with emphasis on forecasting political developments in nations.

596. Colloquium
   a. American Political Institutions (3) I II
   b. Political Behavior (3) I II
   c. Survey of Political Theory (3) I II
   d. Comparative Politics (3) I II
   e. International Relations (3) I II

598. Seminar
   a. American Political Institutions (3) [Rpt./2] I II
   b. Political Behavior (3) [Rpt./2] I II
   c. Political Theory (3) [Rpt./2] I II
   d. Comparative Politics (3) [Rpt./2] I II
   e. International Relations (3) [Rpt./2] I II
   f. Public Law and the Judicial Process (3) [Rpt./2] I II
   g. Public Policy (3) [Rpt./2] I II
   h. American Indian Law and Policy (3) [Rpt./2] I II (Identical with A.In.S. 596h)

610a-610b. Fiscal and Budgetary Administration of Public Agencies (3-3) (Identical with M.A.P. 610a-610b)

** Writing-Emphasis Course. P. Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.)

PORTUGUESE
(See Spanish and Portuguese)
PSYCHOLOGY


Associate Professors Harold S. Arkowitz, Philip Balch, Wayne R. Carroll, Lewis Hertz, Alfred W. Kaszniak (Psychiatry), Spencer A. McWilliams, Ronald H. Pool, William H. Thweatt

Assistant Professors Jeff L. Greenberg, George P. Knight

Lecturer Susan A. Warner

The Department of Psychology offers courses designed to provide an understanding of the scientific principles of human and animal behavior.

Degrees awarded are the Bachelor of Arts, Bachelor of Science, Master of Arts and Doctor of Philosophy with a major in psychology. The master's degree is awarded during doctoral training; there is no M.A. program as such.

The major for the B.A.: 36 units of psyc., including at least eighteen upper-division units, and 101, 245, and 255. Majors must also complete at least six units in each of the following four areas (24 units total): (1) biological bases of behavior: 302, 312, 400, 401, 403, 404a-404b, 411R, 411aL, 481; (2) cognitive-affective bases of behavior: 329, 370, 371, 411bR, 411bL, 425, 428, 472, 482; (3) social bases of behavior: 300, 410, 421, 430a-430b, 435, 450, 483; (4) individual bases of behavior: 265, 313, 414R, 414L, 416, 418, 458, 484. One three-unit course from among 405, 475, 485, 94 series, or 99 series, may be substituted for one, only, of the thirty area courses listed above. A maximum of twelve elective units in psyc. courses may be included in the major. Students planning to attend graduate school should complete 405 and 475.

The major for the B.S.: Same psyc. requirements as above, with the addition of eight units in a biological lab. science (Ecol. 101a-101b excluded); eight units in either chemistry or physics lab. courses; Math. 117e and either Math. 119 or Math. 123.

The department will present additional topics, as needed, in the variable-content courses 481 through 485, 576, and 577: creativity, myths and tales, psychology and women, humanistic psychology, computer applications, ergonomics, visual processes, group leadership, community problems, and others.

Recommended minors are biological, physical, or social sciences, and mathematics. A minimum of three upper-division units is required.

The minor and teaching minor: 17 units of psyc. (nine of which must be in upper-division courses), in addition to 101. A maximum of three units of independent study may be included in the 17 units of the minor.

Honors: The department participates in the Honors Program.

101. Introduction to Psychology (3) I II S Survey of general psychology including history and systems, physiology, sensation and perception, learning, motivation, cognition, development, personality, social, and psychopathology.

245. Psychological Measurement and Statistics (3) I II Measurement, quantitative description, and statistical inference as applied to psychological variables. P, Math. 116; Psyc. 101 or CR.

255. Research Methods (3) I II Students will gain experience in a range of psychological research methods. 2R, 3L. P, 101, 245.

265. Normal Personality (3) I II Practical implications of psychology for normal personality growth, with emphasis on development in the college years; applications to students’ lives discussed in student-led groups. (Students unwilling to participate in the small-group sessions of the course must consult instructor for alternative assignment.) 2R, 3L. P, 101.

300. Social Psychology (3) I II Introduction to major theories and research findings of social psychology; to provide an understanding of the roles of cognitive and motivational processes in social behavior. P, 101.

302. Neurological Foundations of Behavior (3) I II Review of the anatomy and physiology of the mammalian nervous system; designed for students in the life sciences. P; 101 or eight units of bio. lab. sci.
312. **Primate Behavior (3)** I II Survey of psychological research on nonhuman primates; includes sensory processes, learning, development, social and abnormal behaviors. P, 101.

313. **Developmental Psychology (3)** I II The child, from conception to adolescence, with emphasis on experimental analyses of the development of behavior. P, 101.


371. **Environmental Psychology (3)** I Basic concepts in environmental psychology; the relationship between the individual and the large-scale environment. P, 101.

400. **Neurological Psychology (3)** GC I II Group discussion, demonstrations and experiments on current problems in neuropsychology. Problems selected to permit students to integrate laboratory techniques, research literature, and anatomical and physiological knowledge with behavioral theory. P, 101, 255, 302. Writing-Emphasis Course.*

401. **Body Chemistry and Behavior (3)** GC I Biochemical compounds related to life and the role of behavior in life; chemical processes occurring within organisms and how they interact with behavior. P, 101; and 302 or 8 units of bio. lab. sci.

403. **Biopsychology (3)** GC II Functions of the brain and other bodily systems in reflex and learned control of movement and perceptual responses; emotional effects and experiences, sleep, and language. P, 101, 302.

404a-404b. **Human Brain-Behavior Relationships (3-3)** GC 404a: Brain functions in relation to intelligence, speech, memory, judgment and reasoning, and visual-spatial abilities. P, 302. 404b: Continuation of 404a; methods of examination of human brain functioning in relation to individual differences in both normal and brain-damaged persons.


411R-411bR. **Comparative Psychology (3-3)** GC Systematic study of animal behavior. 411aR: Analysis of environmental and genetic determinants of behavior, special behavioral adaptations in animals, and sociobiological concepts. 411bR: Animal learning with emphasis on interspecies comparisons. 411aR is not prerequisite to 411bR. P, 101. Writing-Emphasis Course.*


414L. **Advanced Developmental Psychology Laboratory (1)** [Rpt./1] GC I II Applications of developmental psychology in lab. and natural settings. P, 101; 414R or CR.

416. **Personality (3)** GC I II Advanced study of theories of personality; methods and results of personality study. P, 101, 245.


421. **Psychology of Death and Loss (3)** GC I II Basic concepts in a psychology of death and loss, with emphasis on both the adjustment to death and loss, and the underlying phenomenal, humanistic and current social considerations. P, 101.


428. **Field Methods in Environmental Psychology (3)** GC II Behavior in man-made or managed environments, with emphasis on objective methods; designed for students having a professional interest in environmental design or management. P, 371. (Identical with Arch. 428 and L.Ar. 428)

430a-430b. **Psychology, Law and Social Policy (3-3)** GC Critical review of theory, methods and research in the psychology, law, and social policy interface. P, 101. 430a is not prerequisite to 430b.
435. Psychological Problems of the Aged (3) GC I Cognitive, intellectual, personality, and behavioral correlates of aging; relates general psychological theory to the problems of aging. P, 101 or grad. standing. (Identical with Gero. 435)


458. Psychopathology (3) GC II In-depth study of current theoretical and research formulations in behavior deviancy; various approaches to behavior change. P, 418.

472. Human Memory and Cognition (3) GC II Human learning, memory, and cognition; emphasis on information-processing approach to results and theory. P, 101, 245, 370; or grad. standing. Writing-Emphasis Course.*

475. History of Psychology (3) GC I Growth of psychology as a science; major schools and theories; contributions of famous investigators and major advances; psychology as an art and a science today. P, 101, 255.

481. Topics in the Biological Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule): physiological, neurological, sensory, and motor systems; comparative psyc., others. P, 101 and six units upper-div. psyc.; or grad. standing. Writing-Emphasis Course.*

482. Topics in the Cognitive and Affective Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule): learning, cognition, perception, psycholinguistics, emotion, others. P, 101 and six units upper-div. psyc.; or grad. standing. Writing-Emphasis Course.*

483. Topics in Social Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule): group processes, organizational theory, leadership, others. P, 101 and six units upper-div. psyc.; or grad. standing. Writing-Emphasis Course.*

484. Topics in Individual Bases of Behavior (3) [Rpt./1] GC I II Variable content (consult schedule); developmental psychology, personality, psychopathology, others. P, 101 and six units upper-div. psyc.; or grad. standing. Writing-Emphasis Course.*


507a-507b. Statistical Methods in Psychological Research (3-3) 507a : Research design, application of analysis of variance, multiple comparisons, and computer techniques in psychological research. 507b : Selected methodological issues and multivariate methods in psychology, with coverage of computer applications. Open to psychology majors only.

509. History of Psychological Theories and Research (3) II Development of psychology as a science; schools, systems, theories, major advances, famous investigators.

520a-520b. Theory and Research in Biopsychology (3-3) [Rpt./1] 520a : Review of current theories and research in biopsychology. 520b : Research methods for the study of biological processes and behavior; emphasis on current techniques and instrumentation for stimulus control, recording and analyzing behavioral data, and psychopharmacological studies. P, 403.

521a-521b. Theory and Research in Environmental Psychology (3-3) Advanced topics in environmental psyc. 521a : Emphasizes research and application. 521b : Emphasizes methodology.


550. Theory and Research Methods in Developmental Psychology (3) I Major theories and research methods in contemporary developmental psychology.

551. Social/Personality Development (3) II 1986-87 Theories and research in the development of social behavior patterns and personality.

552. Child Language Development (3) II 1985-86 Advanced theories and research related to children's acquisition of their native language.
555. **Cognitive Processes** (3) Intensive review of current theories and results in human cognitive processes from an information-processing perspective.

560a-560b. **The Effects of Law on Psychology** (3-3) 1986-87 Critical evaluation of the professional organizational standards and laws controlling the science and profession of psychology, and the clients of their services.

561a-561b. **Theory and Research in Law and Psychology** (3-3) [Rpt./1] 1985-86 Advanced topics in law psychology. 561a : Research and application. 561b : Methodology.

575. **Personality Theory and Research** (3) II Basic problems of theory construction, with application to theoretical systems in the personality area. P, 416.

576. **Contemporary Issues in Experimental Psychology** (3) [Rpt./1] II Advanced study of topical problem areas in general and experimental psychology.

577. **Contemporary Issues in Clinical Psychology** (3) [Rpt./1] II Advanced study of topical problem areas in clinical research and practice.

596. Seminar
   u. **Interdisciplinary Environment-Behavior-Design** (3) [Rpt./1] I (Identical with Idis. 596u, which is home)

600a-600b. **Introduction to Graduate Training in Psychology** (1-1) Basic areas of psych., ethics and standards, teaching methods. Open to first-year psych. grad. students only.

620. **Clinical Psychopathology** (3) I Advanced survey of symptoms, causes and treatments of the major psychological disorders. Current research and theory in psychopathology will also be considered. Open to majors only.

621. **Clinical Assessment Methods** (3) II Theory and practice in interview techniques and cognitive and personality assessment. Open to majors only.

622. **Clinical Principles of Behavior Modification** (3) I Systematic review of the major theories of behavior modification, with emphasis on application to clinical problems. Open to majors only.

623. **Clinical Insight Therapies** (3) II Theory, technique and research of approaches to behavior change which are oriented toward internal awareness, self-direction and personal responsibility by means of relationship, insight, and self-awareness. Open to majors only.

624. **Clinical Research Methods** (3) I Contemporary research issues in clinical psychology are critically examined. Open to majors only.

625. **Clinical Community Psychology** (3) II Expanding role of psychology in innovative mental health functions, with emphasis on consultation, program development, primary prevention and social system modification. Open to majors only.

626a-626b. **Clinical Group Psychotherapy** (3-3) 626a : Theory and practice of group psychotherapy. 626b : Experience in leading groups; advanced theory. 2R, 3L.

694. **Practicum**
   a. **Clinical Interviewing and Assessment** (1 to 3) [Rpt./1] I II Open to clinical psych. students only.
   b. **Psychotherapy** (1 to 3) [Rpt./1] I II Open to clinical psych. students only.
   c. **Community Mental Health** (1 to 3) [Rpt./1] I II Open to clinical psych. students only.

* Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

**PUBLIC MANAGEMENT**
(See Management and Policy)

**PUBLIC POLICY, PLANNING AND ADMINISTRATION**
(See Management and Policy)

**PUBLIC RECREATION ADMINISTRATION**
(See College of Business and Public Administration)
The Department offers course work for students interested in electronic communications. This work provides focus upon electronic media production, management, and policy-making as well as the philosophy and techniques of electronic media communications. The facilities of the Division of Media and Instructional Services, including KUAT-TV-AM/FM and film production facilities, are utilized for many laboratory classes. Students have the opportunity to obtain professional experience through the department’s internship program.

The major: In addition to the group requirements for the Bachelor of Arts in Radio-Television, as described in the Faculty of Fine Arts (College of Arts and Sciences) section of this catalog, the student must complete Sp.C. 105 and one of the following English composition courses beyond the Group I requirement: Engl. 207, 209, 210, 307, or 308. Requirements in the major include: 34 units of radio-television courses, including 103, 111, 150, 213, and 305. At least 12 units must be upper division courses. No more than six units selected from 293, 444, 493, and 499 may be counted toward the major, and no more than 48 units may be counted toward the degree. At least 18 units in the major must be completed in residence. It is recommended that students develop the typing ability prior to taking 200 level courses in the department.

From time to time the department will offer specialized courses to meet student demand or the general needs of the community. Persons interested in specialized course offerings should contact the department head. At least 18 units of the major must be completed in residence.

The teaching minor consists of: 103, 111, 213, 305, 310, 360 and electives for a minimum total of 24 units.

Honors: The department participates in the Honors Program.

Basic facilities are provided; however, students are responsible for the cost of film/tape stock, processing and other necessary supplies.

103. Introduction to Radio and Television (3) I II S An introduction to the study of radio and television; examination of the media, their effects on society and culture, history, technology, and ethics.

111. Introduction to the Aesthetics and Theory of Media Production (3) I II A survey of the elements which make up the audio, film, and television image; presentations with individual elements and message design and structure.

150. Survey of Law and Regulation of Electronic Media and Film (3) I II S Introduction to the legal and regulatory framework of the electronic media and film; applicable federal and state laws, copyright, libel, slander, constitutional guarantees, the FCC and FTC. P, 103.

160. Electronic Media and Society (3) II S Survey of the relationships between electronic media and society; violence, stereotyping, obscenity, agenda-setting, political advertising; structure of the industry. P, 103.

170. Development of the Electronic Media (3) I II Examination of history and major program types, with emphasis on the relationships among genres common to radio, television, and broadcast film.

205. Reporting the News (3) I II (Identical with Jour. 205)

213. Fundamentals of Broadcast Production (4) I II Introduction to the elements of broadcast production, including station personnel, professional practices, production elements, and related items. 3R, 3L. Nonmajors enroll in special lab. sections. P, 103, 111.

215. Introduction to Broadcast Film Production (3) I II Basic principles of broadcast film production and examination of production techniques and practices; laboratory experience with film production equipment and production of a short 16 mm. film. 2R, 3L. P, 103, 111.


239. Speaking for Radio and Television (3) I II (Identical with Sp.C. 239)

241. Beginning Photography (3) [Rpt./2] I II (Identical with Art. 241)
293. **Internship**
   a. TV Production (1) I II Open to majors only. P, 103, 111, 150, 220.
   b. Radio Production (1) I II Open to majors only. P, 103, 111, 150, 213.
   c. TV Graphics (1) I II Open to majors only. P, 103, 111, 150, 213.
   d. Radio-TV News (1) I II Open to majors only. P, 103, 111, 150, 230.
   e. Radio-Television Promotion (1) I II Open to majors only. P, 103, 111, 150.
   f. TV Film (1) I II Open to majors only. P, 103, 111, 150, 215.
   g. Radio-TV Advertising (1) I II Open to majors only. P, 103, 111, 150.
   h. Radio-TV Public Relations (1) I II Open to majors only. P, 103, 111, 150.

302. **Recording Studio Production** (2 to 3) I II (Identical with Mus. 302)

305. **Broadcast Writing** (3) I II Theory of broadcast writing, including all types of copy formats, with emphasis on students' writing activities. (Identical with Jour. 305) Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the *Academic Guidelines* section of this catalog).

310. **Intermediate Broadcast Production** (3) I II Production of various types of radio and television programs, including techniques and theory of studio operation, use of equipment and personnel relationships, with emphasis on the role of the broadcast producer. 2R, 3L. Open to majors only. P, 213, 305.

315. **Intermediate Broadcast Film Production** (3) I II Production of broadcast films, with emphasis on sound, editing techniques, and visual design. Students will produce a short informational/documentary film. 2R, 3L. P, 215.

320. **Writing for News and Documentary** (3) I Advanced work in the writing of news and public affairs programs for radio, television, cable, and closed-circuit use, with emphasis on the public affairs program and documentary. P, 230, 305. (Identical with Jour. 320)

330. **Reporting for Radio-Television News** (3) I Advanced procedures and techniques utilized in news gathering; production of newscasts, event coverage, newsroom organization. Performance practice is emphasized in laboratory exercises. 2R, 3L. P, 205 or 230 or 305. (Identical with Jour. 330)

335. **Producing Public Affairs and Documentary Programs** (3) I II Advanced work in the production of documentary and public affairs programs; idea formulation, budgeting, writing, researching, with emphasis on organization of production team and practical production considerations. 2R, 3L. Open to majors only. P, 310, 320 or 330.

360. **Broadcast Communications Research** (3) I Survey research, commercial rating services, other research techniques; problems of minority audiences; applications in the behavioral sciences, marketing, and broadcasting; major emphasis on the radio-TV audience. P, 160.

361. **Broadcast Sales and Time Management** (3) I II Sales activities in broadcast and cable operations; strategies; client need analysis, successful sales behaviors, management structures.

364. **Creative Advertising** (3) I II Open only to students who meet the requirements for advanced standing or specified in the college of Business and Public Administration section of this catalog. (Identical with Mktg. 364)

366. **Public Relations** (3) I II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of this catalog. (Identical with Mktg. 366)

370. **History of American Broadcasting** (3) I S Examination of the American broadcast industry; technical innovation, the rise of stations and networks, financial base, programming, regulation, and changes in audience.

375. **Cinematic Theory and Criticism** (3) I 1985-86 Major theories of the motion picture; examination of major approaches to film criticism, viewing, discussion, and writing. 2R, 3L. P, Dram. 270a-270b.

410. **Advanced Broadcast Production** (3) I II Production of various types of broadcast programs, including continued exposure to studio operations, lighting, staging, and use of color as well as black and white equipment, with emphasis on the role of the broadcast director. Student pays for film, tape and lab. charges. 2R, 3L. P, 310.

415a-415b. **Advanced Broadcast Film Production** (3 - 3) Advanced studies and practice in broadcast motion picture production. Students will produce a team project 16mm sound release print of an original film concept developed during the class. The University provides camera and editing equipment. Students pay all film and lab. costs. Open to majors only. P, 315.

442. **Broadcast Programming** (3) GC I II Investigation of radio and television programming techniques, including both public and commercial broadcasting. P, 360.
DEPARTMENTS AND COURSES OF INSTRUCTION

443. Broadcast Management (3) GC I II Investigation of broadcast management techniques, including both public and commercial broadcasting. P, 150.

444. Readings in Broadcasting (1 to 3) [Rpt./6 units] I II S Individual course of readings approved by instructor to cover subjects not available in other course offerings.

461. Instructional Media Design (3) GC I II Planning and design of instructional systems utilizing radio, television and related media in a variety of learning contexts.

470. The Press and Society (3) GC I II (Identical with Jour. 470)

475. Screen Acting Techniques (3) GC II (Identical with Dram. 475)

493. Internship
   a. Radio-TV Audience Research (1 to 5) I II Open to majors only. P, completion of core courses, 360.
   b. Radio-TV Instructional Services (1 to 5) I II Open to majors only. P, completion of core courses, 461.
   d. Radio Program Production (1 to 5) I II Open to majors only. P, completion of core courses, 310.
   e. Television Program Production (1 to 5) I II Open to majors only. P, completion of core courses, 310.
   f. Radio-Television News (1 to 5) I II Open to majors only. P, completion of core courses, 330.
   g. Film (1 to 5) I II Open to radio/tv majors and gen. fine arts studies majors with cinema option only. P, 315.

494. Practicum
   a. Research (3) I II Open to majors only. P, 360.
   b. Television Directing (1 to 5) I II P, 410.

497. Workshop
   b. Video for Law Enforcement (1) GC

RANGE MANAGEMENT
(See Renewable Natural Resources)

READING

Professors Wilbur S. Ames, Elizabeth M. Antley, Amelia Melnik, Kenneth J. Smith, William J. Valmont
Associate Professors Adela A. Allen, Acting Head, Patricia L. Anders, John M. Bradley, Judy N. Mitchell

The Department of Reading provides pre-service training in reading for prospective teachers. Curricula are available to prepare special reading teachers, reading clinicians, reading supervisors, classroom reading teachers, college teachers, and researchers.

The department offers programs leading to the Master of Arts, Master of Education, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees. For admission and degree requirements, please see the Graduate Catalog.

At the time that the Catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which have been made as a result of the review.

304. Decoding Skills in the Elementary School (2) I II Basic decoding skills needed in reading; methods and materials used in teaching reading. (Identical with Elem. 304)

406. Foundations of Reading Instruction in Spanish (2) GC II Introduction to the theoretical and practical aspects of the reading process, with attention to essential decoding and comprehension skills; special application for teaching Spanish-speaking children to read. Taught in Span. P, Span. fluency. (Identical with M.A.S. 406)

435. Secondary School Reading in the Classroom (3) GC I II Provisions and procedures for evaluating and developing reading skills needed in content areas. (Identical with S.Ed. 435)

480. Literature for Children (3) GC I II (Identical with Li.S. 480)

485. Literature for Adolescents (3) GC I II (Identical with Li.S. 485)

487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)
488. Microcomputer Application in Education (3) GC II S (Identical with Ed.F.A. 488)

494. Practicum
   a. Elementary School Reading (1) I II P, 304. (Identical with Elem. 494a)
   b. Secondary School Reading (1 to 3) I II (Identical with S.Ed. 494b, which is home)
   c. Reading in School Settings (3) I II Credit allowed for one of the following: 494a, 494c, or 494d.
      (Identical with Elem. 494c)
   d. Reading Certification (1) I II S P or CR, 304, 435, or 607.

508. Bilingual Reading (3) I Analysis of reading situations encountered by bilingual students; phonological, semantic and syntactic aspects of instruction; methods and materials. (Identical with Ed.F.A. 508 and M.A.S. 508)

510. Computer Literacy for Teachers (3) I II S Microcomputer operation; software evaluation; use of author systems and word processors in the classroom; computer managed instruction; organization for computer use. P, Ed.F.A. 487.

561. History of Children's Literature (3) II (Identical with Li.S. 561)

571. Classroom Diagnosis and Instruction (3) I II Procedures for diagnosing and developing reading skills for pupils of below-average achievement level. Open to nonmajors only.

594. Practicum
   a. Reading for the Exceptional Child (3) I II P, 304, 406, 435, or 607.

602. Pre-Reading and Beginning Reading Development (3) I II An examination of various aspects involved in pre-reading and beginning reading development, including psychological, sociological, linguistic and educational considerations.

605. Essentials of Reading Instruction (3) I II Theories and principles underlying reading instruction, approaches to teaching reading, basic analysis of reading research.

607. Analysis of Decoding (3) I Phoneme theory; prerequisites for learning phoneme-grapheme associations; teaching word identification skills; examination and analysis of instructional materials and related research. P, 605 or CR.

612. Reading Comprehension: Theories, Research and Methods (3) I II Factors affecting cognitive development; methods of influencing growth in reading comprehension; examination and analysis of instructional materials; research related to comprehension and cognitive development. P, 605 or CR.


628. Field Experience in Reading (3) I II Supervised experience in assessment and teaching of reading skills in the schools; use of developmental, corrective, and remedial techniques and practices.

633. Psycholinguistics and Reading (3) I II Basics in psycholinguistics of reading and reading instruction, with emphasis on the comprehension of written language.

637. Application of Miscue Analysis (3) II 1985-86 (Identical with Elem. 637)

671. Diagnostic Laboratory (3 to 6) [Rpt./6 units] I II Supervised practice in reading assessment; identification of factors influencing reading achievement, evaluation, construction, and administration of assessment procedures; development of interview techniques. Open to majors only. P, 607, 612, 620 or CR.

672. Instructional Laboratory (3 to 6) [Rpt./6 units] I II Supervised practice in teaching reading; preparing, analyzing and critiquing special instructional programs for students. Open to majors only. P, 671 or CR.

680. Investigations in Reading (3) I II Analysis and synthesis of research in reading and its implications and influences on practice.

683. Curriculum Development and Supervision in Reading (3) I II Organizational patterns of reading curricula; approaches to the improvement of reading instruction; personnel relations. Designed for the reading supervisor and the school administrator. (Identical with Ed.F.A. 683)

686. Classroom Reading: Issues, Concerns, Practices (3) I II Critical analyses of principles, procedures and research related to the analysis, assessment, and improvement of reading abilities among individuals and groups at various levels.

695. Colloquium
   b. Issues in Reading (1 to 3) I II
   m. Language, Learning and Reading Disabilities (3) II (Identical with Spec. 695m, which is home.)
795. Colloquium
   a. Problems in Reading (1 to 3) I II [Rpt./15 units]

796. Seminar
   a. Research and Evaluation (1 to 3) I II [Rpt./15 units]

REAL ESTATE
(See Finance and Real Estate)

REGIONAL DEVELOPMENT
(See Geography and Regional Development)

REHABILITATION

Professors Amos Sales, Head, Bob G. Johnson
Associate Professors Marlene Bence, S. Mae Smith, Inez Tucker (Clinical)
Assistant Professor James Organist (Clinical)
Lecturer Thomas L. Fisher

The undergraduate major in rehabilitation will prepare students for selected positions in various areas, including rehabilitation, social, and education services. Trained for case management and client advocacy, students in this program will become skilled interviewers, competent report writers, and able assessors of service eligibility. Students will also become conversant with the philosophy underlying rehabilitation services, the laws that make these services possible, and the agency structure within which services are rendered.

The Rehabilitation Department offers programs leading to the Bachelor of Science in Education, Master of Science, Doctor of Education and Doctor of Philosophy degrees with a major in rehabilitation. For admission and degree requirements for the undergraduate degree, please see the College of Education section of this catalog; for the graduate degrees, please see the Graduate Catalog. Requirements for the 18-unit nonteaching minor include 300, 320a-320b, and 325 and six units from the following: 405, 410, 419, 455, 480, 485.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which have been made as a result of the review.

200a-200b. Introduction to Manual Communication (3-3) 200a : Principles, methods, and techniques of communicating with deaf people, with emphasis on orientation to deafness; history of manual communication and types of hearing loss. 200b : Continuation of 200a, with emphasis on conversational expressive and receptive skills; education and rehabilitation of deaf people; theories of communication with deaf individuals.

210. Introduction to the Health Field (3) I II (Identical with H.R.P. 210)


300. Introduction to Rehabilitation (3) I II Introduction to philosophies and theories underlying rehabilitation and the agencies and personnel providing these services.

320a-320b. Survey of Human Disabilities (3-3) I II Critical study of rehabilitation processes and services for handicapped individuals and groups. P, 300.


405. Fundamental Sign Language (3) GC I II Fundamentals of sign language to develop communication skills for providers of social services for the deaf.

419. Behavior Principles for the Handicapped (3) GC I II (Identical with Spec. 419)
420. Advanced Conversational Sign Language (3) GC I II Comprehensive study of basic sign language idioms and colloquialisms in Ameslan, with emphasis on continued skill building, expressive and receptive ability in Ameslan, and ability to converse with deaf adults. P, 410 or demonstrated proficiency.
425. Advanced Ameslan (3) GC I II American Sign Language, with emphasis on reverse, idioms, and grammatical structure. P, 420.
430. Interpreting for Deaf People (3) GC I II Principles, methods, and techniques of interpreting for deaf people in rehabilitation and other settings. P, 410 or demonstrated proficiency.
435. Advanced Techniques of Interpreting (3) GC I II Emphasis on rapid verbatim interpreting; educational, platform, and religious interpreting and the professional ethics involved; introduction to legal and medical interpreting. P, 430.
440. Perspectives in Health Care Services (3) GC II (Identical with Ph.Pr. 440)
450. Interviewing and Client Services (3) GC I II Intensive study of case procedures and techniques and their application to the functions of rehabilitation and related agencies, with emphasis on the case practices of interviewing. P, 300.
455. Rehabilitation of the Aged (3) GC II Emphasis on aging from the viewpoint of the aging person and those working with the aged.
460. Supervised Casework in Rehabilitation (3) I II Application of philosophies and theories underlying rehabilitation services and the agencies and personnel providing those services. Open to majors only. P, 300, 320b; 450 or CR.
470. Disability and Relationships (3) GC S Effects of disability on interpersonal relationships and ways to assist the disabled person with interpersonal difficulties.
480. Problems of Drug Abuse (3) GC [Rpt./1] I II Survey course for teachers, counselors, and agency workers concerned with drug abuse; examination of community, cultural, and educational approaches to drug use and abuse.
485. Rehabilitating the Public Offender (3) GC I II Components in service delivery to the public offender, how the offender enters the criminal justice system, and treatment and rehabilitation services available.
487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)
488. Microcomputer Application in Education (3) GC I II S (Identical with Ed.F.A. 488)
500. Principles of Rehabilitation (3) I Principles underlying rehabilitation programs and interdisciplinary relationships of agencies engaged in rehabilitation services.
510. Medical Aspects of Disability (3) I II Etiology, therapy, and prognosis of the major disabilities, including drug and alcohol; assessment of physical capacities and limitations; typical restorative techniques.
520. Psychosocial Aspects of Disability (3) I II Exploration of the psychological and sociological aspects of disability; analysis of somatopsychology, psychosomatics, and social psychology.
550. Principles and Practices of Vocational Evaluation (3) I II Understanding work skills and labor market conditions; process of vocational evaluation of rehabilitation clientele; collecting and synthesizing evaluation data and writing meaningful reports.
557. Methods in Marital Therapy (3) I (Identical with C.D.F.R. 557)
560. Role and Function of Workshop Facilities (3) I II Defining the role and function of workshop facilities in rehabilitation; evaluation and production methods; wage and hour regulations; work adjustment methodologies.
600. Counseling Practices in Rehabilitation Setting (3) I II Facilitation training of rehabilitation professionals in their implementation of counseling practices with varied ethnic, age, disability, and dependency populations. 3R, 1L. Open to majors only.
620. Client Assessment in Rehabilitation (3) I II Exploration of the world of work; critical review of vocational choice theories; experiences in the use and interpretation of individual assessment techniques. P, Rhab. 500 or CR.
630. Vocational Planning and Placement (3) I II Problems of physical, mental, social, and emotional disability, as they relate to the formulation of a rehabilitation plan; exploration of the various sources of occupational and career choice information, job placement and development. P, 500, 620.
DEPARTMENTS AND COURSES OF INSTRUCTION

640. Psychosocial Assessment of the Deaf Person (3) II Selection, administration, and interpretation of various psychosocial evaluation instruments used with deaf persons. P, Ed.P. 671, 672a.

650. Construction and Development of Assessment Samples (3) I II Use of occupational information, career exploration and job analysis techniques; development, construction, standardization, and use of work samples and related vocational assessment techniques.


695. Colloquium
a. Rehabilitation Psychology (3) I II
b. Rehabilitation Administration (3) I II
c. Vocational Evaluation (3) I II
d. Rehabilitation of the Deaf (3) I II
e. Group Processes (3) I II

730. Investigations in Rehabilitation Psychology (3) II Identification and analysis of current problems in rehabilitation.

796. Seminar
a. Assessment in Rehabilitation Psychology (3) II P, 500, 620; Ed.P. 672b.
b. Current Issues in Rehabilitation Psychology (3) Open to majors only. P, 500, 620; Ed.P. 692.

RELIGIOUS STUDIES

Committee on Religious Studies

Professors Joseph L. Cowan (Philosophy), Robert Gimello (Oriental Studies), Andrew M. Greeley (Sociology), David Soren (Classics), John Ulreich (English), Donald Weinstein (History)
Associate Professor Peter Machinist (Oriental Studies)
Lecturer Robert A. Burns (Classics), Chairperson

Religious studies is an interdisciplinary program offering a wide range of approaches to the study of various religions.

The major: Thirty units requiring general survey courses in both Asian and Western religious traditions (120, 130 — six units). It also requires six units of courses involving the application of particular disciplinary approaches to the study of religion (233, 411, 439, 522). Finally, the major requires at least nine units each in further study of Western and Eastern religions.

The minor: Twenty units, including 120, 130 and fourteen additional units in religious studies.

120. Western Religions (3) II Religions of the Western World: Judaism, Christianity, Islam.

126. Mythology (3) I II (Identical with Clas. 126)

130. Asian Religions (3) I II (Identical with Or.S. 130)

140a-140b. Oriental Humanities (3-3) (Identical with Or.S. 140a-140b)

233. Philosophy of Religion (3) I (Identical with Phil. 233)


301. Catholic Thought in the 20th Century (3) II Development of Roman Catholic thought beginning with the neo-Thomistic revival under Pope Leo XIII and stressing the documents and theology of the Second Vatican Council.

302. Protestant Thought in the 20th Century (3) I Survey of the various strands of Protestant theology since the turn of the century, with special reference to authors such as Rauschenbusch, Barth, Brunner, Tillich, Bultmann and Bonhoeffer.

303. Epistles of St. Paul (3) I Examination of the religious and cultural background in the Greco-Roman world during the lifetime of St. Paul; analysis of Paul's thought in Acts and the Epistles.
320a-320b. Literature of the Bible (3-3) (Identical with Engl. 320a-320b)
322. Sociology of Religion (3) II (Identical with Soc. 322)
323. Religious Organizations in America (3) II (Identical with Soc. 323)
330a-330b. Chinese Thought (3-3) (Identical with Or.S. 330a-330b)
331. Taoist Meditation Traditions (3) I 1985-86 (Identical with Or.S. 331)
332a-332b. Judaic Thought and Culture (3-3) (Identical with Or.S. 332a-332b)
333. Buddhist Meditation Traditions (3) I (Identical with Or.S. 333)
340. Jesus in Contemporary Thought (3) I 1985-86 Survey of present thinking about the meaning of
Jesus, including humanistic, Jewish, and various Christian interpretations.
370a-370b. History of the Jews (3-3) (Identical with Or.S. 370a-370b)
372a-372b. History and Religion of Israel in Ancient Times (3-3) I (Identical with Or.S. 372a-372b)
374. The Holocaust (3) II 1986-87 (Identical with Or.S. 374)
382. Archaeology and the Bible (3) II (Identical with Or.S. 382)
405a-405b. Medieval Europe (3-3) GC (Identical with Hist. 405a-405b)
407. Intellectual History of Medieval Europe (3) GC II (Identical with Hist. 407)
408. The Renaissance (3) GC I (Identical with Hist. 408)
409. The Reformation (3) GC II (Identical with Hist. 409)
410. History of Hell in Early Europe (3) GC II (Identical with Hist. 410)
411. Anthropology of Religion (3) GC I (Identical with Anth. 411)
416. Tudor-Stuart England (3) GC I (Identical with Hist. 416)
418. Classical Confucianism (3) GC I (Identical with Or.S. 418)
419. Neo-Confucianism (3) GC II (Identical with Or.S. 419)
421a-421b. East Asian Buddhism (3-3) GC (Identical with Or.S. 421a-421b)
427. Religion and Mythology of Mesopotamia (3) GC II 1985-86 (Identical with Anth. 427)
430. Prophecy in Ancient Israel (3) GC II (Identical with Or.S. 430)
431. Indian Religion and Thought (3) GC I II 1985-86 (Identical with Or.S. 431)
432. Islamic Mysticism (3) GC II 1986-87 (Identical with Or.S. 432)
434. Islamic Thought (3) GC II (Identical with Or.S. 434)
435. Jewish Mysticism (3) GC II 1985-86 (Identical with Or.S. 435)
437. Japanese Religion (3) GC I (Identical with Or.S. 437)
445. Hindu Mysticism (3) GC II 1986-87 (Identical with Or.S. 445)
455. Introduction to Rabbinic Literature (3) GC II (Identical with Or.S. 455)
480. Dialectical Theology (2) [Rpt.] I Origin and nature of dialectical theology; reading and discus-
sion of authors such as Karl Barth, Emil Brunner and Friedrich Gogarten. P, 120, 130.

REMOTE SENSING

Committee on Remote Sensing

Professors Philip N. Slater (Optical Sciences), Chairperson, Victor R. Baker (Geosciences),
Dinshaw N. Contractor (Civil Engineering), Benjamin N. Herman (Atmospheric
Sciences), Donald F. Post (Soils, Water and Engineering), John A. Reagan
(Electrical and Computer Engineering), Richard W. Reeves (Geography and
Regional Development)

Associate Professors Charles E. Glass (Mining and Geological Engineering), Robert A.
Schowengerdt (Electrical and Computer Engineering; Arid Lands Resource
Sciences)
Remote sensing concerns the collection of information related in some way to the Earth's natural resources or environment. Data are primarily collected by satellite and aircraft systems in conjunction with localized ground-based surveys and measurements. The data are processed by digital computer or optical techniques to extract information of value to Earth scientists and resource and environment managers at the local, state, and federal levels.

The Committee on Remote Sensing offers no major at the present time but minor programs are available for doctoral students with majors in disciplines within the Colleges of Agriculture, Arts and Sciences, Business and Public Administration, Engineering, and Mines; and in the Office of Arid Lands Studies and the Optical Sciences Center. For further information concerning the minor, please see the Graduate Catalog.

RENEWABLE NATURAL RESOURCES

Programs of the School of Renewable Natural Resources concern the management of resources for water, wood, forage, recreation, wildlife, fisheries, soil and aesthetic values. The Bachelor of Science in Renewable Natural Resources degree is available with majors in natural resource recreation, range management, watershed management and wildlife and fisheries science. A major in landscape architecture for the Bachelor of Landscape Architecture and Master of Landscape Architecture degrees is also offered. In addition, a student may obtain the degree of Master of Science or Doctor of Philosophy with a major in range management, watershed management, wildlife and fisheries science, or renewable natural resources studies.

Renewable Natural Resources

135. Conservation of Natural Resources (3) I Conservation and multiple use of renewable natural resources, including forest, watershed, range, wildlife, and recreation; history of forest and range use and its present status. Zwolinski

202. Forest and Range Plants (2) I Plant classification, identification and nomenclature, with emphasis on the grass, rose, legume, composite, pine, and other plant families containing important forest and range plants. 1R, 3L. P, Ecol. 104 or PI.S. 100. Ogden

295. Colloquium (1 to 3) II
a. Natural Resource Management

321. Natural Resource Measurements (3) I Study of basic land, climatic, hydrologic and vegetative measurements used in management of natural resources; presentation and interpretation of resulting data. 2R, 3L. P, Math. 118; 160 or 263. Lehman

477. Economics of Water and Land Resources (3) GC I (Identical with A.Ec. 477)

546. Principles of Research (3) I Philosophy of science and research, the scientific method, problem selection, problem analysis, study plans, scientific communications. Klemmedson
The curriculum leading to the B.L.A. is a five-year program* comprising two preprofessional years and three professional years designed to prepare the student to meet the demands of the profession and to qualify for professional registration in the state. While the principles of professional practice are universal, the program, which is accredited by the American Society of Landscape Architects, encourages strong linkages in renewable natural resources and recognition of the unique qualities of the arid Southwest.

In addition to complying with University admission requirements, all applicants to the program must file an Application for Admission to the Professional Major with the division chairman by July 1 preceding the intended fall admission. Students are admitted to the professional major in the fall semester only, after having completed the following courses: L.Ar. 101 (two units), 110, 111 (six units), 250 (three units); Math. 117e and 118 (five units); Art. 101 (three units); Chem. 101a (three units), 102a (one unit); Phys. 102a (three units), 180a (one unit); P.I.S. 100 (three units) or Ecol. 105 (three units), 102 (four units); S.W. 200 (three units), 201 (one unit); R.N.R. 135 (three units); C.E. 151 (three units); Geog. 103aR or 103bR (three units); Econ. 210a or A.Ec. 217 (three units); Engl. 101 and 102 or 102 and 103 (six units); Sp.C. 102 (three units); three units of soc. sci. electives.

Applicants will be evaluated by the Landscape Architecture Admissions Committee on the basis of the following criteria: grade point average, course work, statement of intent, work experience, special interests, and creative endeavors. Admission will be restricted to those applicants with the highest evaluation. It is unlikely that a student with an overall grade point average less than 2.5000 will be admitted. Applicants seeking advanced standing will be placed at the Year II level until they fulfill all requirements of the preprofessional phase.

*The curriculum is presently under revision. For current information, contact the departmental office.

101. Introduction to Landscape Architecture (2) I Introduction to the profession of landscape architecture.

110. Landscape Graphic Communication (3) I Introduction to materials and techniques of graphic communication. 6L P; Art. 101.

111. Landscape Design Process (3) II Introduction to programming, analysis and problem solving in landscape architectural design. 6L P; 110.

250. Landscape Analysis (3) II Introduction to basic analytical methods resulting in the solution of site problems; analysis procedures, data collection, data categorization, statistical techniques, computer applications. Field trips. P; 101, 110.

334a-334b. Plant Materials (3-3) II I Plant materials used in landscape design. 2R, 3L. Field trips. P, Ecol. 105 or P.I.S. 100. (Identical with P.I.S. 334a-334b)


410. Site Planning and Design (5) GC I Problems in urban and rural environments; site planning and design principles and issues. 2R, 9L. P; 111
DEPARTMENTS AND COURSES OF INSTRUCTION

411. Urban Landscape Planning and Design (5) GC II Planning and design problems in urban environments. 2R, 9L P, 410.

412. Urban/Rural Landscape Planning and Design (5) GC I Planning and design problems at the urban/rural interface; issues of growth and change. 2R, 9L P, 411.

413. Regional Landscape Planning and Design (5) GC II Planning and design problems of regional scope and emphasis. 2R, 9L P, 412.

414. Internship Preparation (1) GC II Orientation and proposal development for off-campus project. P, 412


428. Field Methods in Environmental Psychology (3) GC II (Identical with Psyc. 428)

435. Planting Design (3) GC II Application of plant materials to problems in landscape design. 2R, 3L. Field trips. P, 111, 334 a or 334b.

441. History and Theory of Landscape Architecture (3) GC II Examination of the historical background and theoretical basis of landscape architecture. P, 410.

450. Landform, Grading and Drainage (3) GC I Introduction to topography, contour, grading, and drainage. 2R, 3L. Field trips. P, 111, 250.

451. Site Engineering (3) GC II Grading, road layout, utilities, and other site engineering considerations. 2R, 3L. Field trips. P, 450.

452. Landscape Construction (3) GC I Construction materials and methods in landscape architecture; introduction to working drawings and specifications. 2R, 3L. P, 451.

453. Professional Practice (3) GC II Professional services, contract documents, contract administration, office organization, ethics, professional registration, roles of the landscape architect, the practice of landscape architecture. P, 415.

497. Workshop
i. Community Design for Non-Designers (3) GC I (Identical with Arch. 497i, which is home)

533. Critical/Significant Environments (3) I Assessment and management of natural and cultural critical environmental resources, including natural, scenic and historic areas, habitats of rare and endangered species, and unique resource combinations. 2R, 3L. Field trips.

595. Colloquium
a. Systems Ecology for Planners and Designers (3) I
b. Western Wildland Planning and Design (3) I

596. Seminar (3) I
u. Interdisciplinary Environment-Behavior-Design (Identical with Idis. 596u, which is home)

696. Seminar (1 to 3) I II
a. Landscape Architecture (1) [Rpt.]

Range Resources

E. Lamar Smith, Chairperson of the Division

Range Management

Training in range management provides students with the knowledge and skills necessary to manage rangelands for maximum and sustained production of forage for livestock and wildlife while maintaining the value of the lands as watersheds and recreation areas. Employment opportunities are with state and federal resource management agencies, private ranches, management and consulting firms and foreign assistance programs.

In addition to the requirements for the curriculum in natural resources, the following courses are required for range management: An.S. 430; 477 or 474; M.C.B. 460 or Ecol. 260; Chem. 103a-103b, 104a-104b, 241a; C.Sc. 111 or S.I.E. 272 Ecol. 102, Econ. 201a-201b; Eng. 101 or 103; 102; 307 or 308; Geos. 101a, 102a; Math. 123; 160 or 263; N.R.R. 381; Phys. 102a; Ecol. 104; Ra.M. 305, 318, 382, 416, 446, 456, 486, 487, 495a; R.N.R. 202, 295a, 321; S.W. 200, 201, 431; Sp.C. 102; Ws.M. 422, 459; W.F.Sc. 444.

305. Range Management (3) I II Historical, political, physiological and ecological factors affecting range use; range plants and grazing regions; range treatments and improvements; range evaluation and planning; multiple use interrelationships. Field trips. P, P.I.S. 100 or Ecol. 104.
318. **Range Field Studies (2)** S Field course covering the practical application of the principles of range management and ecology; grazing problems on forest, brush and grass ranges; noxious plant control; revegetation techniques; multiple use management. Fee $100.

382. **Range Plants and Communities (3)** II Identification, value and habitat relationships of important range plants, and description of major range plant communities. 2R, 3L. P, R.N.R. 202.


446. **Range Improvements (3)** GC I Range improvements through grazing systems, noxious plant control, cultural and mechanical elements of revegetation, runoff control, and specialized range and critical area treatments. 2R, 3L. Weekend field trips. P, 305, Ecol. 102.


480. **Forest Policy and Administration (3)** GC II (Identical with Ws.M. 480)

486. **Range Planning and Economics (3)** GC I Principles of management planning for rangelands and economic analysis of management alternatives; includes case studies, linear programming, computer simulation. P, 305; A.Ec. 215 or 476 or Ws.M. 440.

487. **Ranch Planning (2)** GC II Preparation of a range management plan for a ranch enterprise including field data collection, economic and environmental analysis of management alternatives. 6L. All-day field trips. P, CR 456; 486.

495. **Colloquium**
   a. Range Management (1) II P, 305.

595. **Colloquium**
   a. Rangeland Policy (2) I 1986-87
   c. Range Herbivores (2) I 1985-86

696. **Seminar**
   a. Range Management (1) [Rpt.] I II

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**Forest-Watershed Resources**

Gordon S. Lehman, Chairperson of the Division

**Watershed Management**

Watershed management courses, which consider the management needs of whole watersheds and their multiple uses, qualify the student for a professional career. Students may obtain a major in watershed management with an option in watershed hydrology or forest-watershed management. The forest-watershed option provides students with the education needed to manage forests for multiple uses and benefits, with some emphasis on water and dryland forests. The watershed management program is accredited by the Society of American Foresters.

In addition to the requirements for the curriculum in natural resources, the following courses are required for both options in watershed management: Chem. 103a-103b, 104a-104b; Ecol. 102; Econ. 201a-201b; Engl. 101 or 103; 102; 307 or 308; Ecol. 104 or P.L.S. 100; Geos. 101a, 102a; Math. 160; Phys. 102a or 103a; 180a; Ra.M. 305; R.N.R. 202, 295a, 321; S.W. 200, 201; Sp.C. 102; Ws.M. 410, 460, 462. The watershed hydrology option also requires: Atmo. 171; M.C.B. 460; Chem. 241a; C.E. 471; Math. 125a-125b, 223; Phys. 102b or 103b; 180b; Hydr. 405 or S.W. 470; 406 or A.M.E. 331a; S.L.E. 272; Ws.M. 342 or Ra.M. 382; Ws.M. 440 or A.Ec. 477. The forest-watershed management option also requires: Chem. 241a and M.C.B. 460 or nine units of m.a.p. electives; C.Sc. 111 or S.L.E. 272; Math. 123 or 125a; N.R.R. 381; Ws.M. 250, 342, 408, 415; 420 or 422; 430, 440, 480, 481, W.F.Sc. 325. Students in the forest-watershed management option selecting the m.a.p. electives may use up to six units of m.a.p. courses to fulfill their social science/humanities requirement.

250. **Forest Pathology (3)** II (Identical with PL.P. 250)

330. **Introduction to Remote Sensing (3)** I (Identical with Geog. 330)
342. Silvics and Dendrology (4) I Application of ecological principles to forests; silvical properties and identification of American forest trees and shrubs. 3R, 3L. P, S.W. 200, Ecol. 102, R.N.R. 202. Lehman

408. Forest Fire Management (3) GC I Forest fire behavior, as influenced by fuels, weather, topography; ecological effects of fire; prevention, detection and control methods; fire danger rating and use of prescribed fire in forest management. Zwolinski

410. Silviculture (3) GC II Principles and technical procedures for reproducing, planting, and tending forest crops, with reference to watershed. P, 342 or Ra.M. 382; Ecol. 102.


420. Photogrammetry (2) GC I 1986-87 Aerial photographic planning for natural resource management; stereoscopic principles applied to planimetric and topographic mapping. 1R, 3L. P, Math. 118.

422. Photointerpretation (2) GC II Reading and interpretation of aerial photographs; natural resource inventory from aerial photographs; remote sensing techniques. 1R, 3L. Lehman

425. Wood Products (2) GC II 1986-87 Harvesting, processing, and marketing of wood products. P, Ecol. 104 or P.I.S. 100. Ffolliott

427. Bioclimatology (3) GC II (Identical with Atmo. 427)

430. Forest Resource Management (3) GC I Decision making in the management of forest lands. 2R, 3L. P, 410, 415, 440.

440. Forest Resource Economics (3) GC II Economics of the production of goods and services from forest lands; decision making in microforest resource management situations; supply and demand relationships for products of forest resources. P, Econ. 201a, 201b, Math. 123. (Identical with A.Ec. 440) King

459. Rangeland Water Management (3) GC II Hydrologic principles as applied to arid and semi-arid ecosystems with water management applications in range management, wildlife, fisheries and recreation. Credit is allowed for this course or 462, but not for both. P, Math. 160 or 263 and S.W.201.

460. Watershed Hydrology (3) GC I Application of fundamental principles to quantifying the basic hydrologic processes occurring on watersheds. P, Geos. 100a; S.W. 200, 201, Math. 160. (Identical with Hydr. 460) Gay

462. Watershed Management (3) GC II Evaluating hydrologic impacts of management activities on watersheds to include silviculture, range, mining, and recreation use.

464a-464b. Introduction to Dendrochronology (3-3) GC (Identical with Geos. 464a-464b)

471. Water Quality Control (3) GC II (Identical with C.E. 471)

476. Natural Resource Economics (3) GC II (Identical with A.Ec. 476)


481. Simulation of Renewable Natural Resources (3) GC II Simulation of management impacts for multi-resource decision-making, including biologic, economic, and social factors. 2R, 3L. P, 430.

487. Forestry in Arid Environments (4) GC S Management and development of wood and other forest resources in developing nations. Designed for mid-level and upper-level resource professionals from developing nations. Field trip.

488. Development and Management of Water Resources (6) GC S Development and management of water resources on forest watersheds and rangelands in developing nations. Designed for mid-level and upper-level resource professionals from developing nations. Field trip.

489. Forest-Watershed Field Studies (4) II Field study of forest entomology and pathology, fire ecology (1 unit equiv.); forest measurements, inventory and analysis (2 unit equiv.); harvesting, processing of primary wood products (1 unit equiv.). P, 342, 410, 415. Fee $80.


531. **Dryland Forestry (2)** II 1986-87 Utilization and management of forest resources in dry environments; biophysical and socio-economic issues related to the development of forest commodities and amenities. P. 342.

532. **Agroforestry (2)** I 1985-86 Ecological and socioeconomic factors related to the planning and implementation of agroforestry systems. P. 531.

545. **Systems Analysis in Watershed Management (3)** II 1986-87 Application of hydrologic modeling and system analysis for optimizing management of watersheds. P. 460, 462.

557. **Quantitative Dendrochronology (3)** I 1986-87 (Identical with Geos. 557)

558. **Plant-Water Relations (3)** II (Identical with M.C.B. 563)

565. **Hydrochemistry (3)** II 1985-86 (Identical with S.W. 565)

566. **Botanical Basis of Dendrochronology (3)** II 1985-86 (Identical with Geos. 566)

576a-576b. **Advanced Natural Resource Economics (3-3)** (Identical with A.Ec. 576a-576b)

595. Colloqulm
   a. Non-Point Source Pollution from Watersheds (3) II P, 460.
   c. Urban Forestry (2) II 1985-86
   d. Fire Ecology (2) II

655. **Dendroclimatology (3)** II 1986-87 (Identical with Geos. 655)

696. Seminar
   a. Watershed Management (1) [Rpt.] I II

**Wildlife, Fisheries and Recreation Resources**

William W. Shaw, Chairperson of the Division

**Wildlife and Fisheries Science**

A major in wildlife and fisheries science provides the student with a broad background for a professional career with state fish and game departments, with federal fish and wildlife or other natural resource management agencies, or for graduate study. In addition to the course requirements, it is recommended that students seek summer employment in related work with a state or federal agency. Students may obtain a major in wildlife and fisheries science with an option in wildlife ecology or in fisheries science.

In addition to the requirements for the curriculum in natural resources, the following courses are required for both options in wildlife and fisheries science: Chem. 103a-103b, 104a-104b, 241a, 243a; Ecol. 102; Econ. 201a; 201b or A.Ec. 217; Eng. 101 or 103, 102; Ecol. 104; 320 or 321 or An.S. 213; N.R.R. 381; Phys. 102a, 180a; S.W. 200, 201; Sp.C. 102; W.F.Sc. 125. The wildlife ecology option also requires: Ecol. 472; Eng. 307 or 308; Math. 123 or 125a; 160 or 263; Ra.M. 382, 416; R.N.R. 202, 295a, 321; V.Sc. 400a or 400b; W.F.Sc. 444, 446, 448, 484, 485. The fisheries science option also requires: Chem. 241b, 243b or V.Sc. 250; C.E. 471; Ecol. 477; Geos. 101a, 102a; Math. 117e, 118, 263; W.F.Sc. 441, 455R, 455L, 482.

125. **Introduction to Wildlife Conservation (2)** I Survey of conservation history, ecological principles, wildlife management techniques, and contemporary wildlife conservation issues. Intended for non-majors. Shaw

213. **Animal Genetics (3)** I (Identical with An.S. 213)

325. **Introduction to Wildlife and Fisheries Ecology (3)** I Study of the nature and importance of wildlife and fisheries resources, basic principles of fish and wildlife biology and management; and contemporary issues in the field. P, Ecol. 102. Krausman/Matter

401. **Aquatic Entomology (3)** GC II 1986-87 (Identical with Ento. 401)

430. **Principles of Nutrition (3)** GC I II (Identical with An.S. 430)

441. **Limnology (4)** GC I Study of lakes and streams; biological characteristics, as related to physical, chemical, geological, and historical processes operating on fresh waters. 2R, 6L. Weekend field trips. P, six units of chem. or phys. with lab. (Identical with Ecol. 441) Matter

444. **Wildlife Management (4)** GC I Management of wildlife as a resource; characteristics of wildlife species; principles of population dynamics in wildlife populations. 3R, 3L and field work. Weekend field trips. P, 125, Ecol. 104; 102 or Ra.M. 416. Krausman
DEPARTMENTS AND COURSES OF INSTRUCTION

446. Wildlife Management Techniques (4) GC II Field and lab. methods used in wildlife management; evaluation of wildlife habits; census, productivity, diagnosis, and control of wildlife populations. 2R, 6L and field work. Weekend field trips. P, 444.

448. Current Problems in Wildlife Ecology (1) GC [Rpt.] I Discussions and assignments covering current problems, including the biological, economic, aesthetic, political, and sociological phases of wildlife management. P, 444 or 446. Sowls

455R. Fishery Management (3) GC II Methods and concepts pertaining to fishery investigations and management; application of principles for production of optimum fisheries to benefit man. P, 441 or 444. Matter

455L. Fishery Management Laboratory (1) GC II Laboratory methods pertaining to fishery investigations and management. P, CR 455R, 482. Matter

482. Ichthyology (4) GC I (Identical with Ecol. 482)

484. Ornithology (4) GC II (Identical with Ecol. 484)

485. Mammalogy (4) GC I (Identical with Ecol. 485)

584. Selected Studies of Birds (2) I II (Identical with Ecol. 584)

595. Colloquium
a. Big Game Management (2) I 1986-87 P, 444.
c. Wildlife Habitat Analysis (2) II 1985-86.

630. Issues in Fishery Science (2) [Rpt.] II Procedures for critical evaluation of diverse fishery and aquatic science topics. Tash/Ziebell

649. Fishery-Water Quality Relationships (2) I Pertinent water quality parameters essential for fish life, and the effects of various substances and their interrelationships to fish and aquatic organisms. P, 441 or 455R; Chem. 241a. Ziebell

696. Seminar (1 to 3) I
a. Fish and Wildlife Ecology (1) [Rpt.]

Natural Resource Recreation

Students in the natural resource recreation program are qualified to pursue professional careers with federal and state agencies as recreation specialists, or with private organizations. Sufficient flexibility has been created in the program to allow students to emphasize additional study in the professional areas of water-based recreation, resource planning, interpretation, park management administration and forest recreation management.

In addition to the requirements for the curriculum in natural resources, the following courses are required for natural resource recreation: Chem. 103a-103b, 104a-104b; Ecol. 102; Econ. 201a-201b; Engl. 101 or 103; 102; 307 or 308; W.F.Sc. 125; Ecol. 104; Geos. 101a, 102a; Math. 118, 160; 123 or 125a; 381, 388, 395a, 424, 470, 475; Phys. 102a, 180a; Ra.M. 305, R.N.R. 202, 295a, 321; S.W. 200, 201; Sp.C. 102; Ws.M. 410; 342 or Ra.M. 382; 416; 480 or Pol. 481; W.F.Sc. 444; twelve units of technical electives.

381. Natural Resource Recreation (2) I Recreation concepts, needs, land planning and management techniques for outdoor recreation in natural areas.

388. Environmental Interpretation (3) II 1986-87 Philosophy and techniques of interpreting natural environment through media, visitor centers, nature trails and interpretative planning and design. 2R, 3L. P. 381. Shaw

395. Colloquium
a. Recreation (2) I 1985-86 Open to majors only. P, CR 388, 424.


425. Administration of Recreation (3) II (Identical with Ex.S.S. 425)

470. Economics of Outdoor Recreation (3) GC II 1985-86 Application of economic tools to recreation planning and management, including recreation demand and supply, recreation use projection methods, recreation resource valuation and policy issues. P, Econ. 201b or A.Ec. 204; Math. 160. (Identical with A.Ec. 470) King
Recreational Behavior (2) GC II 1985-86 Theories of leisure behavior and their implications for management of natural resources for outdoor recreation. P, 381, 388.

Colloquium

ROMANCE LANGUAGES
Committee on Romance Languages (Graduate)

Professors Robert terHorst (Spanish and Portuguese), Dana A. Nelson (Spanish and Portuguese)
Associate Professors Ingeborg Kohn (French and Italian), Henri Servin (French and Italian)

The Committee offers a Masters of Arts degree in Romance Languages. Administered by the Department of French and Italian and the Department of Spanish and Portuguese, it is primarily intended for future high-school or junior-college teachers and enables graduate students to acquire a sound foundation in fundamental aspects of Romance languages. For further information, including specific course suggestions for this program, please inquire in either department.

For admission and degree requirements, please see the Graduate Catalog.

Introduction to Romance Philology (3) GC I 1986-1987 (Identical with Span. 422)
Pedagogical Linguistics: Applied Linguistics for Teachers (3) GC II (Identical with Or.S. 429)

RUSSIAN AND SLAVIC LANGUAGES

Professors John Garrard, Head, Joe Malik, Jr.
Associate Professors Alexander Dunkel, Margaret Gibson, Boriss Roberts
Assistant Professor Adele Barker
Lecturer Delbert Phillips

The department’s emphasis is on building competence in the Russian language as preparation for government service, business careers, teaching, graduate study and research.

The department offers the degrees of Bachelor of Arts and Master of Arts with a major in Russian. A Bachelor of Arts in Education and a Master of Education are also available with a teaching major in Russian. For graduate admission and degree requirements, consult the Graduate Catalog.

The major: 40 units (in addition to 101a-101b), including 201a-201b or 205a-205b, 207a-207b, 301a-301b, 305a-305b, 307a-307b, 405a-405b, 407a-407b. No fewer than 28 units must be upper-division course work in the Russian language, no less than 18 of which must be taken in residence. In addition, the student must take 310 and three upper division units in either (a) the history of Russia or the Soviet Union, or (b) government or politics of the Soviet Union. No more than 3-6 units of independent study can apply to the major. It is recommended that students contemplating graduate study in Russian take 300a - 300b - 300c, Russian Literature in Translation, and/or 250a-250b, Russian Humanities in Translation.

The supporting minor: 20 units selected from university-wide disciplines with the assistance and approval of the major adviser.

The teaching major: 34 units (in addition to 101a-101b) including 201a-201b, 207a-207b, 301a-301b, 305a-305b, 307a-307b, 407a-407b. 310 is highly recommended.

The teaching minor: 22 units (in addition to 101a-101b), including 201a-201b, 207a-207b, 301a-301b, 307a-307b.

Honors: The department participates in the Honors Program.

101a-101b. Elementary Russian (4-4) Both 101a and 101b are offered each semester. (The first year of work offered in a foreign language shall not be counted toward a minor.) Phillips
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>201a-201b</td>
<td>Intermediate Russian (4-4)</td>
<td>P, 101b</td>
<td></td>
</tr>
<tr>
<td>205a-205b</td>
<td>Scientific Russian (4-4) Alternate course for 201a-201b, for students interested in reading and translating scientific Russ.</td>
<td>P, 101b</td>
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<tr>
<td>207a-207b</td>
<td>First Level Russian Conversation (2-2)</td>
<td>P, 101b</td>
<td></td>
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<tr>
<td>250a-250b</td>
<td>Russian Humanities in Translation (3-3) 250a: I The Quest for Identity: Russia’s cultural heritage—literature, art, music, architecture, religious tradition—from the earliest beginnings through the 19th century. 250b: II The Search for Utopia: 20th century literature, art, music, architecture, film, and theater in pre- and post-revolutionary Russia and the emigration. 250a is not prerequisite to 250b.</td>
<td>P, 101b</td>
<td></td>
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<tr>
<td>300a-300b-300c</td>
<td>Russian Literature in Translation (3-3-3) Readings and discussion of representative Russian literary works from the earliest times through the Soviet period. Courses may be taken in any order.</td>
<td>P, 101b or 205b</td>
<td></td>
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<tr>
<td>301a-301b</td>
<td>Advanced Composition and Grammar (3-3)</td>
<td>P, 201b or 205b</td>
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<tr>
<td>307a-307b</td>
<td>Second Level Russian Conversation (2-2)</td>
<td>GRD P, 207b</td>
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<td>310.</td>
<td>Russian Civilization and Culture - Pre-Christian Era to the Present (3)</td>
<td>I Selected topics in Russian culture and civilization: architecture, film, fine art, literature, music and theater within their artistic, historical, ideological and sociological contexts. Taught in English. Open to non-majors. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).</td>
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<tr>
<td>405a-405b</td>
<td>Survey of Russian Literature (3-3)</td>
<td>GC Historical survey of Russian literature from the earliest times to the Soviet period; designed to acquaint students with literary terminology and facilitate comprehension of lectures in Russ. Advanced degree credit available only with departmental permission.</td>
<td>P, 301b or 305b</td>
</tr>
<tr>
<td>407a-407b</td>
<td>Third Level Russian Conversation (3-3)</td>
<td>P, 301b</td>
<td></td>
</tr>
<tr>
<td>501a-501b</td>
<td>Russian Stylistics (3-3)</td>
<td>Designed to improve the student’s practical mastery and understanding of Russ. at a higher and more sophisticated level.</td>
<td>P, 301b</td>
</tr>
<tr>
<td>507a-507b</td>
<td>Advanced Russian Conversation (3-3)</td>
<td>P, 407b</td>
<td></td>
</tr>
<tr>
<td>579.</td>
<td>Problems of Teaching Russian (3)</td>
<td>Survey of modern methods of language teaching, with emphasis on the particular problems presented by Russ.</td>
<td></td>
</tr>
<tr>
<td>581.</td>
<td>Russian Phonology and Morphology (3)</td>
<td>P, 301b or 305b</td>
<td></td>
</tr>
<tr>
<td>583.</td>
<td>History of the Russian Language (3)</td>
<td>I P, 301b or 305b</td>
<td></td>
</tr>
<tr>
<td>684.</td>
<td>Pushkin and Lermontov (3)</td>
<td>I 1985-86 Examination of prose and poetry of Pushkin and Lermontov.</td>
<td>P, 405b</td>
</tr>
<tr>
<td>685.</td>
<td>Old Church Slavic (3)</td>
<td>A study of Old Church Slavic language and its relationship to Old Russian and Modern Russian.</td>
<td>P, 301b or 305b</td>
</tr>
<tr>
<td>686.</td>
<td>Russian Drama (3)</td>
<td>II 1986-87 Examination of the major dramatic works of nineteenth- and twentieth century Russian playwrights.</td>
<td>P, 405b</td>
</tr>
<tr>
<td>696.</td>
<td>Seminar</td>
<td>d. Russian Literature: 20th Century (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Slavic Philology (3)</td>
<td>e. West Slavic Literature (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Russian Literature: 18th Century (3)</td>
<td>c. Russian Literature: 19th Century (3)</td>
<td></td>
</tr>
</tbody>
</table>

**SECONDARY EDUCATION**


Associate Professors Margaret B. Fleming, Bruce R. Ledford, Glenn S. Pate, James R. Rankin, D. Paul Robinson

Assistant Professors George Babich, Jacqueline J. McMahon, Janice L. Streitmatter

Lecturer Edward J. Van Metre (*Emeritus*)
Programs of the department are directed toward the preservice preparation of secondary school teachers and the continuing inservice education of certified members of the teaching profession.

The department offers the Bachelor of Arts in Education and Bachelor of Science in Education with majors in subjects taught in Arizona middle/junior and senior high schools. An instructional program is available to students preparing for educational services positions in business, government, military, social services, adult education, and industry. In addition, the department offers graduate programs leading to the Master of Education and Educational Specialist degrees with a major in educational media. The degrees of Master of Education, Master of Arts, Master of Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy are also available.

For information regarding the professional education sequence, please see the College of Education section of this catalog. Requirements for teaching majors and minors are listed under the appropriate departments in the Departments and Courses of Instruction section.

At the time that the Catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

225. Introduction to Teaching (3) I II S Teaching as a profession: examination of current issues and trends, personal career development, and exploration of the social foundations of American education. Observation in elementary and secondary schools. 2R, 3L.


338. The Teaching of Secondary School Subjects Specific methods, objectives, organization of subject matter, and evaluation in the various subjects. P, passing score on ATPE.

b. Business (3) I (Identical with B.C.Ed. 338b)
h. Science (3) I I
j. Bilingual (3) I I
m. Secondary School Music (3) I (Identical with Mus. 338m)
t. Theatre Arts (3) I (Identical with Dram. 338t)
u. Social Studies (3) I
y. Mathematics (3) I

NOTE: All specific methods courses, or courses in the teaching of the several high school subjects, are listed under the general number 338, with letters designating the teaching areas. Required of prospective secondary teachers.

403. Study of Exceptional Children (3) GC I II (Identical with Spec. 403)

405. Mathematics in the Secondary School (3) GC II Study and analysis of curriculum changes in school mathematics, with emphasis on the design and content of experimental programs such as SSMCIS. P; three units of ed.; Math. 125b. (Identical with Math. 405)

408. English as a Second Language in Bilingual Education (3) GC I II (Identical with Engl. 408)

409. Principles of Vocational Education (2) II Social and economic values of vocational education; federal laws, state policies, and administration; theories and principles, with special reference to programs in the secondary school. P, CR 338a, A.Ed. 385. (Identical with A.Ed. 409)

410. Teaching English Composition (3) GC I II (Identical with Engl. 410)

411. Teaching of Literature (3) GC I II (Identical with Engl. 411)
412. The Teaching of the English Language (3) GC I II (Identical with Engl. 412)
414. Teaching of Modern Languages (3) GC II Specific methods, objectives, organization of subject matter and evaluation in modern languages. (Identical with Fren. 414 and Span. 414)
417. Media in Instruction (3) GC I II S Basic design and production of media for instruction; selection and integration of materials; equipment operation. (Identical with Elem. 417 and Li.S. 417)
418. Educational Photographic Media (3) GC I Basic photographic techniques, as applied to the teaching process; still and motion picture photography; individual training in filming, developing and editing. Field trip.
419. Bilingual/Bicultural Education Curriculum Development (3) GC II (Identical with Ed.F.A. 419)
421. Pedagogical Linguistics: Applied Linguistics for Language Teachers (3) GC II (Identical with Or.S. 421)
422. Secondary School Reading in the Classroom (3) GC I II (Identical with Rdng. 422)
423. Instructional Systems Curriculum Development (3) GC I II S Basic skills and knowledge required for curriculum developers to analyze, design, construct and evaluate instructional programs.
424. Implementing Systems Instruction (3) GC I II S Management and evaluation of systems instructional environment; concentration on management styles and internal and external evaluations.
425. Advanced Instructional Methods (3) GC I II S Theory and application of instructional methodologies; development and implementation of units of instruction using the methodologies studied.
426. Classroom Management for Training (3) GC I II S Strategies and objectives used in managing the learning environment, controlling student problems, and implementing due process procedures.
427. Techniques of Teaching Adults (3) GC II Techniques and issues of adult learning and the dynamics of the teaching and learning processes.
428. Teaching Vocational Office and Distributive Education (3) GC II (Identical with B.C.Ed. 428)
429. Development and Instruction of Adult Vocational Education Programs (3) GC I (Identical with B.C.Ed. 429)
430. Organization and Supervision of Vocational Education Programs (3) GC I (Identical with B.C.Ed. 430)
431. Cooperative Vocational Education Programs (3) GC II (Identical with B.C.Ed. 431)
432. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 432)
433. Microcomputer Application in Education (3) GC I II S (Identical with Ed.F.A. 433)
434. Internship a. Student Teaching in Secondary School (6 to 10) I II P, Ed.P. 311; 329, 330, 435; passing score on ATPE, 338 or CR; CR 494b. Students must meet all other College of Education requirements and have satisfactory grades in major subject and professional courses. Application should be made several months in advance.
437. Methods and Materials in Bilingual Education (3) I II (Identical with Elem. 526)
438. Career Education (3) I (Identical with Coun. 538)
439. The Middle School/Junior High (3) II History, purposes, curriculum, and administration of the middle school/junior high.
440. Law for Teachers and Student Personnel Workers (3) II (Identical with Ed.F.A. 560)
441. Colloquium a. Language Experiences in Learning (3) II S (Identical with Elem. 595a, which is home.)
442. Workshop a. Educational Film and Video in the Classroom (3) I
b. Newspaper in the Classroom (1 to 3) I II S (Identical with Elem. 597e, which is home)
c. Investigating the Environment (1 to 3) I II S (Identical with Elem. 597f)
d. The Teaching of English (3) I II S (Identical with Engl. 597o, which is home)
r. Curriculum for Self Development (3) S (Identical with Elem. 597r)
w. Southern Arizona Writing Project (3 to 9) [Rpt./12 units] I II S (Identical with Elem. 597w and Engl. 597w)

612. English Grammar for ESL (3) I (Identical with Engl. 612)
613. Teaching of ESL (3) I (Identical with Engl. 613)
616. Coordination of Instructional Media Programs (3) II Study of organization and distribution practices of media utilization; budgeting, public relations, and implementation of media preparation and media-service programs. P, 417. (Identical with Elem. 616 and Li.S. 616)
617. Preparation of Instructional Materials (3) II Study of techniques used in the development of instructional materials and processes. P, 417. (Identical with Elem. 617 and Li.S. 617)
618. Research Trends in Instructional Technology (3) I Past and current trends in instructional technology.
620. Classroom Communication and Interaction (3) II The teacher's role in promoting effective communication and interaction in the classroom situation.
631. Curricular Studies in School Mathematics (3) II 1986-87 Experimental programs in school mathematics, with emphasis on selection of content and on problems in design and evaluation. (Identical with Elem. 631)
633. Student Activities and Government (3) I Philosophy, values, and coordination of school activities in the secondary school, with emphasis on the theory, organization, and supervision of student government and interscholastic athletics.
634. Analysis of Secondary School Teaching (3) I Analysis of the teaching process; preparation of behavioral objectives; study of recent methods, trends; analysis of current classroom evaluation techniques.
635. Organization and Functions of the Secondary School (3) I Secondary school: its organization, structure and operation; role and responsibilities of the teacher, the administrator and other personnel.
636. Innovations in Secondary Education (3) II Change process in education, with emphasis on those elements which support or hinder change in the schools; detailed study of current secondary school innovations on the national and local levels.
638. Constructing the Secondary School Curriculum (3) I Curriculum and its relationships; basic theories and techniques of curriculum construction discussed, evaluated, and applied.
639. Investigations in Secondary Education (3) I Critical study and evaluation of the investigations and experimental evidence underlying the aims and instructional practices of the various subject-matter fields of the secondary school.
640. Human Relations in the Classroom (3) II Analysis of human behavior in the classroom, with emphasis on case studies, role playing and group dynamics.
647. The Principalship (3) I S (Identical with Ed.F.A. 647)
648. The Superintendency (3) II S (Identical with Ed.F.A. 648)
695. Colloquium
b. Secondary School Scope and Function (1 to 3) I II P, 635.
c. Issues in Secondary Education (1 to 3) I II P, 635.
d. Secondary School Curriculum (1 to 3) I II P, 638.
e. Secondary School Instruction (1 to 3) I II P, 639.
f. Secondary School Evaluation (1 to 3) I II P, 635.
g. Master's Colloquium in Secondary Education (1 to 3) I II
697. Workshop
a. Evaluating the Secondary School (1 to 3) [Rpt./2] I II
b. Teacher Self-Appraisal (1 to 3) I II (Identical with Elem. 697b)
c. Classroom Teaching Innovations (1 to 3) I II
d. Democratic Processes in the Classroom (1 to 3) I II
e. Personalization and Individualization of Instruction (1 to 3) I II
f. Simulation and Gaming in the Classroom (1 to 3) I II (Identical with Elem. 697f)
g. Values Education in the Classroom (1 to 3) I II
DEPARTMENTS AND COURSES OF INSTRUCTION

h. Educational Implications of Prejudice (1 to 3) I II
i. Equality in Education (3) I II S
I. Teacher Style and Student Achievement (3) S
n. Problems and Processes in Teacher Appraisal (1 to 3) [Rpt./6 units] I II (identical with Ed.F.A. 697n and Elem. 697n)
s. Creating Classroom Alternatives (3) I II (identical with Elem. 697s)

794. Practicum
b. Bilingual Education (3) [Rpt./2] I (identical with Ed.F.A. 794b, which is home.)

796. Seminar
a. Secondary Education (1) [Rpt./6] I II

SOCIOLOGY

Professors Richard F. Curtis, Head, Raymond V. Bowers (Emeritus), Maynard L. Erickson, Andrew M. Greeley, Robert L. Hamblin, Michael Hechter, Travis W. Hirschi, Gary F. Jensen, Robert C. Leonard, I. Roger Yoshino
Associate Professors Albert J. Bergesen, James T. Borhek, Courtney B. Cleland, Robert R. Evans, Celestino Fernandez, Neil D. Flibstein, Patricia L. MacCorquodale, Jerry L. L. Miller
Assistant Professors Roberto M. Fernandez, Debra Friedman, Joseph R. Hambenne (Emeritus), Douglas J. McAdam, Trudy L. Mills, Michael E. Sobel
Instructor Kathleen C. Schwartzman

Sociology is the scientific study of social relations in all kinds of human populations, ranging in size from two individuals to nations. Sociologists study changing and stable patterns of social interaction, values and attitudes.

The Department of Sociology offers the following degrees: Bachelor of Arts, Master of Arts, and Doctor of Philosophy with a major in sociology.

The major: Thirty units, including 301, 375a-375b, and 401. A minimum of 24 units must be in upper-division courses.

The supporting minor is usually chosen from the social sciences, mathematics, or computer science, but another field may be selected with the approval of the student’s departmental adviser.

The teaching minor: 21 units, including 251, 301, 375a-375b, and 401.

100. Introduction to Sociology (3) I II Sociological concepts and principles, with special reference to contemporary society.

150. Sociology of Women (3) I II Sociological approach to women’s roles in American society, with emphasis on trends and problems relating to sex-role identification and socialization. P, 100 or 301. (Identical with W.S. 150)

160. Minority Relations and Urban Society (3) I II Analysis of minority relations and mass movements in urban society; trends in the modern world, with special reference to present-day race problems and social conflict. (Identical with BI.S. 160 and M.A.S. 160)

161. The Chicano in American Society (3) II Study of Mexican Americans (Chicanos) as an ethnic-cultural group in American society; analysis of their present problems as a minority group; focus on Chicano-Anglo relations in southwestern U.S. (Identical with M.A.S. 161)

189. World Population (3) I II Basic concepts of population studies; analysis of social trends, problems and solutions in relation to environmental factors, with reference to both advanced and developing nations. P, 100 or 301.


240. Sociology of Childhood and Youth (3) II Children, adolescents, and young adults in American society; their social roles, relationships, and problems. P, six units of soc.*

243. Sociology of Adult Life (3) II The life course perspective with emphasis upon the middle years; implications for personal and social planning in the United States. P, Six units of social science. (Identical with C.D.F.R. 243, Gero. 243)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>251</td>
<td>Sociology of Education (3)</td>
<td>Educational system as a basic social institution; its structure, impact on society, and effects on students; consideration of alternative structures. P, three units of soc. sci.</td>
</tr>
<tr>
<td>301</td>
<td>Sociological Analysis (3)</td>
<td>A survey of sociological concepts and principles for soc. majors. P, for majors, completion of the freshman English requirement.</td>
</tr>
<tr>
<td>302</td>
<td>Sociosomatics (3)</td>
<td>Social control of bodily process and structure, including social determinants of health. Both macro and sociopsychological theory and statistical research literature. P, Upper division standing and 3 units of social science or consult department before enrolling.</td>
</tr>
<tr>
<td>310</td>
<td>Culture and the Individual (3)</td>
<td>(Identical with Anth. 310)</td>
</tr>
<tr>
<td>311</td>
<td>Social Change (3)</td>
<td>Innovation and inertia in society; case studies of the impact of new technology, behavior and ideas; the problems of social progress. P, 100 or 301.</td>
</tr>
<tr>
<td>313</td>
<td>Collective Behavior and Social Movements (3)</td>
<td>Study of riots, panics, crazes, reform and revolutionary movements; their origins, social bases, careers and consequences. P, six units of soc.</td>
</tr>
<tr>
<td>315</td>
<td>Political Sociology (3)</td>
<td>Current competing theories of socio-political institutions. P, 6 units of soc. sci. (Identical with Pol. 315)</td>
</tr>
<tr>
<td>317</td>
<td>The Sociology of Popular Culture (3)</td>
<td>The place of popular culture in mass society; literature, film, popular music, and the life of the mind in general. P, 6 units of soc. sci.</td>
</tr>
<tr>
<td>320</td>
<td>The Sociology of Knowledge (3)</td>
<td>Relationship between social factors and knowledge, with reference to major problems and writers in the field. P, six units of soc.</td>
</tr>
<tr>
<td>321</td>
<td>Sociology of the Family (3)</td>
<td>Analysis of the modern family and its characteristics in a social and historical setting. P, nine units of social science.</td>
</tr>
<tr>
<td>322</td>
<td>Sociology of Religion (3)</td>
<td>Religion as a social institution with special reference to industrial societies. P, Six units of sociology. (Identical with Reli. 322)</td>
</tr>
<tr>
<td>323</td>
<td>Religious Organizations in America (3)</td>
<td>Analysis of religious organizations with primary reference to the U.S., including the nature and variety of belief systems, organizations and relations to each other and the larger society. P, six units of sociology. (Identical with Reli. 323)</td>
</tr>
<tr>
<td>324</td>
<td>Sociology of Sexuality (3)</td>
<td>Impact of individual and community sexual attitudes and behaviors on other sociological and psychological functioning. P, three units of soc. and three units of another social science.</td>
</tr>
<tr>
<td>326</td>
<td>Industrial Sociology (3)</td>
<td>Survey of the sociology of work and its organization, with emphasis on social supports of work motivation and effectiveness. P, six units of soc.</td>
</tr>
<tr>
<td>333</td>
<td>Group Dynamics (3)</td>
<td>Study of small groups; their objectives, leadership, interpersonal relations, and effectiveness. P, 100 or 301; three additional units of soc. or psyc.</td>
</tr>
<tr>
<td>341</td>
<td>Juvenile Delinquency (3)</td>
<td>Nature and causes of, and reactions to, juvenile delinquency. P, 201; three additional units of soc.</td>
</tr>
<tr>
<td>342</td>
<td>Criminology (3)</td>
<td>Study of the social origins of criminal law, criminal behavior, and reactions to crime. P, six units of soc.</td>
</tr>
<tr>
<td>375a-375b</td>
<td>Social Research Methods (3-3)</td>
<td>375a: Problems of conceptualization and design; elementary techniques of data collection and analysis. P, six units of soc. sci. 375b: Techniques of statistical description and elementary statistical inference, as applied to social data. P, Math. 116. 2R, 3L.</td>
</tr>
<tr>
<td>384</td>
<td>Sociology of Latin American Societies (3)</td>
<td>Analysis of their social structures and institutions, including government, religion, family, education, stratification, urban and rural development, economics, migration. P, 100 or 301; three additional units in soc. or anth. (Identical with Anth. 384)</td>
</tr>
<tr>
<td>401</td>
<td>Sources of Sociological Theory (3)</td>
<td>Critical review of the works of leading sociologists. P, for all students, 9 units of social science. P, for majors, Satisfaction of the upper-division writing-proficiency requirement (See &quot;Writing-Emphasis Courses&quot; in the Academic Guidelines section of this catalog).</td>
</tr>
<tr>
<td>402</td>
<td>Kinship and Social Organization (3)</td>
<td>GC I (Identical with Anth. 402)</td>
</tr>
<tr>
<td>404</td>
<td>Sociology of the Southwest (3)</td>
<td>Populations, cultures, and social problems in their regional setting, with emphasis on the Southwest. P, 100 or 301; six additional units of soc. or anth. (Identical with Anth. 404, A.In.S. 404 and M.A.S. 404)</td>
</tr>
<tr>
<td>406</td>
<td>Social Gerontology (3)</td>
<td>Social aspects of aging and retirement, with special reference to the United States. P, nine units of soc.* (Identical with Gero. 406)</td>
</tr>
</tbody>
</table>
407. Peasant Communities (3) GC I (Identical with Anth. 407)

422. Complex Organizations (3) GC II Theories and research regarding large-scale organizations and their relations to the individual and society. P, nine units of soc.*

435. Public Opinion and Voting Behavior (3) GC III (Identical with Pol. 435)

436. Social Structure and Personality (3) GC II Relation between the person and the group; social factors in character formation. P, nine units of soc.

442. Transformation of Agrarian Societies in the Middle East (3) GC II (Identical with Or.S. 442)

444. Group-Process Methods in Public Administration (3) GC II Open only to students who meet the requirements for Advanced Standing as specified in the College of Business and Public Administration section of the catalog. (Identical with M.A.P. 444)

450. Social Stratification (3) GC I II Theories of social class, caste, and rank; social mobility in contemporary society. P, nine units of soc.* (Identical with Anth. 450)

*A major in another social science may substitute for three of these units.

457. Bio-Social Determinants of Socialization (3) GC II (Identical with C.D.F.R. 457)

459. Sociology of Male and Female Roles (3) GC II Social factors in sex-role identification and the perpetuation of sex roles; consequences for individuals and for society; emphasis on research. P, nine units of soc. (Identical with W.S. 459)

461. Race and Ethnic Relations (3) GC I II Social processes involved in minority groups in terms of race, caste, class, ethnicity, politics, and religion. P, 100 or 301; six additional units of soc. or anth. (Identical with Anth. 461, A.In.S. 461, BLS. 461 and M.A.S. 461)

486. Comparative Community Development (3) GC I Principles of social change applied to problems of community development, including analysis of specific programs. P, six units of soc. sci. (Identical with Anth. 486)


505. World-System Theory and Research (3) I II Theory and research on the modern world-system.

510. Political Sociology (3) Basic approaches in political sociology, with emphasis on the relationship of economic and political processes.

522. Advanced Sociology of Religion (3) Review of the classical literature in the sociology of religion, including critical reading of recent research.

525. Intermediate Complex Organizations (3) Basic review of classic and contemporary approaches to the study of complex organizations; formation, development, and internal processes. (Identical with M.A.P. 525)

530. Graduate Social Psychology (3) Basic study of classic and contemporary approaches with particular reference to socialization and the relationship between the individual and social structure.

541. Deviance and Social Control (3) Basic critical review of traditional and contemporary concepts and formulations of deviance and social control; evaluation of contemporary research bearing upon deviance theory and informal and formal mechanisms of social control. P, 201, 341 or 342.

550. Stratification and Class (3) Basic examination of concepts and research in the area of stratification, with emphasis on the classic statements and contemporary research.

560. Intergroup Relations (3) Analysis of recent research on the relations among racial and ethnic groups in society, with special attention to current empirical and theoretical issues. P, 461.

570a-570b. Social Statistics (3-3) 570a. Probability, distributions, estimation and hypothesis testing. 570b. Ordinary least squares regression, generalized least squares regression, structural equation models. (Path analysis and non-recursive systems.)


580. Population Studies (3) I Theory and research in the fields of fertility, mortality, and migration, with emphasis on their relationships to social structure. An original research project is required.

585. Advanced Sociological Theory (3) I Sociological theories as alternative explanations. Classic and modern examples of working through the implications of alternative theories to formulate competing hypotheses for empirical tests. P, two courses in Social Science theory, preferably 500a-500b.
595. Colloquium
   a. Introduction to Graduate Study (1) I

596. Seminar
   a. Advanced Problems in Research (1 to 3) [Rpt.] I II
   c. Advanced Problems in Deviant Behavior (1 to 3) I II
   d. Selected Problems in Sociological Statistics (1 to 3) I II
   f. Advanced Social Change (1 to 3) [Rpt.] I II
   g. Advanced Juvenile Delinquency (1 to 3) I II
   h. Macrosociology (1 to 3) I II

SOILS, WATER, AND ENGINEERING


Associate Professors M. D. Cannon (Emeritus), Wayne E. Coates, David M. Hendricks, Dennis L. Larson, Ian L. Pepper

Assistant Professors Allan D. Matthias, Muluneh Yitayew

Soils, water and engineering includes chemistry, physics and engineering applied to management of soil, water, air, energy and human resources in environments for plant and animal growth in both production agriculture and natural and urban situations. Degree programs in agricultural engineering, irrigation, and soil and water science are described in the sections following.

Agricultural Engineering

The degree of Bachelor of Science in Agriculture Engineering is available through the College of Engineering. The degree of Bachelor of Science in Agriculture with major in irrigation is available through the College of Agriculture. The department offers opportunities for study toward the Master of Science with major in agriculture engineering.

The requirements for the B.S. in Agricultural Engineering are presented in the College of Engineering section of this catalog.

The major in irrigation includes the minimum college requirements as specified under the College of Agriculture section of this catalog. Required courses in the major include 120a-120b, 121a-121b, 250, 311a-311b, 406, 450, Math. 117e, 118, 123 or 125a. M.I.S. 111; Phys. 102a-102b, 180a-180b, S.W. 200, 201, 296a.

The College of Agriculture curriculum in agricultural business and options in turfgrass management and international agricultural are also available to students majoring in irrigation. Courses to be included in each option will be selected in consultation with the student's adviser.

100a-100b. Agricultural Mechanics (3-3) (Identical with A.Ed. 100a-100b)

120a-120b. Agricultural Engineering Problems (1-1) 1985-86 Application of engineering principles to the solution of problems in agriculture. 120a is not prerequisite to 120b. Wiersma

121a-121b. Agricultural Engineering Practices (1-1) 1985-86 Function, operation, construction, maintenance and safety of agricultural machines and equipment. 121a is not prerequisite to 121b. Wiersma

250. Water In Agriculture (3) II GRD Importance of water in agriculture, agricultural water sources, uses, management and conservation; social, political, economic, and health issues.

311a-311b. Power and Machinery Management in Irrigated Agriculture (3-3) 1986-87. 311a. Principles of operation, utilization and management of tractors and irrigation power units. 311b. Selection, operation and management of farm machinery systems used in irrigated agriculture. 2R, 3L. P, Math. 117e, 118. Coates
325. **Solar, Wind and Biomass Energy Utilization (2)**
   Principles of operation and evaluation of equipment to collect solar, wind and biomass energy and convert it to usable forms of energy. 1R, 3L. Field trips. P, Math. 117e. Larson

406. **Applied Hydraulics (3)**
   GC I GRD Fundamentals of hydraulics applicable to the irrigation of agricultural lands, including fluid properties, hydrostatics, irrigation flow characteristics, open channel and pipeline applications, and measurement of flowing water. P, Math. 118, 123 or 125a, Phys. 102a.

410. **Farm Power Engineering (3)**

412. **Agricultural Machinery Design (3)**

415. **Agricultural Process Engineering (3)**

423. **Agricultural Systems (3)**
   GC II 1986-87 Application of systems analysis to agricultural problems; modeling and use of operations research methods. P, C.E. 302 or A.M.E. 310. Larson

425. **Agricultural Engineering Design (3)**
   GC I Selected design problems in the fields of agricultural machinery, buildings, and irrigation. 1R, 8L. P, six units of agricultural engineering courses at the 400-level. Larson Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

450. **Irrigation Principles and Management (2)**
   GC I GRD Principles of operating farm irrigation systems, evaluation of systems, selection of systems, basic drainage principles, energy management, basic irrigation scheduling. P, 250 or a water related course, Math. 117e, S.W. 200; CR 451.

451. **Irrigation Laboratory (1)**

455. **Surface Irrigation (3)**
   Design and operation of border, basin, furrow, and return flow systems, basic drainage design. 2R, 3L. Field trip. P, C.E. 321. (Identical with C.E. 455)

456. **Sprinkler and Trickle Irrigation (3)**
   Design and operation of sprinkler and trickle irrigation systems. 2R, 3L. Field trip. P, 455.

462. **Soil and Water Conservation Engineering (2)**
   GC II 1986-87 Methods for estimating runoff from croplands, Universal Soil Loss Equation, design of terraces, waterways, small earth dams, erosion control structures. P, 406 or C.E. 321. Slack

463. **Energy from Biomass (3)**
   GC II Biomass energy sources; collection and processing methods; thermal, anaerobic digestion and fermentation, conversion, energetics, economic and environmental issues. 2R, 3L. P, A.M.E. 340a. (Identical with N.E.E. 463) Larson

494. **Practicum**
   a. Agricultural Engineering Design (3) I II P, 425

497. **Workshop**
   c. Irrigation (1 to 2) GC I II

507. **Drainage of Irrigated Lands (3)**
   Origin and nature of drainage problems in arid lands; drainage theories, investigations and design for irrigated agriculture and land reclamation. Field trip. P, 406 or S.W. 470. (Identical with C.E. 507)

550. **Small Scale Water Management Systems (3)**
   Design, construction, testing and operation of water management systems for small scale operators; water harvesting; runoff farming. Field trips. P, six units of hydrology, hydraulics, or irrigation.

595. **Colloquium**
   a. Current Subjects in Soil Science and Agricultural Engineering (1) [Rpt./3] I II. (Identical with S.W. 595a which is home)

650. **Advanced Irrigation Management (3)**
   Irigation scheduling using Jensen-Haise and Penman equations for predicting evapotranspiration, determination of crop coefficients, production functions, economics, and energy considerations. P, 450 or 455 or S.W. 520.

655. **Surface Irrigation Analysis (3)**
   Analysis of design and operating criteria for basin, border and furrow irrigation systems, effect of field parameters on system design. Evaluation criteria of existing systems. P, 455.
The degree of Bachelor of Science in Agriculture with major in soil and water science is available through the College of Agriculture. The department offers opportunities for study toward the Master of Science and the Doctor of Philosophy degrees with a major in soil and water science.

The major in soil and water science includes the minimum requirements as outlined under agriculture or agricultural science in the College of Agriculture section of this catalog. In addition to these requirements, the following courses are required. S.W. 200, 201, 296a, 314 or 316 and 317, 431, and two of the following 470, 411 or 435. Also A.En. 250 and 450, Chem. 241a or 322 and 323, Math. 125a or 123, Geos. 101a, Phys. 102a and 180a. Majors are encouraged to take additional classes in chemistry, physics, and mathematics beyond the minimum, as well as classes in computer science and statistics.

The College of Agriculture curriculum in agricultural business and options in turfgrass management and international agriculture are also available to students majoring in soil and water science. Courses to be included with each option will be selected in consultation with the student's adviser.

### Courses
- **200.** Soils (3) I II GRD Fundamental principles of soil science—origin, nature, and constitution of soils; their chemical, physical, and biological properties in relation to plant growth and the nonplant uses of soils. P, Chem. 101a and 102a or 103a and 104a. Post
- **296.** Proseminar a. Crops and Soils (1) [Rpt./2 units] I II (Identical with P.L.S. 296a, which is home)
- **314.** Soil Management (3) I CDT Evaluation of soil factors affecting water-plant relationships; farm planning for soil conservation; soil and water management on irrigated soils. 2R, 3L. Field trips. P, 200. Stroehlein
- **316.** Soil Fertility (2) II CDT Fertility status of semiarid and arid soils; factors affecting availability of the essential elements; influence of physical, chemical, and biological conditions on soil fertility; practices for assessing and improving soil fertility. P, 200. Stroehlein/Tucker
- **317.** Soil Fertility Laboratory (1) II Practical application of the basic concepts of soil fertility presented in 316, through demonstration and experimentation under lab., greenhouse and field conditions. Field trip. P, CR 316.
- **330.** Introduction to Remote Sensing (3) I (Identical with Geog. 330)
- **402.** Introduction to Pesticides and Their Use (2) GC II (Identical with PI.P. 402)
- **405.** Hydrology of Unsaturated Media (3) GC I (Identical with Hydr. 405)
- **411.** Soil Chemistry (3) GC I CDT Soil chemical interactions with water, air, plants and pollutants. P, 200, Chem. 103b, 104b. Bohn
- **431.** Soil Morphology, Classification and Survey (3) GC I Theory and practice of describing characteristics of soils; principles of soil classification and the classification systems; methods and applications of soil surveys. 2R, 3L. Field trips. P, 200, 201, Geos. 101a. Post
- **435.** Soil Microbiology (3) GC I Nature of soil microorganisms and their transformations of inorganic and organic soil constituents, growth-controlling substances, and impact on general environmental quality. 2R, 3L. P, Chem. 241a, Ecol. 101b. (Identical with Micr. 435) Pepper
- **453.** Remote Sensing in Agriculture (3) GC I Multispectral remote sensing techniques and applications in inventory, monitoring and analysis of soils, plants and related agricultural areas. 2R, 3L. Field trips. P, 330 or Phys. 102b.
461. **Soil and Water Conservation (3) GC II 1986-87** Consideration of major world soil and water conservation problems and solutions; principles of soil erosion by wind and water and their effects on world food problems. 2R, 3L. Field trips. P, 200. Post

470. **Soil Physics (3) GC II CDT** Soil structure and physical constitution of soils; the physical properties of soil-water systems, movement and exchange of gases in the soil, and physical laws governing the movement and availability of soil water. 2R, 3L. P, 200, Phys. 102b or CR Math. 125a. *Warrick*

501. **Management of Arid Lands and Salt-Affected Soils (3) II** Principles and practices of soil, water and crop management under arid and semiarid conditions, the use of diagnostic procedures for evaluating soils and waters, reclamation, and economics of irrigation project development. 2R, 3L. Field Trip. *Dutt*

505. **Chemical Analysis of Soils and Plants (4) II** Principles and methods of chemical analysis of soils, water and biological materials with emphasis on instrumental techniques. 2R, 6L. P, Chem. 322, 323; Phys. 102b, 180b. *Hendricks*

520. **Evapotranspiration (3) I** Theories and concepts of potential and actual evapotranspiration in arid regions; measurement and estimation methods, and plant growth- evapotranspiration relations. P, Math. 125b, Phys. 102b.

541. **Soil Genesis (3) II** Physical and chemical processes and mineralogy of weathering and soil formation; quantitative pedology; the soil as part of the ecosystem. Field trips. P, Geos. 101a and Chem. 103b. (Identical with Geos. 541) *Hendricks*

565. **Hydrochemistry (3) II 1985-86** Solute composition of naturally-occurring waters, chemical reactions affecting the solute content of water, relations and effects of above on water quality criteria and pollution, analytical procedures used by water testing laboratories. 2R, 3L. P, Chem. 322 or C.E. 371 or 471. (Identical with Hydr. 565 and Ws.M. 565) *Dutt*

595. **Colloquium**
   a. Current Subjects in Soil Science and Agricultural Engineering (1) [Rpt./3] I


605. **Soil-Water Dynamics (3) II 1986-87** Water flow in soils; closely related problems of solute, pollutant, and heat transfer; emphasis on current concepts and research. P, Math. 254. (Identical with Hydr. 605) *Warrick*

611. **Advanced Soil Chemistry (3) I 1986-87** Soil physical chemistry and the chemistry and experimental methodology relating to soil minerals. P, 411. *Bohn*

696. **Seminar**
   a. Soils, Water and Engineering (1) [Rpt./1] II (Identical with A.En. 696a)

**SOUTHWEST STUDIES**

Southwest studies are designed to bring new perspectives to regional subjects through an interdisciplinary approach. Courses on the Southwest are taught through many University departments and programs, including American Indian studies, anthropology, English, geography, history, Latin American studies, linguistics, Mexican American studies, political science, sociology, Spanish and Portuguese, and women's studies. For information, contact Professor Donald Weinstein in the Department of History.

**SPANISH AND PORTUGUESE**

Professors Alicia de Colombi-Monguíó, Head, Rupert C. Allen, Leo L. Barrow, A. Dolores Brown, Jack Emory Davis (Emeritus), Juan J. Gilabert, Lanin A. Gyurko, Herman Iventosch (Emeritus), Ruth Lee Kennedy (Emerita), Richard P. Kinkade, John W. Martin, Dana A. Nelson, José Promis, Eliana S. Rivero, Renato I. Rosaldo (Emeritus), Robert ter Horst

Associate Professors Gilbert E. Evans, Karl C. Gregg, H. Reynolds Stone

Assistant Professors Armando Miguélez, Karen L. Smith

Lecturers Adalberto Guerrero, M. Nivea Pereira Parsons
The Department of Spanish and Portuguese offers courses in language skills, linguistics, pedagogy, composition and literature. It offers creative writing in Spanish. It provides academic direction in summer programs in Spanish in the Guadalajara Summer School and in a semester program in Portuguese at Pontificia Universidade Católica in Rio de Janeiro.

The department offers programs leading to the following degrees: Bachelor of Arts with majors in Portuguese and Spanish; Bachelor of Arts in Education with a teaching major in Spanish; Master of Arts with major in Spanish; Master of Education with a teaching major in Spanish; and Doctor of Philosophy with a major in Spanish. The department also participates in offering the M.A. with a major in Romance languages through the Committee on Romance languages. For further information regarding the graduate programs, please see the Graduate Catalog.

The major in Spanish for the B.A.: 33 units of upper-division courses in Spanish, including 370, 375, and 12 units selected from among 306, 400a-400b, and 401a-401b.

The major in Portuguese for the B.A.: 24 units, including 405a-405b and at least six units of literature courses in the 400 series. At least 16 units must be upper-division.

The supporting minor for majors in Spanish or Portuguese: recommended subjects are classics, drama, English, philosophy, modern languages, history and theory of art or of music, journalism, speech, anthropology, political science, economics, history, linguistics, psychology, sociology; other subjects as may be individually justified.

The teaching major for the B.A. in Education: 30 units in Spanish, at least 21 upper-division, including 370, 372, 414, and 470.

The teaching minor for the B.A. in Education: 20 units in Spanish, including at least 12 upper-division units.

Spanish and Portuguese 101a, 101b, 201a, and 201b are for the student who is learning a second language. Span. 101m is for the student with less than one year of high school Spanish who is not prepared for Span. 101b. (Span. 101m is not open to the student who has taken 101a). Spanish and Portuguese 202a-202b are for the student who has already learned a second language. Span. 213, 303, and 373 are for Spanish speaking students: Span. 213 is equivalent to Span. 201a-201b; Span. 303 is equivalent to Span. 305; Span. 373 is equivalent to Span. 370. Elementary courses — 101a, 101m, and 101b — may not be counted toward the minor. Students will be placed in the proper class level according to one or more of the following factors: previous experience or study, departmental placement examinations, individual counseling.

The four semester language proficiency Group Requirement may be satisfied by completing with a passing grade Span. 201b, Port. 201b or Span. 213. It may also be satisfied by placing in the fifth semester on the departmental placement examination.

Upper division courses in language acquisition include the following sequences: 303 or 305, 375 and 405 in conversation and composition; 370 or 373, and 470 in grammar. Once a course in either sequence is successfully completed no lower numbered course taken subsequently in that sequence will count toward the major.

Writing-Emphasis Course: Because writing in all upper-division courses is in either Spanish or Portuguese, the requirement will be satisfied through completion of at least one 3-unit course so designated as a Writing-Emphasis Course within the minor department. (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

Honors: The department participates in the Honors Program.

At the time of catalog publication, curriculum revision was under consideration by the Department of Spanish and Portuguese. For current information, contact your adviser.

Spanish

101a/101m-101b. First Year Spanish (4-4) CDT Oral approach. 101a: First-semester Span. for the student with no previous experience in Span. 101m: First-semester Span. for the student with some previous experience in Span. Credit allowed for 101a or 101m, but not for both; either prepares students for 101b. 101b: Second-semester Span. P, 101a or 101m or one year of h.s. Span.

201a-201b. Third and Fourth Semester Spanish (4-4) CDT Credit allowed for 201a or 213, but not for both; credit allowed for 201b or 373, but not for both. P, 101b or two years of h.s. Span.

202a-202b. Intensive Spanish (4-4) 202a is the equivalent of 101a and 101b; 202b is the equivalent of 201a and 201b. P, knowledge of another Romance language.
DEPARTMENTS AND COURSES OF INSTRUCTION

202cG-202dG-202eG. Intensive Spanish (8-8-8) Offered in Guadalajara only. 202cG is the equivalent of 101a-101b. 202dG is the equivalent of 101b-201a. 202eG is the equivalent of 201a-201b. Prerequisite: knowledge of another Romance language.

213. Oral Communication in Spanish (4) I-II Designed for native speakers of Span. only; considered to be at the third-semester level. Credit allowed for this course or 201a-201b, but not for both. (Identical with M.A.S. 213)

303. Comprehensive Spanish for the Bilingual (4) I-II Speaking, reading and writing skills; designed for the native speaker of Span. with some formal study of the language. Credit allowed for this course or 305, but not for both. (Identical with M.A.S. 303)

305. Composition and Conversation (3) [Rpt.] I-II Two hours conversation, 1 hour composition. Prerequisites: 201b or four yrs. of h.s. Span.

306. Introduction to Types of Literature (3) I-II P, 201b.

331. Spanish-American Literary Masterpieces in Translation (3) I Representative masterpieces of Spanish-American literature. Will not count toward fulfillment of the language requirement or the major or minor in Span.

332. Spanish Literature in Translation (3) I 1986-87 Representative works of Spanish literature from the earliest times to the present. Will not count toward fulfillment of the language requirement or the major or minor in Span.


370. Intermediate Grammar (3) [Rpt.] I-II P, 201b or four yrs. of h.s. Span. Consult dept. before repeating course.


372. Phonetics (3) I-II

373. Intermediate Grammar for the Bilingual (3) I-II For native speakers of Span. only. Credit allowed for this course or 370, but not for both. (Identical with M.A.S. 373)

375. Intermediate Composition and Conversation (3) [Rpt.] I-II Two hours conversation, one hour composition. P, 305. Consult dept. before repeating course.

400a-400b. Survey of Spanish Literature (3-3) GC 400a: From the beginning through the 17th century. 400b: 18th-20th centuries. P, 306. 400a is not prerequisite to 400b.

401a-401b. Survey of Spanish-American Literature (3-3) GC 401a: From the beginning through the 18th century. 401b: 19th and 20th centuries. P, 306. 401a is not prerequisite to 401b.

402. Survey of Mexican Literature (3) GC S Major works by Mexican writers. Offered in Guadalajara only. P, five semesters of Spanish.

405. Advanced Composition and Conversation (3) GC I-II Study and practice in formal discussion and expository writing. P, 375.

414. Teaching of Modern Languages (3) GC I-II (Identical with S.Ed. 414)


422. Introduction to Romance Philology (3) GC I 1986-87 Survey of the development of the modern Romance tongues from the Latin language. Prerequisite: knowledge of two Romance languages. (Identical with Fren. 422, Ital. 422, Port. 422, and R.Lg. 422)

423a-423b. Theory of Spanish Syntax (3-3) GC 423a: Introduction to grammar as a theoretical construct; principles of transformational generative grammar exemplified in Span.; examination of traditional grammatical concepts in the new framework. 423b: More detailed and further-ranging analysis of Span. grammar within the general theory. P, 370. (Identical with Ling. 423a-423b)


425a. The Literature of the Caribbean (3) I 1986-87 (Identical with Engl. 425a)
427. **Applied Spanish Linguistics (3)** GC I Pedagogical applications of syntactic theory; introduction to phonological theory of Span. for pedagogical purposes; applied phonetics. (Identical with Ling. 427)

430. **Spanish Civilization (3)** GC I Spanish milieu; geographical, political, and cultural aspects of Spanish civilization.

431. **Spanish-American Civilization (3)** GC II Spanish-American milieu; geographical, political, and cultural aspects of Spanish-American civilization.

435. **Cervantes and His Works (3)** GC II P, 306.


447. **Contemporary Mexican Literature (3)** GC II S Major novelists of modern Mexico; their works, narrative perspective, characterization, language, time, space, and themes. P, five semesters of Span. P, 306. (Identical with M.A.S. 447)

450. **Spanish-American Short Story (3)** GC S Development of the modern short story in Latin America, with examples from various countries and authors. Offered in Guadalajara only. P, five semesters of college Span.


473. **Spanish for the Bilingual Classroom Teacher (3)** GC II Practical Span. for the elementary and secondary school subject-matter teacher who uses Span. as the medium of instruction. P, 370 and 375. (Identical with M.A.S. 473)

495. **Colloquium**
   - Hispanic Literature (3) GC [Rpt./1] S Offered in Guadalajara only. P, 375.

500. **Bibliography (3)** II 1985-86 Bibliographical methods and principal bibliographies.

511. **Literary Theory and Criticism (3)** II 1986-87 Historical survey of theoretical writings on literature, with their implications for practical criticism.

540. **Introduction to Medieval Literature (3)** I 1986-87 Close study of the Poema de mio Cid, Berceo’s Milagros, Juan Manuel’s Conde Lucanor, selections from Juan Ruiz’s El libro de buen amor, and from Santillana’s poems.

541. **Major Medieval Authors (3)** I 1985-86 Representative works from the 11th to the 15th century and their current critics.

550. **Spanish American Lyric Poetry from Colonial Times through Independence (3)** I 1986-87

551. **Spanish American Lyric Poetry from the 1830s through the 1920s (3)** II 1986-87

552. **Spanish American Lyric Poetry from the 1930’s to the Present (3)** I 1985-86

553. **Spanish American Narrative from the Discovery through Independence (3)** I 1985-86 Chronicle, epic, and early novel.

554. **Spanish American Narrative from the 1830’s through the 1920’s (3)** II 1985-86 Novel, short story, narrative poetry, and the artículo de costumbres.

555. **Spanish American Narrative from the 1930’s to the Present (3)** I 1986-87 Novel and short story.

556. **Spanish American Theatre (3)** II 1985-86 Major dramatic works from Colonial times to the present.

557. **Spanish American Essay (3)** II 1984-85 Major essayists from Independence to the present.

560. **Golden Age Prose (3)** III 1986-87 The Celestina, chivalric, picaresque, and pastoral novel from the late 15th through the 17th century.

561. **Golden Age Poetry (3)** III 1985-86 The major poets from the early 16th through the 17th century.

562. **Golden Age Theatre (3)** I 1985-86 The major dramatists from the early 16th through the 17th century.

563. **Neoclassicism and Romanticism (3)** I 1986-87 The emergence of Spanish Romanticism from the Enlightenment.
564. Realism and Naturalism (3) II 1986-87 Major prose writers of the 19th century from Galdós to Blasco Ibáñez.
565. The Generation of '98 (3) I 1985-86 Major literary expressions concerning the problems of Spain and the Spaniard from the late 19th century to 1936.
566. Contemporary Spanish Novel (3) I 1986-87 The novel since the Civil War.
567. Poetry and Drama since the Civil War (3) II 1985-86
620. History of the Spanish Language (3) I 1985-86
621. Spanish in the Americas (3) I 1986-87
679a-479b. Problems of teaching College Spanish (1 to 3 - 1 to 3) Problems encountered in teaching basic language courses. Units cannot be used to satisfy departmental graduate degree requirements.
696. Seminar
   a. Philology and Linguistics (3) I II
   b. Spanish Literature (3) I II
   c. Spanish American Literature (3) I II

Portuguese

101a-101b. Elementary Portuguese (4-4) CDT Both 101a and 101b are offered each semester.
201a-201b. Intermediate Portuguese (4-4) CDT Both 201a and 201b are offered each semester. P, 101b or two yrs. of h.s. Port.
202a-202b. Intensive Portuguese (4-4) P, knowledge of another Romance language or permission of instructor. 202a is the equivalent of 101a-101b; 202b is the equivalent of 201a-201b.
305. Composition and Conversation (3) [Rpt./1] I II S Fifth semester Portuguese; development of writing and speaking skills. P, 201b or 202b.
383. Literature of Brazil in Translation (3) I II 1986-87 Will not count toward fulfillment of the language requirement or the major or minor in Port.
397. Workshop
   r. Portuguese Language Skills and Culture (4) S Offered only in Rio de Janeiro. P, four semesters of Portuguese.
400a-400b. Survey of Brazilian and Portuguese Literature (3-3) GC 1986-87 400a: Brazilian literature. 400b: Portuguese literature. P, 201b or 202b.
402a-402b. Brazilian Civilization (3-3) GC P, 201b or 202b.
405a-405b. Advanced Composition and Conversation (3-3) GC Two hours conversation, one hour composition. P, 201b or 202b.
422. Introduction to Romance Philology (3) GC I 1986-87 (Identical with Span. 422)
463. Studies in Brazilian Literature (3) GC I 1985-86 Major works, authors and tendencies in modern Brazilian literature. P, 201b or 202b.
464. Studies in Portuguese Literature (3) GC II 1985-86 Major works, authors and tendencies in the literature of Portugal. P, 201b or 202b.
696. Seminar
   a. Portuguese Literature (3) [Rpt.] I II
   g. Brazilian Literature: 16th-18th Centuries (3) I II
   h. Brazilian Literature: 19th Century (3) I II
   i. Brazilian Literature: 20th Century (3) I II

SPECIAL EDUCATION

Professors James C. Chalfant, Head, Sidney W. Bijou, William C. Healey, Samuel A. Kirk, Jeanne McRae McCarthy
Associate Professors C. June Maker, John Umbreit
Assistant Professors Shirin Antia, Candace Bos, Anthony K. Van Reusen, Aldine S. von Isser
The Department of Special Education offers programs leading to the Master of Arts, Master of Education, Educational Specialist, Doctor of Education, and Doctor of Philosophy degrees with a major in special education. By a judicious choice of electives and individual studies, a considerable emphasis on multicultural education may be developed within the major.

Students seeking admission to the department’s programs must obtain the approval of the department head. For graduate degree requirements, please see the Graduate Catalog. Requirements for the 18-unit nonteaching minor include 403, 408, and 419.

At the time that the catalog was being edited, the College of Education was undergoing review. Because of this, it is important that students check with their major adviser to assure that they understand any changes which may have been made as a result of the review.

403. Study of Exceptional Children (3) GC I II Incidence, characteristics, and educational problems of exceptional children. (Identical with Ed.F.A. 403, Elem. 403 and S.Ed. 403)

407. Introduction to Learning Disabilities (3) GC I II Theories and history of programs for the learning-disabled — definition, characteristics, etiology. Departmental degree candidates must complete 403 prior to taking 407.

408. Diagnosis and Remediation of Learning Problems (3) GC I II Educational and psychological assessment of children and youth with learning problems; development of competencies required to teach such populations. P, 403 or CR. Not open to students in the learning disabilities concentration.

410. Vision and Visual Functioning (3) GC I II Anatomy and physiology of the eye; visual development, assessment and training; relationship of visual defects to learning and school experiences.

413. The Sensory Impaired (3) GC I Current and historical perspectives; etiology, psychosocial, cognitive, and motor development of hearing impaired, visually impaired and sensory impaired multiply handicapped children and youth.

419. Behavior Principles for the Handicapped (3) GC I II Use of behavior principles to modify the behavior of handicapped persons, especially moderately and severely handicapped. 3R,1L. P, 403. (Identical with Rhab. 419)

423. The Special Education Teacher (3) GC I II S Information to aid teachers in dealing with responsibilities and concerns in school settings with regard to P.S. 94-142, Education for All Handicapped Children Act.

427. Bilingual/Bicultural Education Curriculum Development (3) GC II (Identical with Ed.F.A. 427)

456. Education of Gifted Children (3) GC I Issues in education of the gifted; discussion of definitions, characteristics, development, screening, identification, curriculum, teaching strategies, and program development.

470. Mental Retardation (3) GC I II History and philosophy of educational programs for the mentally retarded and other developmentally disabled; etiology, classification, and characteristics, with consideration of educational, social, and interpersonal problems. P, 403 or CR.

473. Education of Children with Behavioral Disorders (3) GC I Educational programs for children and youth who are emotionally disturbed or socially maladjusted. P, 403.

487. Microcomputers in Education (3) GC I II S (Identical with Ed.F.A. 487)

488. Microcomputer Application in Education (3) GC I II S (Identical with Ed.F.A. 488)

494. Practicum
   a. Teaching Exceptional Children (1 to 10 I II P, 403, methods courses in area of emphasis.
   b. Communication Development for Handicapped Children (1 to 10) I II

495. Colloquium
   g. Introduction to Early Childhood Education for the Handicapped (1) GC I P, 403.


505. Methods of Teaching the Learning-Disabled (3) II Remediation of academic areas and learning processes involving perception, integration, and expression, with emphasis on methods of planning and implementing instructional programs. P, 407, 506, and permission of dept.; CR 593 and 594.
DEPARTMENTS AND COURSES OF INSTRUCTION

506. **Methods for Diagnosing Specific Learning Disabilities** (3) I Educational and psychological assessment of academic areas and learning processes involving perception, integration, and expression, with emphasis on testing and diagnostic teaching. P, 407 or CR and permission of department; CR 593 and 594.

508. **Methods and Materials for Hearing Impaired** (3) I II Teaching of reading and school subjects to hearing impaired children; demonstrations and practice with hearing impaired children. P, CR 593.


514. **Methods of Teaching the Visually Handicapped** (3) I Curriculum development and adaptation in various educational programs; adaptation of classroom materials and procedures for use with blind and partially-sighted children and youth; emphasis on methods of teaching reading, writing, and mathematics. P, CR 593.


526. **Methods and Materials in Bilingual Education** (3) GC I II (Identical with Elem. 526)

550. **Administration and Supervision of Special Education Programs** (3) II Practical aspects of organization and development of special education programs, problems of public relations, personnel, case finding, evaluation, placement, and records. P, consult department before enrolling.

552. **Language Disorders in School Age Children** (3) II S (Identical with Sp.H. 552)

573. **Teaching Children with Behavioral Disorders** (3) II Various methods and techniques for teaching the emotionally disturbed. P, 473.

575. **Observation and Participation in Special Education Programs** (1 to 3) I II Specific types of exceptional children, psychological and educational implications and practices. Field trips, class observations and seminars. P, 403. Special sections in each category of the exceptionality to be arranged in the departmental office.

581. **Language Development for the Exceptional Child** (3) I Pragmatic, semantic and syntactic aspects of language development in exceptional children and youth; cognitive and social bases for intervention.

582. **Teaching Language to Hearing Impaired** (3) II Receptive and expressive language assessment; techniques of teaching language to hearing impaired children and youth.

585. **Speech for the Hearing Impaired** (3) II Oral/aural communication development; methods for assessing and teaching speech and auditory skills.

593. **Internship** (1 to 10) I II Note: Special sections in each category of the exceptionality to be arranged in the departmental office.

594. **Practicum**
   b. **Communication Development for Hearing Impaired Children** (1 to 6) I II

595. **Colloquium**
   a. **Behavioral Disorders** (3) I Open to majors only.
   c. **Mental Retardation** (3) I P, 403.

597. **Workshop**
   a. **Personal Management and Daily Living Skills for the Visually Handicapped** (1 to 3) GC I II
   b. **Orientation and Mobility of the Visually Handicapped** (1 to 3) GC I II
   g. **Creativity and Giftedness** (3) [Rpt./9 units] II

616. **General School Administration** (3) I (Identical with Ed.F.A. 616)

620. **Applied Research with Preschool Children** (3) II Review of principles and practices underlying applied research with exceptional children; practice in preparation of research proposals; conduct of research emphasized.

621. **Methods of Teaching Preschool Handicapped** (3) II Deals with competencies required to teach all categories of handicapped preschool children except deaf/blind. Field trips. P, 575, 622, 495g, 695h.

623. Multidisciplinary Approaches to Preschool Handicapped (1) I Exploring the roles of the interdisciplinary team within the framework of an educational service delivery system. P, 403; CR 575.

624. Working with Families of Young Handicapped Children (1) II Varying strategies for developing family training programs and promoting effective parent-teacher relationships. P, 403, 495g.

625. Application of Child Development Research to Exceptional Children (1) II Relevant research in the areas of delivery systems, origins of human competence, sensorimotor processes, perception, memory, communication, cognitive structures and operations, affective processes, child abuse, genetics and twin studies, and impact of the family on young handicapped children. P, 403, 495g.

664. Theory and Behavior in School Administration (3) II (Identical with Ed.F.A. 664)

671. School Finance (3) I (Identical with Ed.F.A. 671)

675. The Law and American Education (3) I (Identical with Ed.F.A. 675)

695. Colloquium
   a. Recent Advances in Special Education (1 to 4) I II
   b. Behavior Disorders (1 to 4) I II
   c. Issues and Trends in Special Education (1 to 4) I II
   d. Learning Disabilities (1 to 4) I II
   e. Mental Retardation (1 to 4) I II
   f. Sensory Impaired (1 to 4) I II
   I. Issues and Research in Educating the Gifted (3) [Rpt./9 units] II Consult department before enrolling.
   m. Language, Learning and Reading Disabilities (3) II (Identical with Sp.H. 695m, Rdng. 695m)

SPEECH AND HEARING SCIENCES


Associate Professor Linda Swisher

Instructors Mary Ellen Bailey (Clinical), Ron Leavitt (Clinical)

Director, Speech-Language Clinic Anthony DeFeo

The Department of Speech and Hearing Sciences prepares students for careers in basic and clinical sciences (speech-language pathology, audiology, speech science, and hearing science) in university, laboratory, medical or other clinical settings, or as public school clinicians. Professional certification in the state of Arizona and with the American Speech-Language-Hearing Association requires graduate study with the acquisition of at least thirty semester credits or a Master of Science degree.

The department offers the following degrees: Bachelor of Science in Speech and Hearing Sciences, Master of Science and Doctor of Philosophy with a major in speech and hearing sciences. For graduate admission and degree requirements, consult the Graduate Catalog.

The major: In addition to the group units required for the B.S., as described in the College of Arts and Sciences section of this catalog, this major requires 36 units, including 260, 280, 367, 370a-370b, and 483. Students must also meet the requirements in one of the following options:

A. (For students enrolled in the traditional undergraduate degree program): These students take plan A science/mathematics and social science requirements in groups IV and V, Bachelor of Science group unit requirements.

B. (For students enrolled in the American Indian professional training program): Sp.H. 450, 451, and at least four units of 499. These students take plan B science/mathematics and social science requirements in groups IV and V, Bachelor of Science group unit requirements.

A twenty-unit minor is also required (see Faculty of Fine Arts section of this catalog). At least 24 units in the major must be taken in residence. Minimum total units for the degree with this major — 125.

106. Voice and Articulation (2) I II Designed to improve voice, articulation, and fluency patterns in speech. Class members' presentations are videotaped and analyzed. Individual lab. practice.
107. Survey of Hearing, Language, and Speech: Normal and Disordered (3) I II Role of speech, hearing, and language in human communication; normal processes and disorders in speech, language, and hearing; directed observations in labs. and clinics.

260. Speech Science (4) II Anatomy, neuroanatomy, physiology of the speech mechanism; acoustical characteristics of voice and speech sounds; frequency, intensity, time and wave composition. 3R, 3L. (Identical with Ling. 260)

280. Hearing Science (4) I Anatomy, neuroanatomy, physiology of the auditory mechanism; acoustics and psychoacoustics; decibel scale, normal auditory function. 3R, 3L.

367. Phonetics (3) I Scientific study of speech sounds; articulatory phonetics, transcription, dialects and articulatory errors.

370a-370b. Introduction to Communication Disorders: Children and Adults (3-3) Nature of disordered communicative processes; principles of assessment and intervention of these disorders. Open to majors only or consult department before enrolling. P, 260, 280. Writing-Emphasis Course (370b). P, Satisfaction of the upper-division writing-proficiency requirement (See “Writing-Emphasis Courses” in the Academic Guidelines section of this catalog).

450. Structure of Speech and Language (3) GC I Study of the nature of language and linguistics; current approaches in linguistics.

451. Acquisition of Speech and Language (3) GC II Normal development of speech and language in the child; relationships with cognitive and social development. (Identical with Ling. 451)

458. Introductory Clinical Studies: Speech-Language Pathology (1 to 3) [Rpt./9 units] GC I II S Basic clinical procedures for managing a limited range of speech and language disorders. Includes observation and supervised practice. Open to majors only. P, 451 or CR 471.

459. Introductory Clinical Studies: Audiology (1 to 3) [Rpt./9 units] GC I II S Basic clinical procedures for identifying and managing a limited range of hearing losses in children and adults. Includes observation and supervised practice. Open to majors only. P, 483 or CR.

461R. Speech and Hearing Science Instrumentation (2) GC I II Study of some common and specific instruments and methods employed in speech and hearing labs. and clinics. P, 260, 280 or CR.

461L. Speech and Hearing Science Instrumentation Laboratory (1) GC P, CR 461R.

471R. Articulation Disorders and Therapies (2) GC I II Etiology, diagnosis, prognosis, and therapy for the articulatory aspects of communication problems. P, 370; 367; CR or subsequent registration in 471L (for majors).

471L. Laboratory in Articulation Disorders (1) GC I II Open to majors only. P, 471R or CR.

479. Speech and Hearing Disorders for Related Professions (3) GC I II Recognition and management of language, speech and hearing problems for related professions such as education, nursing, psychology, and speech communication. Open to nonmajors only.


484. Audiologic Rehabilitation: Adults (3) GC II Speech reading; auditory training; problems encountered with amplification units; social, psychological, educational, speech, and language difficulties encountered by the hearing handicapped. P, 280, 483.


494. Practicum a. Speech Pathology (1 to 2) [Rpt./6 units] I II Open to majors only. P, 370; 471R or CR. b. Audiology (1 to 2) [Rpt./6 units] I II Open to majors only. P, 483; 484 or CR.


500. Introduction to Graduate Study (3) I Introduction to the conduct of research and grad. study in speech and hearing sciences.

510. Counseling Techniques in Communication Disorders (3) II S Basic counseling techniques pertinent to clinical practice with the communication handicapped and their families.

552. Language Disorders in School Age Children (3) II S The nature and treatment of language disorders in children from grades K-12; relationships between language and learning disorders; assessment and treatment strategies. P, 451 (Identical with Spec. 552)
553R. Language Disorders in Preschool Children (2) II Etiology, evaluation and therapy for children with delayed language and/or language disabilities; relationships with learning disabilities; dialect and bilingualism.

553L. Laboratory in Preschool Language Disorders (1) II

554R. Adult Aphasia (2) II Etiology, evaluation and therapy for language disorders associated with brain damage. P, 370; 450 or 451; CR or subsequent registration in 554L (for majors).

554L. Laboratory in Adult Aphasia (1) II P, 554R or CR.

558a-558b. Intermediate Clinical Studies: Speech-Language Pathology (1 to 3 - 1 to 3) [Rpt./9 units] II S Under faculty supervision, students assess speech and language functioning, develop treatment plans, and carry out remedial programs based on empirical data and current technology. 558b is in an extern setting. Open to majors only. P, 451, 471.

559. Intermediate Clinical Studies: Audiology (1 to 3) [Rpt./9 units] II S Under faculty supervision, students assess hearing impairments, formulate objectives, and carry out remedial programs with emphasis on the application of research data and current technology to clinical treatment. Open to majors only. P, 483.

560a-560b. Experimental Phonetics (3 -3) 560a : Systematic examination of current experimentation and research in speech as motor behavior, with emphasis on physiological investigations of normal respiration, phonation, resonance, and articulation; critical evaluation of research design. P, 260. 560b : Systematic examination of current experimentation and research in speech as an acoustical phenomenon; critical evaluation of research design. P, 260, 461. 2R, 3L. 560a is not prerequisite to 560b.

565R. Aerodynamic Evaluation and Management of the Speech Mechanism (2) II Principles and clinical methods of aerodynamic evaluation and management of the disordered speech mechanism, with practical experience provided through case studies and class experiments. P, 260, 461, 560a.


570R. Evaluation Process (2) I Study of principles, methods and selected procedures involved in the assessment of individuals with communication disorders; attention to skills in interviewing and preparation of reports. P, 370, 483; CR or subsequent registration in 570L (for majors).

570L. Laboratory in Evaluation Process (1) I II Open to majors only. P, 570R or CR.

571. Cleft Palate, Other Craniofacial Disorders, and Communication (2) I Communication disorders associated with cleft palate and other craniofacial defects. Speech assessment, evaluation and treatment; survey of dental and surgical services.

572R. Disorders of Phonation (2) I Etiology, diagnosis, prognosis, and therapy for disorders of voice; speech for the laryngectomized. P, 260.

572L. Disorders of Phonation Laboratory (1) I Open to majors only. P, 572R or CR.

573R. Disorders of Fluency (2) II Primarily a study of stuttering: identification, nature and assessment; theoretic considerations; management approaches; proportionate attention to other anomalies of fluency. P, 370; CR or subsequent registration in 573L (for majors).

573L. Laboratory in Disorders of Fluency (1) II Open to majors only. P, 573R or CR.


576. Communicative Aspects of Aging (2) II Hearing, speech, voice, and language changes in the elderly caused by aging and disease. Emphasis on management of these problems. (Identical with Gero. 576)

579. Organization and Administration of Speech and Hearing Programs (3) II Problems in organizing a speech and hearing program: philosophy, case load, space, staff, budget, interagency cooperation.

580. Industrial Audiology (2) II Auditory and non-auditory effects of noise, industrial hearing conservation, noise measurement and control.

581. Evaluation and Selection of Hearing Aids (3) I Development of hearing aid evaluations; circuitry of hearing aids and their physical characteristics; speech intelligibility and the electroacoustics of low-fidelity circuitry; patient evaluation and counseling. P, 483; CR or subsequent registration in 494b (for majors) .
582. Disorders of Hearing (3) II Pathologies of the hearing mechanism and their auditory manifestations in both adults and children. P, 280, 483.

583. Special Auditory Tests (3) II Special audiologic procedures to differentiate conductive versus sensorineural, sensory versus neural, central versus peripheral, and organic versus functional hearing disorders. Open to majors only. P, 483, 582.

584. Audiologic Habilitation: Children (3) I Amplification, room acoustics, auditory and visual processing, evaluation and remedial programming for children with mild to moderate hearing impairment. P, 483 or 589.

585. Physiological Acoustics (3) I Study of contemporary auditory theory and its historical development; theories related to the function of physiological and neurological mechanisms in the light of empirical findings; psychophysical findings related to physiological findings. 2R, 3L. P, 280.

586. Electrophysiologic Evaluation of the Auditory and Vestibular Systems (3) II Techniques, normative data, and clinical interpretation of auditory-evoked potential and electronystagmography tests. 2R, 3L.

587. Psychophysical Acoustics (3) II Experimental procedures and instrumentation; study of psychoacoustics; stimulus integration, pitch and loudness limen and scales, masking, and auditory fatigue; binaural hearing; theory of signal detection. 2R, 3L. P, 280, 461.

588. Principles of Audiology (3) I Basic techniques of pure-tone audiometric testing; interpretation of audiograms; disorders of hearing; anatomy and physiology of the hearing mechanism; basic acoustics. Open to nonmajors only.

596. Seminar
a. Experimental Phonetics (1 to 3) [Rpt./2 or 9 units] I II
b. Clinical Audiology (1 to 3) [Rpt./2 or 9 units] I II
c. Hearing—Physiology and Psychophysics (1 to 3) [Rpt./2 or 9 units] I II
d. Language and Language Disorders (1 to 3) [Rpt./2 or 9 units] I II
e. Speech Pathology (1 to 3) [Rpt./2 or 9 units] I II

658a-658b. Advanced Clinical Studies: Speech-Language Pathology (1 to 3 - 1 to 3) [Rpt./9 units] I II S With faculty consultation and supervision, students assume responsibility for all aspects of case management of children and adults. Exposure to clinical research methods and interdisciplinary staffings. 658b is in an extern setting. P, 471, 553.

659. Advanced Clinical Studies: Audiology (1 to 3) [Rpt./9 units] I II S With faculty consultation and supervision, students assume responsibility for all aspects of case management of adults and children. Exposure to clinical research methods and interdisciplinary staffings. Open to majors only. P, 483.

693. Internship
a. Speech Pathology (1 to 6) I II Open to majors only. P, 494a.

695a-695b. Special Clinics in Language, Learning and Reading Disabilities (1 to 6) I II Identical with Spec. 695m, which is home.

SPEECH COMMUNICATION

Professors Judee K. Burgoon, Michael K. Burgoon, Henry L. Ewbank, Andrew A. King, Frank K. La Ban, Klonda Lynn (Emerita), Alethea S. Mattingly (Emerita)

Associate Professors David A. Williams, Acting Head, James W. Davis, Mary Z. Maher, Ronald J. Matlon, Robert W. Sankey, Patricia D. Van Metre

Lecturers William E. Bailey, F. Dave Nott, Tim Moore

The Department of Speech Communication is concerned with the theory and practice of spoken discourse. The study of speech communication is designed for students who wish to concentrate on communication skills and understandings to prepare for careers in communication, business, government, law and teaching. It also provides substantive grounding for students who plan to pursue graduate work in the field.

The degrees offered by the department are the Bachelor of Arts in Speech Communication, Master of Arts and Doctor of Philosophy with a major in speech communication. The degrees of Bachelor of Arts in Education and Master of Education with a teaching major in speech communication are also available. Students should consult the Faculty of Fine Arts section of this catalog for undergraduate program requirements of the faculty. For
graduate admission and degree requirements, students should consult the Graduate Catalog.

The major requires 36 units in speech communication, 18 of which must be upper-division course work. All majors must take 102, 115, 136, 210, 300, 303, 325, 418 and one elective at the 300 or 400 level, courses which provide students with basic knowledge and training in communication studies. In addition to the required courses, students must select at least three units from each of the following groups: (1) Communication theory: 312, 313, 412a-412b, 428, 453, 462. (2) Oral interpretation: 436, 445, 446, 447. (3) Rhetoric and public address: 414, 416, 420, 422, 424a-424b. At least 18 units of the major must be taken in residence.

The teaching major requires the following 38 units: 102, 115, 136, 210, 300, 303, 325, 355, 410, 418, 447, 125a-125b and one additional course at the 300 or 400 level.

The teaching minor requires 24 units, including 102, 136, 210, 300, 325, 355, and a choice of 303, 410, 418, 447 or 467.

The minor in communication for students interested in law or law-related or public policy professions is designed to improve communication skills and decision-making processes. It consists of a minimum of 24 units of Sp.C. 102, 136, 210, 325, 408, 414, 418, and 420.

Honors: The department participates in the Honors Program.

101a-101b. Speech for Foreign Students (3-3) Speech communication skills designed to meet the particular needs of foreign students. Initial placement is determined by testing. 101a is not prerequisite to 101b.

102. Public Speaking (3) I II Beginning course in the practice of public speaking, with emphasis on organization, effective thinking, and delivery.

105. Development of the Speaking Voice (3) I II Developing the speaking voice and cultivating its effectiveness; emphasis on voice quality, articulation, and intonational features as well as on nonverbal cues.

112. Introduction to Organizational Communication (3) I II Analysis of the structure and function of speech communication in complex organizations. Interpersonal, group, and public communication experiences are provided.

115. Interpersonal Communication (3) I II Study and application of basic communication concepts to the description and analysis of interpersonal communication transactions.

125a. Speech Activities in Debate and Forensics (1) [Rpt.] I II Student participation in intercollegiate debate and forensics. Open only to members of the university speech team. Approval of the instructor is required prior to admission to this offering. No more than three units of 125 credit (a or b taken in any combination) may count toward graduation.

125b. Speech Activities in Interpreters’ Theatre (1) [Rpt.] I II Student participation in Interpreters’ Theatre. Open only to students cast in departmental shows. Approval of the instructor is required prior to admission to this offering. No more than three units of 125 credit (a or b) may count toward graduation.

136. Oral Interpretation of Literature (3) I II Introduction to the performance of literature, with emphasis on the sound and gesture and the emotional and intellectual meanings of the texts of prose, poetry, and drama.

181. Public Address in Western Civilization (3) I II Role of public address in the social, political and intellectual history of western man; representative speakers and their speeches from classical times to the present.


237. Oral Interpretation of Classical Drama (3) I Backgrounds in and analysis of structure and content of dramatic masterpieces of world literature from the Golden Age in Greece through the Restoration, with emphasis on oral presentation of selected scenes.

238. Oral Interpretation of Modern Drama (3) I Interpretation of modern plays from Ibsen to the present; presentation of speakers in drama, with emphasis on the physical and vocal qualities that project these characters; deals with the modern masters, such as Shaw, Miller and Williams.

239. Speaking for Radio and Television (3) I II Communication learnings and behavior for presenters on radio and television, includes backgrounds, current trends, and performance experience in various types of radio and television speaking. (Identical with R.T.V. 239)
300. Introduction to Speech Communication Theory (3) I Origin and development of basic concepts in speech communication theory and research; survey and analysis of theories and models in research. Writing-Emphasis Course. P, Satisfaction of the upper-division writing-proficiency requirement (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog).

303. Communication in Small Groups (3) I II Introduction to theory of small group communication, with practice and amplification of principles in small group discussion.

312. Conflict in Organizational Communication (3) I A practical and theoretical study of conflict and communication interaction in the organizational context. P, 112, or M.A.P. 305.

313. Advanced Communication in Small Groups (3) I Consideration of advanced problems in group interaction, with emphasis on the analysis and solution of communication problems. P, 303.

325. Argumentation and Advocacy (3) I II Study of the philosophy, theory and practice of argumentation; analysis and comparison of classical and contemporary models of advocacy and evidence; examination of argument in public policy, legal, and debate settings.

355. Administering the Forensic Program (3) I 1985-86 Philosophy, organization, and administration of competitive speech activities, debate, discussion, and individual events; individual and group activities in the administration of intercollegiate and interscholastic speech contests.

408. Parliamentary Procedure (3) II Theory, strategy, and practice of decision-making procedure in democratic organizations. (Identical with Pol. 408).


412a-412b. Organizational Communication (3-3) GC Analysis of interpersonal and group communication practices affecting goal achievement in business, governmental, and professional organizations. 412a. Theory; 412b. Process. P, 300 or M.A.P. 305.

414. Classical Rhetorical Theory (3) GC I Intensive reading and analysis of the works of major Greek and Roman rhetorical theorists. P, 325 or CR.

416. Modern Rhetoric (3) GC II 1986-87 Intensive reading and analysis of the works of major rhetorical theorists from the 18th century through the present. P, 414.

417. Relational Communication (3) GC II The relational communication process and messages people use to define interpersonal relationships, including dominance-submissiveness, affection, involvement and similarity.

418. Persuasion (3) GC I II Theories of audience analysis and the motivation of human conduct: the study of rhetorical devices.

420. Speech Communication in the Legal Process (3) GC II Analysis of communication questions and skills facing lawyers, judges, litigants, and jurors. Application of speech communication theories to legal concerns of interview, negotiation, and litigation. Field trips.

422. Rhetoric of the British Empire (3) GC II 1986-87 Significant public argument in the British Empire, with emphasis on the political, social and economic issues in the "Golden Age" of rhetoric: Chatham, Burke, Pitt, and Fox. P, 325, 414.

424a-424b. American Public Address (3-3) GC 424a: II 1985-86 History and criticism of American religious and reform speakers from Colonial times to the present. 424b: 11 1986-87 Analysis of American political speaking from 1765 to the present. P, six units of speech. 424a is not prerequisite to 424b.

428. Communication Theory and Research (3) II 1986-87 Theories of communication and their research backgrounds; research methodology in communication behavior studies.

436. Shakespeare through Performance (3) GC I Understanding Shakespeare’s plays through performance. Performance-oriented analysis compels a thorough comprehension of the ideas, emotions, attitudes and intent of the plays being studied. P, 237 or 238 or 200 level drama course. (Identical with Dram. 436)

445. Oral Interpretation of Poetry (3) GC I Types of poetry analyzed, with emphasis on their differentiation for oral presentation; preparation for and presentations of a public recital. P, 138.

446. Oral Interpretation of Fiction (3) GC II Analysis of short stories and selected short novels, with emphasis on point of view, tone, and characterization in preparation for performance. P, 136.

447. Studies in Group Reading (3) GC I 1986-87 Study in forms, styles, and aesthetics of Readers Theatre, Chamber Theatre, and the documentary; examination of essay, biography, short fiction, novel, and dramatic literature for group reading. P, three units of speech, dram. or Engl.
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<th>Course Code</th>
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<tr>
<td>453</td>
<td>Theories of Small Group Communication (3) GC I</td>
<td>Theories of small group communication, their research backgrounds, and their relevance to communicative interaction in small groups. P, 303 or 313.</td>
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<tr>
<td>462</td>
<td>Communication and Human Relationships (3) GC S</td>
<td>An advanced course enabling students to inventory, evaluate, and develop oral communication skills in the interpersonal, group, and organizational dimensions of their lives. P, senior standing.</td>
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<tr>
<td>467</td>
<td>English Phonetics (3) GC I II</td>
<td>Scientific study of the sounds of speech; emphasis on laws and principles determining articulatory features, dialect variation, sound change, and sound as communication context.</td>
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<td>525</td>
<td>Rhetorical Criticism (3) I 1985-86</td>
<td>Systems of criticism; rationale of approaches to the critical act; analysis of representative criticism of rhetorical events and movements.</td>
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<tr>
<td>567</td>
<td>Applied Phonetics (3) II 1986-87</td>
<td>Analysis of English dialect variations, with emphasis on interviewing procedures forming the basis of the Linguistic Atlas of the United States and on determining and modifying dialect forms of nonnative speakers of English; atlas field projects and tutorial work with nonnative speakers of English. P, 467 or ability to transcribe phonetically.</td>
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<td>567</td>
<td>Rhetorical and Communication Theory I (3) I</td>
<td>Historical development of theoretical and pedagogical perspectives on the process of generating and understanding public discourse.</td>
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<td>567</td>
<td>Rhetorical and Communication Theory II (3) II</td>
<td>Contemporary approaches to the process of human communication, psychological, philosophical, linguistic, literary, behavioral, and other perspectives.</td>
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<td>610</td>
<td>Interpreting Individual Literary Styles (3) I</td>
<td>1986-87 Intensive critical study of selected writings of one or two significant premodern and modern literary figures in terms of the oral presentation. P, 136, and six additional units in interpretation.</td>
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<tr>
<td>610</td>
<td>Modern Theories of Oral Interpretation (3) II</td>
<td>1985-86 Mechanical and natural schools of oral interpretation, their backgrounds, and their influence upon modern teaching and performance.</td>
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<td>610</td>
<td>Modern Theories of the Performance of Literature (3) II 1986-87 Twentieth-century theories of interpretation and their application, with emphasis on developing a rationale for criticism of performed literature.</td>
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<tr>
<td>660</td>
<td>Research Methodologies I (3) I</td>
<td>Historical and critical methods of investigating, analyzing, and evaluating rhetoric and literature. (Identical with Jour. 660)</td>
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<tr>
<td>670</td>
<td>Research Methodologies II (3) II</td>
<td>Experimental, descriptive, statistical, and computer-assisted methods of investigating, analyzing, and evaluating human communication. (Identical with Jour. 670)</td>
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<td>696</td>
<td>Seminar</td>
<td>Rhetorical Criticism (3) [Rpt./1] I II</td>
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<td>a. Rhetorical Criticism (3) [Rpt./1] I II</td>
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<td>b. Oral Interpretation (3) [Rpt./1] I II</td>
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<td>c. Rhetorical Theory (3) [Rpt./1] I II</td>
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<td>d. Speech Education (3) [Rpt./1] I II</td>
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<td>e. Communication Theory (3) [Rpt./1] I II</td>
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<td>f. Linguistic Investigations and Applications (3) I II (Identical with Ling. 696f)</td>
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<td>g. Argumentation (3)</td>
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**STATISTICS**

Professors Jean E. Weber, Head, Bruno Baldessari
Assistant Professors J. George Caldwell (Adjunct), Dalice Sim (Adjunct), Michael Trosset

The Department of Statistics does not offer an undergraduate major but offers a major in statistics for the Master of Science degree and a Ph.D. minor for students in other disciplines. For further information please see the Graduate Catalog.

<table>
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<th>Course Code</th>
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<tr>
<td>361</td>
<td>Statistics for Engineering and the Physical Sciences (3) I II Probability theory, point and interval estimation, hypothesis testing and regression analysis; applications to quality control and reliability theory. P, nine units of calculus.</td>
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<tr>
<td>461</td>
<td>Elements of Statistics (3) GC I II Advanced degree credit available for nonmajors only. (Identical with Math. 461 )</td>
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<tr>
<td>464</td>
<td>Theory of Probability (3) GC I (Identical with Math. 464 )</td>
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</tbody>
</table>
DEPARTMENTS AND COURSES OF INSTRUCTION

465. Statistics for the Medical Sciences (4) GC I Standard and nonparametric one- and two-sample procedures, ANOVA designs, linear and multiple regression, bioassay, probit analysis, and contingency tables. 3R, 3L. Not open to majors. P, two semesters of calculus. (Identical with Tox. 465)

466. Theory of Statistics (3) GC II (Identical with Math. 466)

468. Applied Stochastic Processes (3) GC II (Identical with Math. 468)


567a-567b. Statistical Inference (3-3) 1985-86 (Identical with Math. 567a-567b)


664. Applied Multivariate Analysis (3) II Consideration of multivariate statistical analyses, with emphasis on applications, interpretation of computer printouts and effects of violations of model assumptions. P, 660.

665. Applied Time Series Analysis (3) I Methods used in time series analysis, with emphasis on applications, including computer analysis of data and consideration of violations of model assumptions. P, 660.

SYSTEMS AND INDUSTRIAL ENGINEERING

Professors John S. Ramberg, Head, A. Terry Bahill, Lucien Duckstein, William R. Ferrell, Donald G. Schultz, Roger J. Weldon (Emeritus), A. Wayne Wymore, Sidney J. Yakowitz

Associate Professors Robert L. Baker, Duane L. Dietrich

Assistant Professors Thuruthickara C. John, Joseph J. Pignatiello, Jr., Suvrajeet Sen

The Department of Systems and Industrial Engineering in the College of Engineering offers the degrees of Bachelor of Science in Systems Engineering, Bachelor of Science in Industrial Engineering, Master of Science with a major in either systems or industrial engineering, and Doctor of Philosophy with a major in systems engineering. For specific undergraduate program requirements, see the College of Engineering section of this catalog.


170R. Problem Solving Using Computers (2) I II S Problem analysis, top-down modular design of algorithms for solving elementary engineering problems, structured programming techniques; FORTRAN 77 programming, graphics, and an introduction to PASCAL programming. Introduction to the use and choice of personal computers. CR 170L and CR Math. 125a.


250. Introduction to System Design (3) I System design, from the problem-definition stage through the evaluation of the implemented system. P, 150.

258. Introduction to Industrial and Manufacturing Systems (3) I Analysis, design and control of manufacturing and production systems, including topics in facilities layout and location, materials handling, inventory control, computer-integrated manufacturing, information systems, and simulation. P, 170, Math. 125b.


272. Comparing Computer Languages for Problem Solving (3) I II Solving engineering problems through use of PASCAL and other languages, with appropriate features of each language explored. Methods for building expert systems. Student projects. 2R, 3L, P, 170.

310. Human Factors Fundamentals (2) I II Human characteristics that must be taken into account in system design. Basic measurement analysis and design methods. P, Psyc. 101; CR 320a.


350. Deterministic Systems (3) I I I Analysis and design of linear deterministic systems in both the time and frequency domains using Fourier analysis, Laplace transforms and state space methods. Attention will be given to modeling physical and engineering systems. P, Math. 254.


405. Digital Systems Simulation (3) GC I II Simulation modeling of systems using digital computer languages, emphasizing random variate generation, Monte Carlo, timekeeping structures and statistical design and analysis of simulation experiments. P, 320b or CR 420.

406. Engineering Quality Control (3) GC I Single, double, multiple, and sequential sampling plans; acceptance sampling plans of the Department of Defense, Shewhart Control Charts; cu-sum control charts; applications of quality control concepts in reliability analysis. P, 320b or CR 420. (Identical with A.M.E. 406)

408. Reliability Engineering (3) GC I (Identical with A.M.E. 408)


411. Human Interaction with Computers and Software (3) GC II The interaction of technical requirements with the characteristics of computer users and programmers as they affect the design of software, and the physical and cognitive interfaces between people and computers. P, 310.


422. Engineering Decision Making under Uncertainty (3) GC I Application of principles of probability and statistics to the design and control of engineering systems in a random environment. Methodology includes utility theory, risk analysis and Bayesian decision analysis. P, 320b or CR 420.


442. Design of Delivery/Distribution Systems (3) GC II The design of distribution and delivery schemes using concepts of system theory, operations research, economics, statistics, and human factors; one case study is selected by the instructor, another one by the students. P, 320, 340, 405.

453. Deterministic Control Systems (3) GC I The analysis and synthesis of deterministic linear control systems, with emphasis on design using both frequency-domain and state-variable approaches. P, 350.
DEPARTMENTS AND COURSES OF INSTRUCTION

462. Production Systems Analysis (3) GC I Production systems, product and process design, forecasting, production planning models, inventory models, material requirements planning, facility layout and materials handling. P, 340.


465. Modeling Manufacturing Systems (3) GC II An intermediate level introduction to topics in hierarchical design, planning, and control of manufacturing systems and their applications. Topics include modeling automated transfer lines and flexible manufacturing systems. Attention will be given to the performance of manufacturing systems and operational issues such as the role of robots, flexible machines, computers, and material handling systems. P, 340b.

473. Concepts in Information and Communication Systems (3) GC II Introduction to signals and signal processing; signal representations; information measures and channels; modulation and demodulation, detection, estimation. P, 350.

474. Knowledge Engineering (3) GC I Building, using and evaluating expert systems. 2R, 3L.

475. Software Engineering (3) GC I Basic principles for medium-scale professional programming projects. Documentation, maintainability, portability, and verification. Source codes for word processing, games, spread sheets, etc. Programming project required. P, 270.


505. Digital Systems Simulation (3) II Continuation of 405, with emphasis on current research problems including random variate generation, Monte Carlo, language development, and statistical analysis of output. P, 405.

506. Advanced Quality Control and Reliability (3) II Applications of modern statistical theory in quality control and reliability. Topics include Bayesian decision theory; multivariate methods: Markov processes and selected papers from the recent literature. P, 406 and 420. (Identical with A.M.E. 506)

508. Advanced Reliability Engineering (3) II (Identical with A.M.E. 508)


518. Reliability Testing (3) II (Identical with A.M.E. 518)


540. Queueing Theory (3) I Application of the theory of stochastic processes to queueing phenomena; steady-state analysis of birth-death, Markovian and general single- and multiple-channel queueing systems; application of queueing models to production systems, computer and communication systems, airport, police patrol and firefighting.

544. Linear and Integer Programming (3) I II Revised simplex method, theory of polyhedra, duality theory, computational complexity, ellipsoid and related methods, integer programming formulations, branch and bound and implicit enumeration, Lagrangian relaxation, generation of valid inequalities.

550. Theory of Linear Systems (3) I An intensive study of continuous and discrete linear systems from the state-space viewpoint, including criteria for observability, controllability, and minimal realizations; and optionally, aspects of optimal control and filter theory. P, 350

554. Mathematical System Theory (3) I Mathematical theory of discrete systems and models for application to large-scale, complex, man-machine systems.

556. Finite State Methods in Water Resources Management (3) II (Identical with W.R.A. 556)


562. Scheduling Theory (3) I Introduction to problems of sequencing and scheduling for single, multiple, and parallel processor systems; discrete programming and heuristic procedures for flow-shop and job-shop models; network methods for project scheduling. P, 544.
563. **Facility Layout and Location** (3) II Mathematical characterizations of single and multifacility location models as minimum norm problems; mathematical programming methods for facility layout; investigation of computer-aided design systems. P 544.

565. **Multi-Objective Analysis of Engineering Systems** (3) I Systems design versus operation; multi-objective simplex; goal programming and other distance-based techniques; multi-attribute utility; techniques with qualitative criteria; interactive, quaninteractive and dynamic approaches; model choice; resource engineering applications. P, 340b or 544.


620. **Selected Topics in Probabilistic Systems** (3) II Topics include Markov and semi-Markov processes; regenerative processes; Markov decision theory; application in queueing, production and computer communication systems. P, 520, 540.

640. **Advanced Queueing Theory** (3) II Analysis of stochastic models of complex queueing and production systems; transient and steady-state analysis of single stage and network of queues; application of complex queueing models to production systems such as flexible manufacturing systems and flow lines. P, 540.


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**TOXICOLOGY**

*(See Pharmacology and Toxicology, College of Pharmacy)*

**URBAN PLANNING**

*(See Planning)*

**VETERINARY SCIENCE**

Professors J. Glenn Songer, Acting Head, Robert B. Chiasson, Leonard W. Dewhirst, C. John Maré, Dewey E. Monty, George Olson, Raymond E. Reed, James N. Shively, Raymond E. Watts (Emeritus)

Associate Professors Ronald W. Hilwig, Charles R. Sterling

Assistant Professor Lynn A. Joens

Lecturer Lee Kelly, Ted H. Noon

The department offers counseling to preveterinary students seeking to fulfill the requirements for admission to schools and colleges of veterinary medicine throughout the United States. For students interested in the care and health of animals but not necessarily pursuing a career in veterinary medicine, guidance is provided in a curriculum which will prepare the students for rewarding careers in animal health research and technology.

The degree of Bachelor of Science in Agriculture with a major in animal health science is available in the agricultural science curriculum. No major is offered in veterinary science. Programs of instruction leading to a Master of Science or Doctor of Philosophy degree may be arranged through departmental cooperation with the Committee on Animal Physiology.

The requirements for the major in animal health science may be found in the **College of Agriculture** section of this catalog under the curriculum in agricultural science. Since preveterinary studies do not constitute a major, students who elect a four-year preprofessional program must choose a major compatible with the course requirements of the veterinary college to which they seek admission. During completion of the animal health science
major, students may complete all requirements for admission to veterinary schools in Colorado, Washington, and Oregon. These states have entered into a compact with the state of Arizona through the Western Interstate Commission for Higher Education (WICHE) under the terms of which certain qualified Arizona students may attend the veterinary schools of these states without paying nonresident tuition. Such students must have completed pre-veterinary training and must have been bona fide residents of Arizona for five years immediately preceding admission to veterinary school. Admission to the professional schools depends to a great extent upon the quality of the student’s academic record.

250. Basic Principles of Animal Anatomy and Physiology (4) II Systematic anatomy and physiology of domestic species, stressing broad concepts and principles important in daily maintenance and progression of life. Designed for an.s. majors. 3R, 3L. Field trips. Not available for credit toward the major in animal health science. P, three units of bio.

400a-400b. Animal Anatomy and Physiology (3-3) GC Physiology, gross and comparative anatomy. 400a : Nervous, musculoskeletal, immune, hemolymphatic, circulatory, and respiratory systems of domestic animals. 400b : Urinary, digestive, endocrine and reproductive systems. P, Ecol. 104, Chem. 103a-103b, 104a-104b.

403R. Biology of Animal Parasites (3) GC I Biology of host-parasite relationships with emphasis on parasites of veterinary and human importance. Parasite morphology and physiology, life cycles, epidemiology, pathogenesis and zoonotic potential. P, eight units of biol. or micr. (Identical with Ento. 403R, Ecol. 403R, Micr. 403R)

405. Animal Diseases (3) GC I Integration of management, husbandry, and preventive veterinary medicine, as related to animal diseases.

415R. Physiology of Reproduction (3) GC I (Identical with An.S. 415R)

415L. Physiology of Reproduction Laboratory (1) GC (Identical with An.S. 415L)

419. Introductory Immunology (3) GC I (Identical with Micr. 419)

420R. Pathogenic Microbiology (3) GC II (Identical with Micr. 420R)

420L. Pathogenic Microbiology Laboratory (2) GC II (Identical with Micr. 420L)

423R. General Pathology (3) GC II Pathogenesis, pathophysiology and morphologic changes of human and animal diseases. P, Micr. 420R. (Identical with Micr. 423R and Tox. 423R)

423L. General Pathology Laboratory (1) GC II Gross and histologic changes occurring in tissues and organs in selected human and animal diseases and disease processes. P, 423R or CR. (Identical with Micr. 423L and Tox. 423L)

438. Control of Infectious Disease (3) GC II (Identical with Micr. 438)

450. Medical Mycology (4) GC I II (Identical with Micr. 450)

458. Comparative Vertebrate Anatomy (4) GC I Evolution and gross structure of vertebrate organ systems. 2R, 6L. P, eight units of animal bio. (Identical with Ecol. 458)

459. Comparative Vertebrate Histology (4) GC I Structure, identification and function of normal vertebrate tissues. 2R, 6L. P, eight units of animal bio. A vertebrate anatomy course is strongly recommended. (Identical with Ecol. 459)

489. Parasitology (4) GC S (Identical with Ecol. 489)

601. Experimental Surgery (2) II 1985-86 Exercises in the surgical procedures commonly necessary in animal experimentation, including aseptic technique, anesthesiology, surgical operations, and care of the postsurgical patient. 1R, 3L. P, three units of mammalian anat.

630. Immunology (4) II 1986-87 (Identical with Micr. 630)

681. Biostatistical Methods in Microbiology (2) I (Identical with Micr. 681)

WATERSHED MANAGEMENT
(See Renewable Natural Resources)

WILDLIFE AND FISHERIES SCIENCE
(See Renewable Natural Resources)
WOMEN'S STUDIES

Committee on Women's Studies

Myra Dinnerstein, Chairperson
Professors Herbert E. Carter (Arid Lands Resource Sciences), William Ittelson (Psychology), Eliana Rivero (Spanish and Portuguese)
Associate Professors Susan Hardy Aiken (English), Ingeborg Kohn (French and Italian)
Patricia MacCorquodale (Sociology), Alice Schiegel (Anthropology)
Assistant Professor Shirley Fahey (Psychiatry)

Women's Studies is an interdisciplinary academic program that offers courses focusing on the new scholarship on women's experiences and perspectives. The committee offers the Bachelor of Arts degree with a major in women's studies.

The major allows students to specialize in courses focusing on women and at the same time to pursue concentrated study in one major discipline and a supporting minor. The student is required to take 36 credit hours: two required courses 100 and 200; one course chosen from Soc. 150, Hist. 253a or 253b; one course in cross-cultural perspective chosen from either 489 or 424 or a course approved by the student's adviser; four other upper-division Women's Studies electives; and four upper-division courses in one of the humanities or social sciences departments. At least one of these four humanities or social science courses must be a writing-emphasis course. (See "Writing-Emphasis Courses" in the Academic Guidelines section of this catalog.

The minor in women's studies consists of at least twenty units selected by the student in consultation with the chairperson of the committee in charge and approved by the student's adviser. Students with a minor in women's studies are encouraged to take courses sequentially, beginning with W.S. 100, then taking intermediate-level courses, and finishing with a senior proseminar.

100. Introduction to Women's Studies (3) I II Introduction to the new information and research on women in literature, history, sociology, philosophy, anthropology, psychology, and political science; investigations of each discipline's approach to women's roles and status.

150. Sociology of Women (3) I II (Identical with Soc. 150)

200. Women in Western Culture: Plato to Plath (3) Women as depicted in leading works by outstanding male and female philosophers, painters, sculptors, and writers from the classical Greek period to the 1960s.

253a-253b. History of Women in the United States (3) I II (Identical with Hist. 253a-253b)

303. Sex Differences and Language (3) I (Identical with Anth. 303)

341. Women and Health (3) I II (Identical with Nurs. 341)

417. Women Authors (3) I (Identical with Engl. 417)

418. Women in Literature (3) II (Identical with Engl. 418)

424. Gender and Social Identity (3) GC II (Identical with Anth. 424)

439. Women in the Literature of the Americas (3) I 1985-86 (Identical with Engl. 439)

453. History of Women and Work (3) GC I (Identical with Hist. 453)

458. Feminism: A Comparative History (3) GC II (Identical with Hist. 458)

459. Sociology of Male and Female Roles (3) GC I II (Identical with Soc. 459)

465. Women in International Development (3) GC I 1985-86 (Identical with Anth. 465)

469. History of Women In Latin America (3) GC II (Identical with Hist. 469)

476. Women and the Law (3) GC I 1986-87 (Identical with Pol. 476)

480. Women in Management (3) I II Open only to students who meet the requirement for Advanced Standing as specified in the College of Business and Public Administration section of the catalog. (Identical with M.A.P. 480)

485. Mexicana/Chicana Women's History (3) GC I CDT (Identical with M.A.S. 485)
Women in East Asia (3) GC I (Identical with Or.S. 489)

Proseminar
a. Women's Studies (3) [Rpt./2] I II

Counseling Women (3) II (Identical with Coun. 571)

Colloquium
e. Advanced Studies in the History of Women (3) I II (Identical with Hist. 595e, which is home)

ZOOLOGY
(See Ecology and Evolutionary Biology)
Faculty
Arizona Board of Regents

EX OFFICIO

BRUCE BABBITT, J. D. ......................................................... Governor of Arizona
CAROLYN P. WARNER ..................................................... State Superintendent of Public Instruction

APPOINTED

PAUL D. JULIEN, Ed.D., Assistant Treasurer ......................................................... May, 1985
DONALD PITTS, J.D., President ................................................................. January, 1986
ESTHER N. CAPIN, M.Ed. ................................................................. January, 1986
TIO A. TACHIAS ................................................................. January, 1988
WILLIAM P. REILLY, Treasurer ................................................................. January, 1988
DONALD G. SHROPSHIRE, Secretary ................................................................. January, 1990
A. JACK PFISTER, LL.B., President-Elect ................................................................. January, 1990
EDITH S. AUSLANDER, M.A. ................................................................. January, 1992
HERMAN CHANEN, Assistant Secretary ................................................................. January, 1992
ADMINISTRATIVE OFFICERS

(Year of first University appointment in parentheses after each name)

HENRY KOFFLER (1962) .......................................................... President of the University of Arizona, 1965-66; President Emeritus of the University of Arizona; M.S., 1944, Ph.D., 1947, University of Wisconsin; D.Sc., 1977, Purdue University.

RICHARD A. HARVILL (1934) .................................................. President Emeritus of the University of Arizona; B.S., 1926, Mississippi State College; A.M., 1927, LL.D., 1959, Duke University; Ph.D., 1932, Northwestern University; Doctor "Honoris Causa," 1966, Universidade Federal do Ceara; LL.D., 1971, Bowling Green State University; LL.D., 1971, Arizona State University; LL.D., 1971, University of Arizona.

NILS HASSELMO (1983), Senior Vice President for Academic Affairs and Provost; B.A., 1957, Augustana College; Ph.D., 1961, Harvard University.

BEN J. TUCHI (1985), Senior Vice President for Administration and Finance; B.S., 1959, M.S., 1962, Pennsylvania State University; Ph.D., 1970, St. Louis University.

LEE B. JONES (1964), Vice President for Research; Dean of the Graduate College; B.A., 1960, Wabash College; Ph.D., 1964, Massachusetts Institute of Technology.


LAUREL L. WILKENING (1973), Vice Provost for Academic Affairs; B.A., 1966, Reed College; Ph.D., 1970, University of California at San Diego.

ALBERT B. WEAVER (1958), Executive Vice President Emeritus; A.B., 1940, University of Montana; M.S., 1941, University of Idaho; Ph.D., 1952, University of Chicago.

RICHARD M. EDWARDS (1958), Vice President Emeritus for Student Relations; B.S.C.H.E., 1941, Purdue University; M.S.Ch.E., 1948, University of Washington; Ph.D.Ch.E., 1964, E.Chem., 1974, University of Arizona.

ARNO RICHARD KASSANDER (1954), Vice President Emeritus for Research; B.A., 1941, D.S.C., 1971, Amherst College; M.S., 1943, University of Oklahoma; Ph.D., 1950, Iowa State College.


SARAH A. BLAKE (1983), Associate Vice President for Finance; B.S., 1977, University of Arizona.

CELESTINO FERNANDEZ (1976), Associate Vice President for Academic Affairs; B.A., 1973, Sonoma State College; M.A., 1974, Ph.D., 1976, Stanford University.

JOHN A. MONNIER, CP.A. (1981), Associate Vice President for Information Services; B.A., 1962, DePaul University; M.B.A., 1969, University of Chicago.

WILLIAM R. NOYES (1968), Associate Vice President for Academic Affairs; A.B., 1962, Stanford University; M.A., 1963, Fletcher School of Law & Diplomacy; Ph.D., 1968, University of California at Los Angeles.


JAMES T. WHEELER (1975), Assistant Vice President for Research; Director of Sponsored Projects; B.B.A., 1967, M.B.A., 1968, University of Wisconsin.


MYLES BRAND (1981), Dean of the Faculty of Social and Behavioral Sciences, College of Arts and Sciences; B.S., 1964, Rensselaer Polytechnic Institute; Ph.D., 1967, University of Rochester.

WILLIS R. BREWER (1949), Dean Emeritus of the College of Fine Arts; Professor Emeritus of Music; B.Mus., 1941, University of Rochester; Ph.D., 1945, Cornell University.

BARTLEY P. CARDON (1980), Dean of Agriculture; B.S., 1939, M.S., 1940, University of Arizona; Ph.D., 1946, University of California at Berkeley.

FREDERICK W. GAINES (1959), Dean of the College of Arts and Sciences; B.S., 1961, Texas Christian University; M.A., 1962, University of California at Berkeley; LL.D., 1969, The College of Artecia.

RONALD GOURLEY (1978), Dean, College of Architecture; B.Arch., 1943, University of Minnesota; M.Arch., 1948, Harvard University.

ROBERT LESLIE HULL (1964), Dean Emeritus of the College of Fine Arts; Professor Emeritus of Music; B.Mus., 1939, M.Mus., 1941, University of Rochester; Ph.D., 1945, Cornell University.

DONALD J. IRVING (1948), Dean of the Faculty of Fine Arts, College of Arts and Sciences; B.S., 1955, Massachusetts College of Art; M.A., 1956, Ed.D., 1963, Columbia University.

EDGAR J. McCULLOUGH, JR. (1957), Dean of the Faculty of Science, College of Arts and Sciences; A.B., 1953, M.S., 1955, West Virginia University; Ph.D., 1963, University of Arizona.

EUGENE H. LEVY (1975), Director of the Lunar and Planetary Laboratory; A.B., 1966, Rutgers University; Ph.D., 1971, University of Illinois.


SHARON L. KHA (1983), Director of Public Information; B.A., 1968, Bethel College; M.A., 1971, University of Texas.

STARDUST K. JOHNSON (1984), Coordinator of Summer Session; B.Mus., 1972, M.Mus., 1979, University of Arizona.

J. JULIUS HUMPHREY (1969), Director, Scholarship Development; B.S., 1946, Mississippi State University; B.A., 1946, University of Tennessee.

RICHARD E. IMWALLE (1978), Director of the Development Office; B.S., 1964, University of Oregon.


R. FRANK GREGG (1981), Director, School of Renewable Natural Resources; B.A., 1949, University of Colorado.


ROBERT E. BURKE (1984), Manager, Printing and Reproductions; B.A., 1960, University of Arizona.


FRANK A. SONNEVILLE (1965-77; 1979), Director of Cooperative Education; B.A., 1957, University of Connecticut; M.Ed., 1978, University of Arizona.


FREDERICK H. CHAFFEE, JR. (1984), Director of the Multiple Mirror Telescope Observatory; A.B., 1963, Dartmouth College; Ph.D., 1968, University of Arizona.


B. SUE CRISWELL (1980), Director of the Medical Technology Program; B.S., 1964, North Texas University; M.S., 1968, Ph.D., 1969, Baylor University.

RALPH E. DEAL (1937), Director Emeritus, Purchasing; B.S., 1929, University of Arizona.

MURRAY DEARMOND (1969), Director, Student Health Service; B.A., 1957, DePauw University; M.D., 1961, Indiana University.


LEONARD W. DEWHIRST (1976), Director of the Agricultural Experiment Station; B.S., 1949, M.S., 1950, Ph.D., 1957, Kansas State College.

JAMES L. ENYEART (1977), Director, Center for Creative Photography; B.F.A., 1965, Kansas City Art Institute; M.F.A., 1970, University of Kansas.

MANUEL ESCAMILLA (1982), Director of Minority Student Affairs; B.A., 1970, Colorado State University; M.Ed., 1972, Antioch College; Ph.D., 1976, University of Kansas.


KENNETH EARL FOSTER (1972), Director, Office of Arid Lands Studies; B.S.A.E., 1967, Texas Technological College; M.S., 1969, Ph.D., 1972, University of Arizona.


R. FRANK GREGG (1981), Director, School of Renewable Natural Resources; B.A., 1949, University of Colorado.

JAMES SEAVEY GRIFFITH (1978), Director of the Northwestern Folklife Center; B.A., 1961, M.A., 1967, University of Arizona.

THOMAS D. HIGDON (1965 -71; 1975), Librarian and Director of Arizona Health Sciences Center Library; B.S., 1957, University of Arizona.
CORNELIUS JOHN MARE (1978), Director of International Programs; Associate Director of the Agricultural Experiment Station; B.S., 1944, College of St. Scholastica; M.A., 1950, University of Minnesota; Ph.D., 1971, University of Washington.

AARONSON, MARC (1977), Associate Professor of Astronomy and Associate Astronomer in the Steward Observatory; B.A., 1974, Ph.D., 1977, Harvard University.


ABBOTT, JAMES LeROY (1952), Assistant Research Scientist Emeritus in Agriculture Chemistry, Agricultural Experiment Station; B.S., 1942, New Mexico College of Agriculture and Mechanic Arts; M.S., 1965, University of California at Davis.

ABRAMS, HERBERT KERMAN (1968), Professor Emeritus of Family and Community Medicine; B.S., 1936, Northwestern University; M.S., M.D., 1940, University of Illinois; M.P.H., 1947, Johns Hopkins University.

ADAMCIN, JULIE (1970), Extension Agent, 4-H in the Cooperative Extension Service; B.S., 1969, Oklahoma Baptist University.

ADAMEC, LUDWIG WARRAN (1967), Professor of Oriental Studies; Director of the Near East Center; B.A., 1960, M.A., 1961, Ph.D., 1966, University of California at Los Angeles.
ANDREWS, GREGORY RICHARD (1979), Associate Professor of Computer Science; B.S., 1969, Stanford University; Ph.D., 1974, University of Missouri.


ALBANESE, CHARLES ANTHONY (1967), Professor of Architecture; B.Arch., 1965, M.Arch., 1967, University of Illinois.

ALBERTS, DAVID S. (1975), Professor of Internal Medicine and Pharmacology; B.S. 1962, Trinity College; M.D., 1966, University of Virginia.

ALCORN, ESTHER E. (1976), Lecturer in Family and Community Medicine; B.A. 1948, University of California at Berkeley; M.D., 1955, University of California at San Francisco.

ALCORN, STANLEY MARCUS (1963), Professor of Plant Pathology; Research Scientist in Plant Pathology, Agricultural Experiment Station; B.S., 1948, Ph.D., 1954, University of California at Berkeley.

ALEMONI, LAWRENCE MASSUD (1975), Director of Instructional Research and Development; Professor of Educational Psychology; B.A. 1961, Westminster College; M.A., 1964, University of Utah; Ph.D., 1966, Michigan State University.

ALEPA, FRANCIS P. (1979), Professor of Internal Medicine; B.S., 1954, Lebanon Valley College; M.D., 1958, Georgetown University.


ALFONSO, MICHAEL JOSEPH (1964), Assistant Professor of Naval Science; B.S.M.E., 1962, Trinity College; M.D., 1966, Stanford University.

ALLEN, ADELA (1968), Associate Professor of Reading, Acting Head of the Department; B.A., 1952, University of the Americas; M.A., 1954, University of Houston; Ph.D., 1974, University of Arizona.

ALLEN, ALVIN (1948), District Director Emeritus of Agriculture in the Cooperative Extension Service; B.S., 1948, M.S., 1961, University of Arizona.

ALLEN, HUGH D. (1973), Assistant Director, ECHO/Phonolaboratory; Professor of Pediatrics; B.A., B.S., 1962, Otterbein College; M.D., 1966, University of Nebraska.

ALLEN, PAUL MALCOLM (1961), Professor of Secondary Education; B.S., 1947, M.A., 1948, Ph.D., 1956, University of Nebraska.

ALLEN, R. V. VAN (1963), Professor Emeritus of Elementary Education; B.A., 1938, M.A., 1940, West Texas State College; Ed.D., 1948, University of Texas.

ALLEN, RONALD EUGENE (1960), Associate Professor of Animal Sciences and of Nutrition and Food Science; Associate Research Scientist, Agricultural Experiment Station; B.S., 1972, Texas A & M University; Ph.D., 1976, Iowa State University.

ALLEN, ROSS MARVIN (1952-54; 1957), Professor Emeritus of Plant Pathology; Research Scientist Emeritus in Plant Pathology, Agricultural Experiment Station; B.S., 1950, Ph.D., 1953, University of Arizona.

ALLEN, RUPERT CLYDE, JR. (1956-60; 1962), Professor of Spanish and Portuguese; A.B., 1951, M.A., 1953, Ph.D., 1960, University of California at Berkeley.

ALLEN, RUTH AMELIA (1955), Professor Emerita of Home Economics; B.S., 1934, M.S., 1940, Iowa State University.

ALMAGRO, BERTHA (1978), Assistant Librarian, Arizona Health Sciences Center; B.A., 1950, M.S., 1955, University of Havana; M.S., 1958, Cuban Library College.

ALTMAN, ELLEN (1979), Acting Dean of the College of Education; Professor of Library Science; A.B., 1957, Duquesne University; M.L.S., 1965, Ph.D., 1971, Rutgers University.

ALTSCHUL, D. ROBERT (1963), Associate Professor of Geography and Regional Development; B.A., 1957, Harpur College, State University of New York; M.A., 1959, Ph.D., 1966, University of Illinois.


AMBERG, JOHN (1964), Professor of Radiology; B.S., 1946, University of Minnesota; M.D., 1949, University of Minnesota.

AMBURGEY, LYMAN R. (1955), Extension Specialist Emeritus, Cooperative Extension Service; B.S., 1946, Marquette University; Ph.D., 1953, University of Missouri.

AMUNDSON, GARY ROBERT (1978), Lecturer in Animal Sciences; B.S., 1973, Montana State University.

AMY, GARY LEE (1978), Associate Professor of Civil Engineering and Engineering Mechanics; B.S., 1970, M.S., 1971, San Jose State University; Ph.D., 1978, University of California at Berkeley.

ANDERS, PATRICIA LEE (1976), Associate Professor of Reading; B.S., 1971, M.S., 1972, Ph.D., 1976, University of Wisconsin at Madison.

ANDERSON, JON VICTOR (1980), Associate Professor of English; B.S., 1963, Northeastern University; M.F.A., 1966, University of Iowa.

ANDERSON, KAREN SUE (1980), Assistant Professor of History; B.S., 1969, University of Kansas; Ph.D., 1975, University of Washington.

ANDERSON, ROBERT M. (1962), Associate Professor of Surgery; Associate Dean of Continuing Medical Education; M.D., 1946, Marquette University.

ANDERSON, ROGER A. (1959), Professor of Aerospace and Mechanical Engineering; B.S., 1948, M.S., 1950, Ph.D., 1953, California Institute of Technology.

ANDERSON, RUTH MARJORIE (1955), Lecturer Emerita in Speech and Hearing Sciences; B.Mus., 1937, M.A., 1947, University of Wichita.

ANDERSON, WALDO KEITH (1966), Professor of Higher Education; Assistant Director of University Extension in Continuing Education; A.B., 1945, Ottawa University; M.Ed., 1953, University of South Dakota; Ph.D., 1963, University of Minnesota.

ANDERSON, WARREN H. (1956), Professor of Art; B.S., 1950, Western Illinois State College; M.A., 1951, University of Iowa; Ph.D., 1961, Stanford University.


ANDREWS, GREGORY RICHARD (1979), Associate Professor of Computer Science; B.S., 1969, Stanford University; Ph.D., 1974, Washington University.
ANGEL, J. ROGER P. (1973), Professor of Astronomy and Optical Sciences; Astronomer in the Steward Observatory; B.A., 1963, St. Peters College; M.S., 1966, California Institute of Technology; Ph.D., 1967, Oxford University.

ANGEVINE, JAY BERNARD, JR. (1967), Professor of Anatomy; Lecturer in Neurology; B.A., 1949, Williams College; M.A., 1952, Ph.D., 1956, Cornell University.

ANGUS, ROBERT CHAUNCEY (1959), Professor of Agricultural Economics; Research Scientist in Agricultural Economics, Agricultural Experiment Station; B.S., 1950, Cornell University; M.S., 1954, Ph.D., 1960, Pennsylvania State University.

ANTHONY, JAMES RAYMOND (1974), Professor of Political Science; Diplomate, European School of Paris; Ph.D., 1964, University of Southern California.

ANTHONY, JOHN WILLIAMS (1946), Professor Emeritus and Graduate Student Coordinator of Geosciences; B.S., 1946, M.S., 1951, University of Arizona; Ph.D., 1964, Harvard University.

ANTIA, SHIRIN DARA (1980), Assistant Professor of Special Education; B.A., 1971, University of Calcutta; M.Ed., 1973, Ph.D., 1979, University of Pittsburgh.


ANTLEY, ELIZABETH MARTIN (1967), Professor of Reading; Director, Bureau of Educational Services; B.A., 1950, University of Mississippi; M.Ed., 1960, Ed.D., 1962, University of Southern Mississippi.

ANTRIM, WILLIAM H. (1959), Lecturer Emeritus in Business and Career Education; B.S., 1950, Syracuse University; M.Ed., 1968, University of Arizona.

ARPENDT, JACK ROBERT (1977), Lecturer in Pharmacy Practice; B.S., 1953, Feris Institute; M.S., 1956, Ph.D., 1973, University of Wisconsin.


ATKINSON, GEORGE H. (1983), Professor of Chemistry; Head of the Department; B.S., 1967, Eckerd College; Ph.D., 1971, Indiana University.

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522 FACULTY OF THE UNIVERSITY

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FACULTY OF THE UNIVERSITY 533

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Index
Abbreviations, 9-10; 188
Absences, 46
Absentia, work in, 50, 172
Academic calendar, 6-7
Academic deficiencies, 26-27
Academic disqualification, 36-37
Academic divisions, 15
Academic guidelines, 35-47
Academic Learning Skills Center, 63
Academic probation, 36
Academic renewal, 37
Accounting, 190-192
major in, 113, 190
Master of, 109, 190
Accounts, clearance of, 32, 50
Accreditations, 13
Activities
athletics, 71-72, 175-176, 285-287
eligibility for, 71-72
extracurricular, 71-74
religious, 74
Adding courses, 33
Address, registration of, 69
Adjustments, registration, 33
Administration
business, 110, 114-115, 117-121, 228
criminal justice, 114, 122, 343
educational, 263-266
general business, 114, 123, 343
health services, 114, 123, 343
human services, 114, 123, 344
public, 114, 121-123, 342, 346
public recreation, 114, 123, 342
university, 488-490
Administrative
drop, 46
officers, 488-490
Admission, 24-31 (see also individual college sections)
advanced placement, 27
advanced standing, 28, 116-117, 132-133
affidavit for, 24
affirmative action, 4, 24
application fee, 29-30
application for, 24, 27, 169
cancellation of, 25
college requirements, 29 (see also individual college sections)
deadlines for application, 24
disabled students, 31
domicile affidavit, 24, 52
entrance credit, 27
entrance tests, 24, 25
equal opportunity, 4, 24
foreign students, 30, 170-171
freshman standing, 25
general regulations, 24-25
graduate, 170-171
health report form, 24, 64
immigrant and refugee-status students, 30
Law College, 151-152
Medical College, 153
nonresidents, 29-30
readmission, 25
refugee-status students, 30
required high school subjects, 26
scholastic requirements for, 25
summer session, 183
transfer of credits, 28
transfer students, 27
veterans, 31
war orphans, 31
Admission test for law school, 151
Admission to candidacy, 49-50, 56, 172
Advanced degrees, 172, 174-176
Advanced placement, 27, 42-43
Advanced standing, admission to, 28, 116-117, 134-135
Advisers
American Indian student, 64
arts and sciences, 96-97
business and public administration, 115
foreign student, 64
pre-education, 128-129
Advising, student, 63
Aerospace & mechanical engineering, 192-196
Aerospace engineering, 136, 192-196
Aerospace studies (military), 181, 371-372
Affidavit, admission, 24
Affirmative action, 4
Aging, 315-316
Agricultural
biochemistry (see nutritional sciences)
business curriculum, 85-86
chemistry and soils, 463-464
communications, 84, 199
economics, 196-198
education, 198-200
engineering, 137-138, 461-463
Experiment Station, 16
Extension Service, 18
journalism, 84, 87, 296
machinery and equipment engineering, 461
science curriculum, 85-86
Agriculture, College of, 84-89
class standing, 38
courses (see individual dept. listings)
degrees, 84
facilities, 86
international activities, 86, 199, 463
majors, 84-85
maximum units allowed per semester, 37
requirements, 85-86, 87
specializations, 85
Agronomy and plant genetics, 426-429
Aid, student, 58-59
Air Force ROTC, 180-181, 371
Air science, 180-181, 371
Alumni association, 77
placement, 63
American College Test, 24, 25, 40-41
American Indian
speech and hearing program, 471
student advising, 64
studies, 201-202
Analytical Center, University, 22
Anatomy, 202-203
Ancient near east, 401
Anesthesiology, 361
Animal disease diagnostic service, 16
Animal health science, 481-482
Animal physiology, 203
Animal sciences, 203-205
Annual expenses, 53
Anthropology, 205-212
Appeal of grade, 39
Application fee, admission, 29-30
Application for admission, 24, 27, 169
Application for degree candidacy, 49-50
Applied mathematics, 212
Applied Research in Anthropology, Bureau of, 18, 206
Arabic, 401, 406-407
Arboretum, Boyce Thompson, 17
Archaeology, 206, 242
Architecture
admission requirements, 29, 90-92
class standing, 38
College of, 90-94
courses, 213-215
degrees, 90
landscape, 89, 447-448
library, 67
maximum units allowed per semester, 37
requirements, 90-93
Area development, 121, 304-307
Arid lands resource sciences, 215-216
Arid lands studies, 21
Arizona Board of Regents, 487
Arizona Center for Educational Evaluation and Measurement, 16, 132
Arizona Center for Educational Research and Development, 16, 132
Arizona Cooperative Fishery Unit, 16
Arizona Cooperative National Park Resources Study Unit, 16
Arizona Cooperative Wildlife Research Unit, 16
Arizona Early Music Society, 76
Arizona Friends of Music, 76
Arizona Poison and Drug Information Center, 17
Arizona Research Laboratories, 23
Arizona Remote Sensing Center, 17
Arizona State Museum, 17, 75
Arizona Transportation and Traffic Institute, 17
Army ROTC, 179-180, 371
Art, 216-222
Art education, 99-100, 216-217, 221-222
Art gallery, 75
Art history, 100, 216-217, 220-221
Art museum, 23, 75
Artist Series, 75
Arts and sciences
academic divisions, 95
academic procedures, 108
admission requirements, 29, 96
class standing, 38
College of, 95-113
degrees, 95
faculties, 95
general education requirements, 97-102
general studies, 103
majors, 95, 97, 104-105
maximum units allowed per semester, 37
minors, 97, 105-106
preprofessional programs, 108-110
regulations, 108
requirements for degrees, 97
Arts Society, International, 76
Asia (see Oriental studies)
Assistance, financial, 58-59, 179, 180, 181
Associated Students, 64, 72
Astronomy, 222-223
Athletic coaching minor, 285
Athletics
eligibility for, 71-72
intercollegiate policy, 71-72
intramural, 177
Atmospheric Physics, Institute of, 19, 224
Atmospheric sciences, 224-225
Attendance, 46
Auditing courses, 32, 33, 39, 51, 174
Automobiles, regulations, 71
Average, grade-point, 28, 35, 36
Average, graduation, 49, 50
Averaging of grades, 39
for final nonuniversity credit course, 50
Awards and prizes, 61-62
Bachelor's degree
application for candidacy, 49-50
major fields, 83
second, 50
units required for, 48-49
Bands, university, 379, 385
Baritone, 386
Basic Education Opportunity Grants (BEOG), (see Pell grants)
Bassoon, 386
BEOG (see Pell grants)
Bicycle regulations, 71
Bilingual teacher education, 130, 273
Biochemistry, 225-227
botanical (see nutritional sciences)
Biological sciences (see biology)
Biology, 227
botanical, 377-378
developmental, 377-378
ecology, 255-259
evolutionary, 255-259
general (see ecology and evolutionary biology)
microbiology, 368-371
molecular, 377-378
Biomedical engineering, 133-134, 227
Black studies, 228
Board and room, 53-54, 68-69
Board of Regents, 487
Books, estimated expense, 53
Botany (see biology and plant sciences)
Boyce Thompson Southwest Arboretum, 17
Brazil program, 86, 183, 465
Breakage deposit, 55
Broadcasting
  courses, 438-440
  services, 18-19
Bureau of
  Applied Research in Anthropology, 18, 206
  Geology and Mineral Technology, 18
Business administration, 114, 117-121, 228
  Bachelor of Science in, 114, 117-121
  general major in, 119
  major fields, 118-121
  Master of, 114
Business, agricultural, 85
Business and career education, 229-230
Business and public administration
  admission requirements, 29
  advanced standing, 29, 116-117
  advisement, 115
  class standing, 38
  College of, 114-125
  degrees, 114-115
  majors, 114-115, 118-121, 122-123
  management emphasis areas, 123
  maximum units allowed per semester, 37
  requirements, 117-123
  transfer credits, 115-116
Business economics, 114, 119, 259-263
Business, agricultural, 85
Business and career education, 229-230
Business and public administration
  admission requirements, 29
  advanced standing, 29, 116-117
  advisement, 115
  class standing, 38
  College of, 114-125
  degrees, 114-115
  majors, 114-115, 118-121, 122-123
  management emphasis areas, 123
  maximum units allowed per semester, 37
  requirements, 117-123
  transfer credits, 115-116
Business economics, 114, 119, 259-263
Business education, 129, 229-230
Cafeterias, 54-55, 69
Calendar
  academic, 6-7
  presession, 7
  summer session, 7
Campus life, 68, 76
Cancellation of readmission or registration, 25, 34, 57
Cancellation of courses, 34
Candidacy of degrees
  graduate, 56, 172
  undergraduate, 49-50, 56
Cap and gown rental fee, 56
Career development, 63
Career education, 229-230
Cars on campus, 71
Catalog, choice of, 49
Cello, 386
Cellular and developmental biology
(see molecular and cellular biology)
Center for
  Creative Photography, 18, 66
  Educational Evaluation and Measurement, 16, 132
  Educational Research and Development, 16, 132
  English as a Second Language, 30, 277
  Study of Higher Education, 18, 132, 320-321
Centers
  Academic Learning Skills, 63
  Arizona Poison and Drug Information, 17, 169
  Arizona Remote Sensing, 17
  Computer, 22
  Mexican American Studies and Research Center, 367-368
  Optical Sciences, 21
  Poetry, 75
  Southwest, 21
Computer science, 244-246
Concerts, 75-76
Concurrent enrollment, 51
Contents, 5
Conduct, student, 46-47, 70-71
Conducting, 386
Consumer studies and home management, 84, 87, 291, 296
Contact hour, 35
Contemporary media music (see jazz studies)
Continuing education, 50, 182
Contracts, residence hall, 69
Cooperative Extension Service, 18
Cooperative Fishery Research Unit, 16
Cooperative National Park Unit, 16
Cooperative program
in agriculture, 87
in arts and sciences, 111
in engineering, 150
in international management, 111
in mines, 160
Cooperative residence hall, 68
Cooperative Wildlife Research Unit, 16
Cooperative work-study, 87, 111, 150, 162
Correspondence instruction, 35, 49, 173, 182
Council for Environmental Studies, 86
Counseling and guidance, 247-248
Counseling service, student, 62-65
Courses, 187-484
adding, 33
attendance at, 46
auditing, 32, 33, 39
cancellation of, 34, 188
classification of, 187
correspondence, 35, 49, 173, 182
dropping, 33
graduate, defined, 172
house-numbered, 189
individual studies, 189-190, 385-386
load, 37, 38
numbering system, 187
off-campus, 182
repetition of, 39
required for admission, 26
withdrawal from, 33
Creative Photography, Center for, 18, 66
Creative writing, 95, 97, 277
Credit by examination, 27, 35, 42, 45
fee for, 55
credit hour, 35
Credits
degree, 48-49
for military service, 179
from community colleges, 28
graduate, for seniors, 46, 172, 187-190
restrictions, 37
study abroad programs in, 182-183
transfer, 28, 172-173
university, 35, 49
Criminal justice administration, 109, 114, 122, 343
Cultural opportunities, 75-76
Curricular change, 187
Cuts, 46
Dance, 95, 99, 249-250
Deadlines
application, 24
dropping a course, 33
Dean of Students, 62
Dean's list (see individual college sections)
Deficient scholarship, 26-27
Degree candidacy, 49, 172
fees for, 50, 56
Degrees
advanced, 172, 176
bachelor's, 48
doctor's, 175
graduate, 172, 174-176
in absentia, 50
master's, 174-175
requirements, 48
second bachelor's, 50
specialist, 175
undergraduate, 83
units required for, 48
Dendrochronology, 20
Dentistry, 109
Departmental organizations, 74
Departments, 190-484
Deposits
breakage, 55
cap and gown, 56
military equipment, 53, 55
room, 53-54
Design, interior, 84, 87, 291, 293-294
Developmental biology, 377-378
Dietetics, 393
Dining halls, 53, 54, 69
Disabled student services, 31, 64
Discipline, academic, 46
Dishonest scholastic work, 46
Dismissal, 46
Disqualification, 36-37
(see also suspension)
Dissertation, 190
in absentia, 174
microfilm fee, 56
Distributive education, 127, 229
Divisions
academic, 15
Economic and Business Research, 18, 124
general, 177-183
Media and Instructional Services, 18-19
research and special public service, 16-23
Doctor's degrees, 177
major fields, 176
Domicile
affidavit, 24
legal classification of, 52
Dormitories, 53-54, 68-69
Drama, 95, 99, 250-255
education, 95, 99, 250-251
production, 95, 99, 250-251
series, 75
Dramatic theory, 95, 100, 250-251
Dropping a course, 33
Drug information center, 17, 169
Drugs, regulations, 70
Early childhood education, 126, 127, 129, 132, 273, 291, 292
Earth sciences (see geosciences or hydrology)
teaching major, 127
East Asia Study Center, 111
Ecology and evolutionary biology, 255-259
Economics and Business Research, Division of, 18, 124
Economics, 259-263
  agricultural, 196-198
  business, 114, 119
  mineral, 374-375
Education
  administration, 263-266
  admission requirements, 29
  agricultural, 198-200
  areas of specialization, 126-127
  bachelor's degrees, 126
  bilingual, 130
  business, 129, 229-230
  class standing, 38
  College of, 126-132
  community college, 131
  distributive, 229
  Doctor of, 126
  early childhood, 126, 127, 129, 132, 273, 291, 292
  elementary, 126, 129-130, 273-276
  foundations of, 263-266
  health, 317-318
  higher, 132, 320-321
  home economics, 291, 295-296, 297
  Master of, 126
  maximum units allowed per semester, 37
  music, 381
  noncertification track, 127, 131
  open courses, 128
  physical, 177, 285 (see also exercise and sport sciences)
  placement, 63
  requirements, 127-128
  secondary, 126, 130-131, 454-458
  special, 126, 131, 468-471
  specialist in, 126
  student teaching, 128
  teaching majors and minors, 127
Educational
  administration, 263-266
  evaluation and measurement, office of, 132
  foundations, 263-266
  media, 455
  opportunity grants, 58
  psychology, 266-268
  research and development, 16, 132
  Specialist, 126, 176
Electrical and computer engineering, 268-273
Electrical engineering, 140-141, 268-273
Elementary education, 273-276
  program in, 126, 129-130
Eligibility
  athletic, 72
  extracurricular activities, 71
Employment, 58
Energy engineering, 141-142, 387-390
Engineering
  admission requirements, 29
  advanced standing, 134-135
  aerospace, 136, 192-196
  agricultural, 137-138, 461-463
  biomedical, 133-134, 227
  chemical, 156, 230-232
  civil, 138-139, 236-241
  class standing, 38
  clinical, 134
  College of, 133-150
  computer, 139-140, 268-273
  computer software, 134
  cooperative program, 150
  electrical, 140-141, 268-273
  energy, 141-142, 387-390
  Experiment Station, 19
  geological, 154, 157, 373-374
  graduate study in, 133
  hydrology, 144-145, 329
  industrial, 145-146
  manufacturing systems, 134
  materials science and, 154, 158, 351
  mathematics, 142-143
  maximum units allowed per semester, 37
  mechanical, 146-147, 192-196
  mechanics, 236-242
  metallurgical (see materials science and engineering)
  mining, 154, 159, 375-376
  nuclear, 147-148, 387-390
  physics, 143-144
  premedical, 134
  soils, water, 461-464
  student professional and honorary societies, 150
  systems, 149, 478-481
Engineering Experiment Station, 19
English
  as a foreign language, test of, 30, 171
  as a second language, 30, 277
  composition requirement, 40-41
  courses, 276-282
  entrance test, 24
  foreign student requirements, 30
  freshman requirements, 40-41
Entry requirements, general, 24-31
  (see also individual college and department sections)
Environment and behavior, 284
Environmental Research Laboratory, 19
Environmental Studies Council, 86
Equal opportunity, 4, 24
Ethnic studies
  American Indian programs, 95, 201-202
  Black studies, 95, 228
  Latin American studies, 95, 334-335
  Mexican American studies, 95, 367-368
Evolutionary biology, 255-259
Examinations
  advanced placement, 27, 42-43
  college-level, 28, 43-44
  credit by, 27, 42, 45, 55
  entrance, 24, 30
  English as a foreign language, 30, 170-171
  exemption, 42, 44
  proficiency, 42, 44-45
  required, 41
  special, 42, 45
upper-division writing-proficiency, 41
Excess units, 37
Exchange programs, 109, 160, 333
(see also international programs)
Exemptions, 31
examinations, 42, 44
from failing grades, 31, 37
veterans', 31
Exercise and sport sciences
courses, 284-291
degree requirements, 285
department, 177, 284-291
major, 177, 284-285
minor, 177, 284-285
Expenses and fees, 51-57
Experiment stations
agricultural, 16
engineering, 19, 151
Explanatory notes, 187-188
Extended English, teaching major, 277
Extension courses, 182
Extension education, 198, 296
Extension Service, Cooperative, 18
Extracurricular activities, 71-76
Faculty of
Fine Arts, 95
Humanities, 95
Science, 95
Social and Behavioral Sciences, 95
Family and community medicine, 367
Family and consumer resources
child development and family relations, 84, 87, 292-293
clothing, textiles, interior design, 84, 87, 293-295
degrees, 87, 291
divisions of, 84, 87
home economics education/consumer studies, 84, 87, 295-297
majors, 87, 291
requirements, 87
school of, 84, 87-88, 291-298
Family economics, 295-297
Family housing, 54, 69
Family relations, 292-293
Fashion promotion, 293-295
Federal student aid, 58-69
Fees, 51-57
application, 29-30
audit, 51
board, 53-54
breakage deposit, 55
cap and gown rental, 56
change of schedule, 33, 55
college-level examination, 55
credit by examination, 55
degree candidacy, 50, 56
dissertation microfilm, 58
examination, 40-41, 55
expense summary, 53
family housing, 54
field trip, 55
foreign language examination, 55
Graduate Record Examination, 171
graduation, 56
health center, 64
housing, 53-54
identification card replacement, 56
instrument rental, 55
laboratory penalty, 55
late registration, 51
library card replacement, 56
meals, 53
military equipment, 53, 55
music, 55, 387
music instrument rental, 55, 387
noncredit, 51
nonresident application, 29-30
nonresident tuition, 51-53
payment of, 51
processing, thesis, 56
receipt, replacement, 56
refunds of, 56, 57
registration, 51-53, 57
residence hall, 53-54
room deposit, 53-54
senior degree check, 56
special college, 56
student housing, 53-54
student teaching, 55
summary of, 53
testing, 41, 55
thesis processing, 56
transcripts, 56
Field trip fees, 55
Fields of study
graduate, 174-175
undergraduate, 83
Film
courses (see drama, radio-television)
facilities, 18-19
library, 19
studies, 102
Final examinations, 41
Finance, major in, 114, 119, 298
Finance and real estate, 298-300
Financial aids (see scholarships and financial aids)
Financial assistance
ROTC program, 179-180, 180, 181
Fine arts (see also arts and sciences)
Faculty of, 95
degrees, 95
minors, 105
requirements, 97, 99-102
Fisheries science (see wildlife and fisheries science)
Fishery Research Unit, 16
Flandrau Planetarium, 19
Flight training program, 181
Flute, 386
Food sciences, 393-394
Food service management, 393-394
Foreign language examination fee, 55
Foreign languages (see also languages)
proficiency exam, 44
requirement (see individual college sections)
Foreign service, 112
Foreign students
admission, 30, 170-171
adviser, 64
credit, transfer, 28, 30, 172-173
INDEX 559

English requirement, 30, 170-171
insurance, 30, 171
language requirement, 30, 171
Foreign study, 86, 112, 182-183, 300, 333, 465
Forest-watershed management, 449-451
Former students, readmission, 25
Foundation, University of Arizona, 79
Foundations of education, 263-266
Fraternities, 73
French and Italian, 300-303
French horn, 286
Freshman composition, 40-41, 277-278
standing, 25
Freshman Week (see new student orientation)
Friends of Music, 75
Full-time student status, 38, 173

General agriculture, major in, 84
General biology (see ecology and evolutionary biology)
General business administration, 114, 119, 228
General divisions, 177-183
General fine arts studies, 101-102, 103
General home economics, 291, 296
General studies, 101-102, 103-104
Genetics, 303
plant, 426
Geochemistry, 308
Geography and regional development, 304-307
Geography, major in, 304
Geological engineering, 154, 157, 373-374
Geology, 308-313
Geology and Mineral Technology, Bureau of, 18
Geophysics, 308
Geosciences, 95, 308-313
German, 313-315
Gerontology, 315-316
Good standing, 35
Government (see political science)
Government, student, 72
Grade by examination, 42, 45
Grade-point average, 28, 39
Grades
appeal, 39
audit, 38, 39
average required for admission, 25, 28, 29
average required for graduation, 49
average required in major, 49
averaging of, 39
change of, 39
forgiveness of, 31, 37
incomplete, 38
minimum averages required, 35
no credit, 38, 39
pass-fail option, 40
special, 39
withdrawal, 39
Grading system, 38
Graduate College, 170-176
admission, 170-171
doctor's degrees, 176, 177
maximum units allowed per semester, 37, 173
master's degrees, 175-176, 177
specialist degrees, 175, 176
Graduate credit
for seniors, 46, 172, 187-190
transfer of, 172-173
Graduate degrees, 174-176
Graduate Library School, 126, 337-339
Graduate majors, 174-175
Graduate recitals, 190
Graduate Record Examination, 171
Graduation
average, 49, 61
candidacy, 49-50, 57
credits, 48
expenses, 56
requirements, 48-50
units, 48
university credit, 49
Graduation with distinction, 61
Graduation with honors, 61
Grants, 58-59
Graphic design, 216
Graphics center, 19
Greek, 242-244
Greens, 73
Guaranteed student loan, 58
Guidance and counseling, 247-248
Guidance services, student, 62-63
Guide to abbreviations, 9-10
Guide to symbols, 188
Guidelines, academic, 35-47
Guitar, 386
Gynecology, 363
Handicapped students (see disabled student services)
Harp, 386
Harpsichord, 386
Health education, 65, 178, 317-318
Health insurance, 30, 65
Health professions student loans, 58
Health regulations, 24-25
Health-related professions, 178, 317-320
admission requirements, 29
class standing, 38
maximum units allowed per semester, 37
Health Sciences Center Library, 67
Health services administration, 114, 123, 343-344
Health services, student, 64-65
mental health, 65
Hearing clinic, 64
Hearing sciences, 95, 100-101, 471-474
Hebrew, 401, 405
Higher education
Center for the Study of, 18, 132, 320-321
courses in, 320-321
majors in, 320
High school requirements, 25-27
High school transcripts, 24
Hindi, 401, 403-404
History, 322-327
History and philosophy of science, 327
History of the university, 14
Holidays, 6-7
Home economics, 84, 87, 88 (also see family and consumer resources)
and journalism, 84, 87, 291, 296
degrees, 84
education/consumer studies, 84, 87, 291,
295-296, 297
textension education, 84, 87, 291, 296
general, 291, 296
majors, 295-296
Home economics education, 291, 295-296, 297
Home management, 84, 87, 291, 295-296, 297
Homework requirements, 35
Honor societies, 73 (see also individual college sections)
Honors, awards, and prizes, 60-61 (see also individual college sections)
Honors courses, 39, 328
graduation with distinction, 61
University scholarship, 60-61
University-wide program, 60, 328
Horn, 386
Horticulture, 426-429
Hospital services, 64-65
House-numbered courses, 189
Housing facilities, 68-69
coeducational residence halls, 68
cooperative residence halls, 68
disabled students, 68
family, 69
fees, 53-54
graduate students, 68
married students, 69
men's residence halls, 68
occupancy of rooms, 69
off campus, 69
regulations, 69-71
single-parent, 69
temporary, 69
undergraduate, 68-69
women's residence halls, 68
Human Development Laboratory, 19
Human resource management, 344-345
Human services administration, 114, 123, 344-345
Humanities, 328
Hydrology and water resources, 144-145, 329-331
Identification cards, 32, 56
Immigrant students, admission, 30
in absentia, degrees, 50
Incomplete, 38
Independent study, 182, 190
India-Pakistan, 471
Indian languages, 300-303
Indian student adviser, 64
Individual studies, 189, 385-386
Industrial engineering, 145-146, 478-481
Infirmary, 64-65
Information, release of, 34
Institute of Atmospheric Physics, 19, 224
Instructional materials collection, 132
Instructional Research and Development, 19
Instrumental music major, 380-381
Instruments, rental, 55, 387
Insurance for foreign students, 30, 171
student, 65
Interactive Educational Television System, 19
Intercollegiate athletics, 72, 177-178
Interdisciplinary programs, 178, 331
Interior design, 291, 294
Internal medicine, 362
International agriculture, 199, 463
International Arts Society, 76
International management, 111
International programs, 86, 111, 112, 182-183, 300, 333, 465
International students, 30, 64, 170-171
Internships, 35, 87, 189
Intramural athletics, 177
Irrigation, 461-463
Italian (see French and Italian)
Japan, 401, 404-405
Jazz studies, 95, 99-100, 380
Jeffrey M. Golding Clinical Research Unit, 19
Jobs, student, 58, 63
Journalism, 332-334
agricultural, 84, 87
broadcast, 438
home economics, 84, 87, 296
Judaic studies, 401, 405
Junior college, 28, 96, 131
Karl Eller Center for Study of Private Market Economy, 20
Key to symbols, 188
Kindergarten-primary education, 129-130, 273, 292
Kitt Peak Observatory, 21-22
KUAT, 18-19
Laboratories
contact hours, 35
Environmental Research, 19
Human Development, 19
Lunar and Planetary, 20
Pharmacokinetics, 21, 169
Laboratory of Tree-Ring Research, 20
Laboratory penalty fee, 55
Land management, 448-451
Landscape architecture, 84, 85, 88-89, 447-448
Language arts-social studies, major, 127
Language proficiency exam, 44
Language requirement (see individual college sections)
Languages
classical, 242-244
Eastern, 400-407
French, 300-303
German, 313-315
Indian, 201-202
Italian, 303
Oriental, 400-407
Portuguese, 464-465, 468
Romance, 453
Russian, 453-454
Slavic, 453-454
Spanish, 464-468
Last day to drop a course, 33, 39
Late registration fee, 92, 51
Latin, 242-244
Latin American Area Center, 334-335
Latin American studies, 334-335
Law
class standing, 38
College of, 151-152
courses, 335-337
honors, 60-61
library, 67
maximum units allowed per semester, 37
pre-law studies, 108, 109
Law school admission test, 151
Lecomte DuNouy Memorial Room, 75
Leadership societies, 74
Leaving the university, 46-47
Lectures, contact hours, 36
Legal residence, 24, 52
Legislative internships, 189
Liberal arts (see arts and sciences)
Librarians, 337
Libraries, 65-67
Library identification card, 56
Library science, 337-339
   Master of, 337
Library science library, 66
Limitation of registration, 34
Linguistics, 339-341
Loans, student, 58-59
Lower-division courses
   defined, 187
   required, 40-41
Lunar and Planetary Laboratory, 20
Mail, 65
Main library, 65-66
Majors
   change of, 33
   graduate, 174-175
   graduation grade average, 49
   undergraduate, 83
Management (see also management and policy)
   emphasis areas, 123
   food service, 393-394
   international, 111
   operations, 114, 120, 123
   personnel, 114, 120
   race track, 203-204
   range, 84, 448-449
   watershed, 84, 449-451
Management and policy, 342-347
Management information systems, 114, 120-121, 347-349
Marketing, 114, 120, 349-351
Married student housing, 69
Master's degrees
   major fields, 174-175
   Master's report, 190
Materials science and engineering, 154, 158, 351-353
Mathematics, 354-360
   applied, 212
   engineering, 133, 142-143
Minimum annual expense, 53
Minimum grade average, 35
Minimum grade average, 35
Mines, 373
   admission requirements, 29, 154
   class standing, 36
   College of, 154-159
   cooperative program, 160
   degrees, 154, 159-160
   financial assistance, 160
   majors, 154
   maximum units allowed per semester, 37, 155
   professional degrees, 159-160
   requirements, 154-159
National annual expense, 53
Mechanical engineering, 133, 146-147
Media and instructional services, Division of, 18-19
Media, educational, 455
Media production, 438-440
Medical care, 64-65
Medical insurance, student, 30, 65
Medical microbiology, 368-371
Medical technology, 178, 318-319
Medical withdrawal, 47
Medical
   College of, 153
   courses, 360-366
   entrance requirements, 153
   grading, 38-39
   library, 67
   loans, 58
   premedical studies, 108-109, 153
Medieval studies, 367
Memberships and accreditations, 13
Men's residence halls, 68
Mental Health Section, 65
Military equipment fee, 53, 55
Military aerospace studies, 181, 371-372
Military science, 179-180, 371
Military service, credit for, 179
Military training and experience, 31
Mineral economics, 374-375
Mineral engineering, 375-376
Mineralogical Museum, 21
Mineralogy, 308
Mines, 373
   admission requirements, 29, 154
   class standing, 36
   College of, 154-159
   cooperative program, 160
   degrees, 154, 159-160
   financial assistance, 160
   majors, 154
   maximum units allowed per semester, 37, 155
   professional degrees, 159-160
   requirements, 154-159
Mines, 373
   admission requirements, 29, 154
   class standing, 36
   College of, 154-159
   cooperative program, 160
   degrees, 154, 159-160
   financial assistance, 160
   majors, 154
   maximum units allowed per semester, 37, 155
   professional degrees, 159-160
   requirements, 154-159
Museums
   Arizona State, 17, 75
   art, 17, 75
   mineral, 21
   state, 17, 75
Music
   Arizona Friends of, 76
   Arizona Early Music Society, 76
   Bachelor of, 96, 99-100
   choral, 381
   collection, 66
   composition, 381, 385
   courses, 379-387
   degrees, 379
education, 95, 99-100, 381
fees, 55, 387
instrument rental, 55, 387
instrumental, 380-381
library, 66
majors, 379-381
performance, 95, 99-100, 380, 385-386
School of, 379-387
teaching and composition, 95, 99-100, 381
Music series, 75
Musical Arts, Doctor of, 379
Narcotic drugs, regulations, 70
National Direct Student Loans, 59
National financial aid programs, 58-59
Native American programs, 201-202, 471
Natural resource recreation, 84, 85, 88-89, 452-453
Natural resources, 84, 85, 88-89, 446-453
Naval science, 180-181, 371-373
Navy ROTC, 180-181, 371
Near Eastern Center, 111
Neurology, 363
New Start Program, 63-64
New student orientation, 32
No-credit
fees, 32, 51
grades, 39
registration, 32, 34, 174
Nonresident students, admission, 29-30
tuition, 51-53
Nuclear engineering, 133, 147-148, 387-390
Numbering system, 187
Nursing
admission requirements, 29
class standing, 38
courses, 390-393
degrees, 162, 390
loans, 58
maximum units allowed per semester, 37
requirements, 162-164
Specialist in, 176, 390
Nutrition and dietetics, 393-394
Nutrition and food science, 393-397
Nutritional Sciences, 393, 397
Oboe, 386
Observatory, 21-22
Obstetrics-gynecology, 363
Occupancy of rooms, 69
Occupational safety and health, 178, 317, 319-320
Off-campus courses, 182
Off-campus housing, 69
Office administration, 229-230
Office education, 229-230
Office of Arid Lands Studies, 21
Office of Interdisciplinary Programs, 178, 331
Office of International Programs, 182-183
Office of Minority Student Affairs, 63-64
Open courses (education), 128
Operations management, 114, 120, 345
Opportunity grants, educational, 58
Ophthalmology, 363
Optical sciences, 398-400
Optical sciences center, 21
Optometry, 110
Orchestra, 379, 385
Organ, 386
Organizational behavior, 344-345
Organizations, 73-74 (see also individual
college sections)
Oriental studies, 400-407
Orientation, 32, 63
Overloads, academic, 37
Overseas studies, 86, 111, 112, 182-183, 300,
333, 465
Pacific-10 athletic conference, 72, 177-178
Pakistan, 401, 403-404
Paleontology, 308
Parking, 71
Part-time students
fees, 51
Pass-fail, 40, 173
Pathology, 364
Payment of fees, 51
Pediatrics, 364
Pell grants, 58
Penalty, late registration, 32
Performance, music, 95, 99-100, 380, 385-386
Persian, 401, 406
Personnel management, 114, 120
Petitions, 33, 39, 46
Petroleum, 308
Pharmaceutical sciences, 407-408
Pharmacokinetics Laboratory, 21, 169
Pharmacology, 408-409, 410
Pharmacy, 165-169, 407-414
admission requirements, 29
College of, 165-169
degrees, 165
Doctor of, 165, 412
electives, 168
maximum units allowed per semester, 37
prepharmacy studies, 109
requirements, 165-168
student loans, 58-59
Pharmacy practice, 412-414
Philosophy, 415-417
Philosophy, Doctor of, 172, 175, 176
Photography, Center for Creative, 18, 66
Photography emphasis, 216
Physical education (see exercise and
sport sciences)
teaching major, 177, 285
minor, 177, 285
Physics, 417-420
engineering, 133, 143-144
Physiology, 420-421
animal, 203
Pianists' Foundation Series, 76
Piano, 385
accompanying, 386
Placement
advanced, 27, 42-43
career, 63
English, 40-41
examinations, 40-41, 42-43
foreign language, 44
tests, 40-41, 42-43
Placement service, 63
Planetarium, 19
Planetary sciences, 421-423
Planning, 423-424
Plant pathology, 425-426
Plant protection, 426
Plant sciences, 426-429
Plate tectonics, 308
Podiatry, 110
Poetry center, 75
Poison and Drug Information Center, 17
Policy and planning, 346
Political science, 429-433
Portuguese (see Spanish and Portuguese)
Post office boxes, 65
Practicums, 35, 190
Predentistry, 108, 109
Prelaw, 108, 109
Premedicine, 108-109, 110, 134, 153
Prenursing, 106, 162
Preoptometry, 108, 110
Prepharmacy, 108, 110
Preprofessional programs, 107-110
Prerequisites, 187
Presession, 183
calendar, 7
Press, University, 23
President's Club, 79
Preveterinary, 481
Primary-kindergarten education, 129-130, 273, 292
Prizes, 60-61
Probation, 36-37
Professional degrees,
College of Mines, 154, 159-160
Professional organizations, 73-74 (see also
individual college sections)
Proficiency examinations, 40-41, 42-45
Programs of study
graduate, 174-176
undergraduate, 83
Proseminars, 189
Provisions for superior students, 60-61
Psychiatry, 365
Psychology, 434-437
educational, 266-268
Public administration
courses, 346-347
degrees, 114-115, 121-123, 342
majors, 122-123, 342
Master of, 114, 342
requirements, 121-123
Public management, 114, 122, 346
Public policy, planning and administration
(see management and policy)
Public recreation, 123, 342
Publications, student, 72
Publishing, 23
Race track management, 203-204
Radiology, 365-366
Radio-television
courses, 438-440
degree requirements, 97, 100
services, 18-19
Range management, 448
Reading, 440-442
Reading/Study Skills Center, 63
Readiness tests (math), 355
Readmission, 25
Real estate
courses, 298-300
major, 114, 120
Recitals, 190
Recreation, 123, 342, 452-453
Recreational sports, 177, 265-287
Referral service (Switchboard), 64
Refugee-status students, admission, 30
Refunds, 56-57
Regents, Board of, 487
Regional development, 121, 304-307
Registration, 32-34
adjustments, 33-34, 55
automobile, 71
bicycle, 71
cancellation of, 25, 34, 57
cancellation of courses, 34
change to less advanced course, 33
change of major, 33, 105
change to no-credit, 33
change to pass-fail, 40
change of schedule, 33, 55
class standing, 38
classification of students, 32
tees, 32, 51, 55-57
identification card, 32
late, 32, 51
limitation of, 34
maximum units, 37
motorcycle, 71
no-credit, 32, 51, 174
pass-fail, 40, 173
period of, 32
petitions, 33
procedures, 32
required subjects, 26-27
supplementary, 173-174, 190
Regulations
automobile, 71
general, 69-71
health, 24-25, 64-65
housing, 69, 70
traffic, 71
Rehabilitation
courses, 442-444
majors, 130, 442
services, 31, 64, 132
Release of information, 34
Religious activities, 74
Religious council, 74
Religious observance and practice, 25
Religious studies, 444-445
Remote sensing, 17, 445
Removal of incomplete, 38
Renewable natural resources, 84, 85, 88-89, 446-453
Renewal, academic, 37
Rental of instruments, 55
Repeating a course, 39
Required secondary school subjects, 26-27
Requirements
admission, 24-31
composition, 40-41
entrance, 24-31
examinations, 24, 25, 40-41
fresman composition, 40-41
Graduate College, 170-174
graduation, 48-50 (see also individual
college and department sections)
language, 30
scholarship, 25, 28, 35-36, 173
university composition, 40-14
university credit, 35, 49
upper-division writing proficiency, 41
writing-emphasis classes, 41
Research, registration for, 190
Research and special public service, 16-23,
131-132
Reservations, room, 53-54
Reserve officers' training program, 178-181
Residence halls, 53-54, 68-69
coeducational, 68
contracts, 69
cooperative, 68
disabled student, 68
facilities, 68
fees, 54
graduate, 68
men's, 68
regulations, 68-70
reservations, 53-54
room deposit, 53-54
women's, 68
Residence requirements, 51-52
in music, 379
Retailing, 120
Retention, student, 34
Retroactive withdrawal, 47
Riecker Lectureship Foundation, 75
Romance languages, 453
Room
fees for, 54
occupancy of, 69
regulations, 68-70
reservations, 53-54
ROTC
Air Force, 181, 371
Army, 179-180, 371
Navy, 180-181, 371
Russian and Slavic languages, 453-454
Ruth E. Golding Laboratory, 21, 170
Ruth Stephan Poetry Center, 75
Sales management, 120
Saxophone, 386
Scandinavian, 313-315
Schedule changes, 33
fees for, 55
Scholarship honors, 60-61
Scholarship report, midsemester, 36
Scholarship requirements
for admission, 25
for continuation, 35
for graduation, 49-50
for transfer students, 28
Graduate College, 173
in major, 49
Scholarships and financial aids, 58-59
in Mines, 160
in ROTC, 179-180, 180-181
Scholastic Aptitude Test, 24, 25
Scholastic honor societies, 73 (see also
individual college sections)
Science-Engineering Library, 66
Second bachelor's degree, 50
Second education, 126-127, 130-131, 454-458
Secondary schools
subject units required, 26-27
Sedimentology, 308
Semester hour, 35
Seminars, 35, 189
Senior degree check, fee, 56
SEOG, 58
Service organizations, 74
Services, 16-23, 62-67
for disabled students, 31, 64, 132
Single-parent housing, 54, 69
Slavic languages, 453-454
Social life, 71-77
Social studies, teaching major in, 127
Social work, 112
Societies, honor and professional, 73-74 (see
also individual college sections)
Societies, leadership and service, 74
Sociology, 458-461
Soil and water science, 463-464
Soils, water and engineering, 461-464
Solar energy (see Environmental Research Lab
and nuclear and energy engineering)
Sororities, 73
Southwest Center, 21
Southwest studies, 464
Southwest Institute for Research on Women, 21
Spanish and Portuguese, 464-468
Special education, 126, 131, 468-471
Special examination for credit, 35, 42, 43, 45, 55
Special examination for grade, 35, 42, 43, 45, 55
Special grades, 39
Special services, 31, 64, 132
Special students (law), 152
Special testing, 32, 40-46
Specialist degrees, 175, 176
Speech and hearing clinic, 64
Speech and hearing sciences, 95, 100-101,
471-474
Speech communication, 95, 100, 474-477
Sports, 71-72, 177-178, 284-291
Standards, academic, 35-47
Standing
class, 38
good, 35
State museum, 17, 75
Statistics, 477-478
Steward Observatory, 21
Stratigraphy, 308
String bass, 386
Student
activities, 71-76
classification, 32
counseling, 62-64
evancement, 58-59, 63
employment, 109, 160, 333
fees, 51-57
general responsibility, 4, 70-71
government, 72
guidance services, 62-65
health services, 64-65
housing, 53-54, 68-69
housing fees, 53-54
INDEX 565

insurance, 30, 65
leadership and service societies, 74
loans, 58-59
mail, 65
organizations, 73-74 (see also individual
college sections)
placement and career services, 63
publications, 72
recruitment, 63-64
regulations, 24-25, 70-71
religious activities, 74
religious observance and practice, 25
Resource Center, 62-63
retention, 34
services, 62-67
status, full-time, 38, 173
teaching
elementary, 128
fee, 55-56
grades available, 41, 128
secondary, 128
transfer, 27-28
Studio art, 95, 99-100, 216-220
Studios, 35
Study abroad, 86, 111, 112, 182-183, 300, 333, 465
Study skills, 63
Summer session, 183
calendar, 7
Superior students, 60-61
Supplemental educational opportunity
grants (SEOG), 58
Supplementary registration, 173-174, 190
Surgery, 366
Suspension, 46-47
(see also disqualification)
Switchboard, 64
Symbols, key to, 188
Systems and industrial engineering, 478-481
Systems engineering, 149, 478-481
Table of contents, 5
Teacher education, 126-132 (see also
individual department sections)
Teacher placement, 63
Teaching majors and minors, 127
Telescopes, 20, 21-22
Television
courses, 438-440
services, 18-19
Testing office, 43, 63
Testing, special, 32, 40-45
Tests
English as a foreign language, 30, 170-171
entrance, 24, 29-30
for credit or grade, 27, 42-45, 55
placement, 40-41, 42-45
readiness (math), 355
Textiles, 84, 87, 293-294
Theatre, 95, 102, 250-251
Theory and composition, music, 95, 99-100, 381
Thesis, 190
in absentia, 174
processing fee, 56
Thunderbird, 111
Toxicology, 411
Traffic regulations, 71
Transcripts, 24, 28, 47, 171
fee, 56
Transfer
admission application, 27
credits, 28
graduate credit, 172-173
scholarship requirements, 28
undergraduate credit, 28
Transfer to less-advanced course, 33
Transportation and Traffic Institute, 17
Traveling Scholars Program, 31
Tree-Ring Research Laboratory, 20
Trombone, 386
Trumpet, 386
Tuba, 386
Tuition, 51-53
nonresident, 51-53
refund, 56-57
Turfgrass management, 85, 461
Unclassified students, 32, 170, 172
Undergraduate majors, 83
Unit system, 35
Units
defined, 35
maximum allowed, 37
required for admission, 26
required for degrees, 48-49
required for upper-division, 49
University Analytical Center, 22
University Computer Center, 22
University credit, 35, 49
University of Arizona Press, 23
University property, use of, 70
University religious council, 74
University-wide honors program, 60
Upper-division unit requirement, 49
Upper-division courses, defined, 187
Upper-division writing-proficiency exam, 41
Urban planning (see planning)
Urdu, 403-404
Vehicles, registration of, 71
Veterans’ admission, 31
Veterinary science, 481-482
Viola, violin, 386
Vocal coaching, 386
Vocational education, 229
Vocational evaluation, 63
Voice, 386
War orphans, admission of, 31
Water resources administration, 329, 330-331
Water Resources Research Center, 23
Water science, 463-464
Watershed management, 446, 449-451
Western Interstate Commission on Higher
Education (WICHE), 109, 160, 482
Wildlife ecology (see wildlife and
fisheries science)
Wildlife and fisheries science, 446, 451-452
Wildlife research unit, 16
Wind instruments, 386
Winter session, 183
Withdrawal
from courses, 33, 46-47
from the university, 33, 46-47
grades, 36
medical, 47
retroactive, 47
Women's residence halls, 68
Women's studies, 95, 483-484
Workshops, 35, 189
Work-study programs, 58, 87, 111, 150, 160
Writing-emphasis courses, 41

Yiddish, 313-315

Zoology (see biology)
<table>
<thead>
<tr>
<th>Number</th>
<th>Location/Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Administration</td>
</tr>
<tr>
<td>88</td>
<td>Administration Annex</td>
</tr>
<tr>
<td>49</td>
<td>Aeronautical Engineering Building</td>
</tr>
<tr>
<td>39</td>
<td>Aerospace and Mechanical</td>
</tr>
<tr>
<td></td>
<td>Engineering Laboratories</td>
</tr>
<tr>
<td>52</td>
<td>Agriculture</td>
</tr>
<tr>
<td>64</td>
<td>Agricultural Sciences</td>
</tr>
<tr>
<td>31</td>
<td>Anthropology</td>
</tr>
<tr>
<td>83</td>
<td>Apache Residence Hall</td>
</tr>
<tr>
<td>7</td>
<td>Architecture</td>
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</table>
Mailing Address:

The University of Arizona
Tucson, Arizona 85721

For Further Information On:

Applications For Admission
Write: Director of Admissions

Financial Assistance
Write: Director of Student Financial Aid

Housing Facilities
Write: Director of Residence Life

Medical Facilities
Write: Director of the Student Health Service

Orientation Programs
Write: Dean of Students

For Copies of Other University Catalogs:

General Catalog
Write: Printing and Reproductions

Continuing Education
Write: Division of Continuing Education

College of Law
Write: Admissions, College of Law

College of Medicine
Write: Admissions, College of Medicine

Scholarships and Financial Aid
Write: Office of Student Financial Aid

Summer Session
Write: Summer Session