490 Problems of Teachers of Indian Students. (3) S
Current issues, trends and problems encountered by teachers. Viable solutions discussed. Research reviewed and evaluated. Prerequisite: IED 411.

498 Pro-seminar: Administration and Management of Indian Education. (3) A
Examines administrative practices, federal, state and tribal law, court decisions, personnel, program and fiscal management.

498 Pro-seminar: Development of Indian Cultural and Language Materials. (3) A
Provides a cultural/language approach to curriculum development. Examines philosophies and materials used in bicultural/bilingual curriculum.

511 Community Schools in Indian Education. (3) A
Development, implementation, and administration of Indian community schools. Techniques and methods for effective school-community relations.

522 Education of Indian Adults. (3) A
Development and implementation of Indian adult education, including program selection, content, and ingredients of successful programs.

544 Role of Tribal, State and Federal Government in Indian Education. (3) A
Examines responsibilities and relationships of each agency in the operation of Indian education programs. Analyzes legislation, financial resources, and tribal control.

594 Workshop in Indian Education. (6) SS
Practical approaches to teaching Indian students. Curriculum and materials development, community involvement, current issues and research examined.

Special Courses: IED 394, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

MULTICULTURAL EDUCATION

MCE 446 Understanding the Culturally Diverse Child. (3) F, S, SS
Physical, social, psychological and educational needs of children from culturally and linguistically different populations. Multidisciplinary approach will be followed.

447 Methods of Teaching the Culturally Diverse Child. (3) A
Techniques for organizing and providing special educational experiences for students from culturally and linguistically different populations. Prerequisite: MCE 446.

Special Courses: MCE 394, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

READING EDUCATION

RDG 314 The Teaching of Reading.* (3) F, S, SS
For elementary teachers-in-training; aimed at improving classroom reading programs and practices. Required course provides basic teacher skills, evaluation, classroom environments and reading methods. Discussion sessions must be scheduled. Prerequisite: ENG 213 or equivalent.

315 Decoding in Reading.* (3) F, S, SS
Emphasizes linguistic and psycholinguistic aspects of reading. Includes teaching sound/symbol correspondences through phonics methods. Discussion sessions must be scheduled. Prerequisite: RDG 314.

456 Diagnosis of Reading Problems. (3) F, S
Acquaints the preservice teacher with diagnostic procedures in reading. Clinic methods and materials will be presented with modifications for children with learning disabilities. Prerequisites: RDG 314 and 315.

467 Reading in the Content Areas: Secondary. (2) F, S, SS
Introduces reading procedures in subject matter fields. Emphasis: content reading principles and methodology, including decoding. Required for Secondary Education majors. To be taken concurrently with SED 373.

480 Practicum: Secondary Reading. (1) F, S
Provides for practical application of content reading principles in an on-site secondary school setting. Required for Secondary Education majors. To be taken concurrently with SED 403.

481 Practicum: Elementary Reading.* (3) F, S, SS
Preservice students test and tutor children who are experiencing difficulty with reading. This required practicum is scheduled in local schools under direct college supervision. Prerequisite: RDG 314.

505 Developmental Reading. (3) F, S, SS
For classroom and special reading teachers. Specific professional skills in decoding, comprehension and evaluation. Recommended for special reading endorsement stamp. Prerequisite: Teaching certificate.

507 Reading in the Secondary School. (3) F, S, SS
Acquaints classroom teachers with techniques for efficient reading, vocabulary development and readability procedures. Prerequisite: Teaching certificate.

533 Reading-Teaching Bilingual Students.* (3) S, F, SS
Acquaints teachers with theory and practice in second language acquisition and with strategies for developing word recognition and comprehension in native language and second language reading (Spanish-English emphasis).

544 Resource Specialist and the Content Area Teacher. (3) S
For reading consultants, teachers and majors interested in the role of "reading teacher as a resource person to content area teachers." Prerequisites: RDG 507, 556 and 550 or 557.

550 Directed Experiences in Reading. (3) F, S, SS
Practicum experience utilizing diagnostic and instruction techniques of the classroom for corrective reading remediation. Participants tutor assigned students twice a week. Prerequisite: RDG 505 or instructor's approval. Laboratory sections.

556 Diagnostic and Treatment Procedures in Reading. (3) F, S, SS
Basic and specialized diagnostic and instruction techniques for corrective and clinical reading remediation. Recommended for special reading endorsement stamp. Prerequisite: RDG 505.

557 Reading Clinic Experience. (3) F
Practicum experience utilizing specialized diagnostic and instruction techniques for clinical reading remediation. Participants tutor assigned students twice a week. Recommended for special reading endorsement stamp. Prerequisite: RDG 556 or approval of instructor. Laboratory sections.

581 Individualizing Reading Instruction. (3) F, S, SS
For classroom and special reading teachers. Specific techniques for individualizing the teaching of reading. Emphasizes literature as the medium of instruction.

630 Research in Reading. (3) F
For advanced graduate students interested in applied research problems, literature of reading instruction and major issues related to reading research. Approval of instructor required.

Special Courses: RDG 294, 298, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 680, 683, 684, 690, 691, 692, 693, 700, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

Higher and Adult Education

PROFESSORS:
RICHARDSON, FENSKE

ASSOCIATE PROFESSORS:
ROSSMAN (ED B-7A), AXFORD
BOGART, PADILLA

ASSISTANT PROFESSOR:
SKINNER

HAE 510 Development and Structure of Higher and Adult Education. (4) F, S
An historical and structural examination of the development of American higher/adult education including the philosophical, political and social aspects.

511 Program Development. (2) F, S
Methods of curriculum development in higher and adult education.

512 Learners in Higher and Adult Education. (3) F, S
Participation, retention and attainment. Characteristics of adult learners and non-traditional clientele. Implications of age-related changes to instruction.

513 Minorities in Higher and Adult Education. (1) F, S
Analysis of the key policies and issues affecting the participation of racial and ethnolinguistic minorities in post-secondary education.

514 Instructing Adults. (1) F, S
Theory and practice for instructing adults.

515 Instructional Personnel. (2) F, S
Professional roles and responsibilities of instructional personnel in higher and adult education.

516 Management Concepts in Higher and Adult Education. (1) F, S
Introduction to concepts of management theory and practice. Societal goals in relation to observable outcomes and concepts of cost effectiveness.

517 Student Support Services in Higher and Adult Education. (1) F, S
Theory, organization, and operation of support services for students. Basic principles of assisting students.

522 Introduction to Educational Gerontology. (3) S
Educational considerations and methods used in teaching older adults from the perspectives of psychology and educational gerontology.

533 The Community-Junior College. (3) F, S
History, functions, organization and current issues. Meets Arizona community college course requirement for certification.

555 Adult Basic/Developmental Education. (3) S
Roles of teacher, student and program in Adult Basic/ Developmental Education. High school equivalency and related areas.

566 International Adult Education. (3) F
Review and comparison of adult education programs and facilities in selected countries.

611 Curriculum/Programming. (3) S
Curriculum development, instructional organization and improvement of instruction in two- and four year college. Micro-teaching. Prerequisites: HAE 510, 511, 512 and 514.

633 Research in Higher and Adult Education. (1) F, S
Comparative analysis of methods in study of higher and adult education. Prerequisite: EDP 454 or equivalent.

644 Financing Higher Education. (3) S
Public and private funding of post-secondary education. Issues related to cost/benefit, tuition and student financial aid. Institutional planning, budgeting and financial management. Prerequisites: HAE 510 and 516.

649 Law in Higher Education. (3) F
Legal issues and administrative process case method of analysis applied to key court decisions. Prerequisites: HAE 510 and 516.

664 Community Service, Extension and Continuing Education. (3) S
Objectives, organization and practices of post-secondary programs of continuing education, community and public service and extension. Prerequisites: HAE 510 and 516.

689 Administration. (3) F
Theory and practice. Prerequisites: HAE 510 and 516.

Special Graduate Courses: HAE 580, 591, 594, 683, 684, 690, 691, 692, 693, 790, 791, 792, 799.
Seminars covering such topics as current issues, institutional advancement and support, institutional research, student financial aid, collective bargaining, staff development, teaching adults and proposal writing are offered periodically.

Secondary Education

Including Humanities Education, Safety Education, Educational Foundations and Social and Philosophical Foundations

PROFESSORS:
JOHN E. BELL (ED 409), APPLETON, ARMSTRONG, JAMES W. BELL, BELOK, COOK, EDWARDS, FRASIER, FULLERTON, GRIFFITH, HAGGERSON, HOOVER, KIESOW, LAMM, MITCHELL, MOULTON, SHAFER, SVOBODA

ASSOCIATE PROFESSORS:
BROOK, CUMMINGS, FINER, FRAZIER, MANERA, METHA, STAHL, THOMAS, WAMACKS, WURSTER

ASSISTANT PROFESSORS:
CARRASCO, B. PARRISH, W. PARRISH

SECONDARY EDUCATION

SED 343 Introduction to Secondary Education. (3)
The secondary school in a social, historical and philosophical context; study of adolescents and observation of teaching. Observation/participation in secondary schools required. Prerequisites: Concurrent enrollment in EDF 300 and admission to Secondary Teacher Education program. Lab fee required.

373 Principles, Curricula and Methods I. (5)
Development of knowledge and skills of instructional planning and methods of teaching and evaluating in the secondary school. Observation/participation in secondary schools required. Prerequisite: SED 343. Lab fee required.

403 Principles, Curricula and Methods II. (5) F, S, SS
Advanced level of development of knowledge and skills of instructional planning and methods of teaching and evaluating in the secondary school. Observation/participation required. Prerequisite: SED 373. Lab fee required.

433 Student Teaching in the Secondary Schools.
(3-12) F, S, SS
The practice of teaching. The relationship of theory and practice in teaching. Prerequisites: SED 403 and Special Methods.

480 Special Methods of Teaching Social Studies. (3) F, S
Interdisciplinary approaches: production and collection of materials. Prerequisite: SED 373.

522 Secondary School Curriculum Development. (3) F, S, SS
Social processes, issues, principles, patterns, and procedures in curriculum development. Prerequisite: SED 433.

533 Improving Instruction in Secondary Schools. (3) F, S, SS
Analyses of procedures, methods, techniques, and experiments in teaching in secondary schools. Prerequisite: SED 433.

566 Evaluating Secondary School Programs. (3) N
Development of evaluative criteria for secondary school programs. Prerequisite: SED 433.

577 Issues and Trends in Secondary Education. (3) F, SS
Analyses of lay and professional reports; problems and issues in American secondary education. Prerequisite: SED 433.

588 Human Relations in the Secondary Schools. (3) S, SS
Problems in human relations inherent in the interaction of pupils, teachers, administrators, non-professional staff and laymen. Prerequisite: SED 433.

711 Secondary Curriculum Development. (3) S, SS
Theories and processes of developing curriculum; evaluation of research. Prerequisites: SED 433, 522 or equivalent.

722 Improvement of Instruction in the Secondary School. (3) F, SS
Evaluation of the research; issues and theories related to the improvement of instruction. Prerequisites: SED 433, 533.

Special Courses: SED 294, 298, 394, 484, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 680, 683, 684, 690, 691, 692, 693, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

HUMANITIES EDUCATION

HUE courses may be elected to meet General Studies requirements in Humanities and Fine Arts.

HUE 101, 102 Ideas and Values in the Humanities. (4, 4) F, S
Interrelation of art, architecture, literature, music, philosophy, religions, theatre and other performing arts in the modern world. Two lectures, two discussion meetings per week.

118 Encountering the Arts. (3) F, S
Introductory course emphasizing personal contacts with the fine and performing arts. Attendance of a wide range of events, with analysis and evaluation.

130 Introduction to Popular Culture. (3) F, S
Reflections of American values in 20th century popular arts. Music, print, art, television, radio, movies, the esthetics of popular culture.

318 Artistic Styles and Forms. (3) S
Formal and stylistic aspects of the fine and performing arts. Development and progression of style and form in the various arts.

401 Humanities in World Cultures. (3-6) F, S, SS
A humanities study program of foreign travel. Fine and performing arts of the various world cultures. May be repeated for credit. Prerequisite: approval of instructor.

480 Methods of Teaching the Humanities. (3) N
Methods of instruction, organization, discussion and presentation of the courses in the interdisciplinary humanities. Prerequisites: HUE 101, 102 or approval of instructor.

530 Popular Culture in America. (3) F
The uses of leisure time from a historical perspective. Areas of concern include television and radio, film and stage, music, art and paperbacks.

585 Philosophical Foundations of the Humanities. (3) S
Issues in intellectual traditions of the Western world that are basic to the interdisciplinary humanities. Prerequisite: Humanities education graduate status or approval of instructor.

Special Courses: HUE 294, 394, 497, 499, 500, 584, 590, 591, 592, 594, 598, 599, 600, 680, 684, 690, 691, 692. (See pages 35-36).

SAFETY EDUCATION

SAE 466 Safety Education. (3) F, S, SS
Safety education in home, school and place of employment.

477 Driver and Traffic Safety Education, I. (3) F, SS
Preparation for teaching the classroom phase of driver education in the secondary school. Prerequisites: valid operator's license and SAE 466. COE only.

478 Driver and Traffic Safety Education, II. (3) S, SS
Preparation for teaching behind the wheel phase of driver education. Simulation included. Prerequisite: valid operator's license and SAE 477. COE only.

Special Courses: SAE 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

EDUCATIONAL FOUNDATIONS

EDF 111 Exploration of Education. (3) F, S
Education as an instrument in the development of the individual and society; its significance as an American institution.

300 Self-Assessment for Teaching. (3)
Instructional and field experiences to introduce students to the profession of teaching and the process of education. Observation/participation in elementary and secondary schools required. Lab fee required.

333 Basic Issues in Education. (3) F, S
Important contemporary socio-philosophical issues educators face; analysis and problem-solving.

422 Group Dynamics and Education. (3) F, S
Theory and use of group processes to facilitate human interaction and learning.

500 Educational Research. (3) F, S, SS
Introductory course in the analysis, production, and use of educational research in the field.

Special Courses: EDF 294, 298, 484, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 600, 680, 683, 684, 690, 691, 692, 693, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

MULTICULTURAL EDUCATION

See offerings under MCE listing on page 201 (MCE, EED) and Educational Foundations (SED).

SOCIAL AND PHILOSOPHICAL FOUNDATIONS

SPF 411 History of American Education. (3) F
Social conditions, ideas and institutions which formed American education.

511 School and Society. (3) F, S, SS
Interrelationship of school and society and the role of education in social change.

515 Education of Women. (3) F, S
Analysis of roles and status of women; educational practices and alternatives.

520 Cultural Pluralism and Education. (3) N
Philosophic analysis of the concept of cultural pluralism and its social implications for American education.

533 Comparative Education in the Western World. (3) F
Educational practices and traditions in the leading nations of Europe and the Soviet Union.

534 Education and Change: Developing Nations. (3) S
Education as economic and socio-political change agent in Africa, Asia, the Middle East and Latin America.

543 Bilingual Education Models. (3) F
Bilingual education programs in other countries; analysis of political, social, economic, and educational implications; practice in planning bilingual education curricula.

544 Philosophical Foundations of Education. (3) F, S, SS
Theories of education in ancient, medieval, and modern classical and contemporary philosophies.

566 History of Education. (3) F, S, SS
Development of educational institutions and ideas in the Western World, from ancient times to the 20th century.

711 Social and Historical Foundations of Education. (3) S, SS
Problems of American education and their socio-historical context.

Special Courses: SPF 298, 492, 493, 494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 680, 683, 684, 690, 691, 692, 693, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

Special Education

PROFESSORS:

WEBB (ED 305), ABRAHAM, D'ALONZO, FAAS, MOORE, PREHM, PRIETO, RUTHERFORD, ZUCKER

ASSOCIATE PROFESSORS:

COHN, HOWELL, HARTWELL, McCOY, NELSON, ROBERTS, RUEDA, WISEMAN

SPECIAL EDUCATION

SPE 311 Orientation to Education of Exceptional Children. (3) F, S, SS
Includes gifted, mentally retarded, vision, hearing, speech, emotional disturbance, disadvantaged, specific learning disabilities and others.

312 Mental Retardation. (3) F, S, SS
Characteristics and assessment specific to mental retardation. Terminology, educational programming and therapeutic procedures are emphasized.

314 Introduction of Bilingual/Multicultural Special Education. (3) F, S, SS
Theoretical background and practical application of general issues regarding the education of bilingual /multicultural handicapped children. Practicum included.

336 Behavioral and Emotional Problems in Children. (3) F, S, SS
Characteristics and assessment specific to emotionally and behaviorally disturbed children. Terminology and educational programming emphasized.

361 Introduction to Learning Disabilities. (3) F, SS
Characteristics and assessment specific to learning disabilities. Terminology and educational programming emphasized.

411 Parent, School, Community Relations and the Exceptional Child. (1-6) F, S, SS
Educational situations facing the special education teacher presented through instructional modules. Students must complete a minimum of six one-hour modules during the program.

412 Evaluating Exceptional Children. (3) F, S, SS
Normative and criterion-referenced diagnostic techniques including formative evaluation. Emphasis upon application. Practicum included.

413 Methods in Language, Reading and Arithmetic for Exceptional Children. (3) F, S, SS
Methods, techniques and materials for use in prescriptive teaching. Practicum included. Prerequisite: SPE 412 or concurrent with SPE 412.

414 Methods and Strategies in Behavior Management. (3) F, S, SS
Practical techniques of behavior management. Overview of humanistic, psychoeducational, cognitive and ecological approaches. Practicum included.

415 Social Behavior Problems of Exceptional Children. (3) F, S, SS
Analysis and intervention into social behavior problems of exceptional populations. Practicum included. Prerequisite: SPE 414 or concurrent with SPE 414.

455 Early Childhood and the Handicapped. (3) S
Early childhood education as it applies to the handicapped child. Methods, materials and techniques.

465 Student Teaching in Special Education. (3-15) F, S
Prerequisites: (1) Approval of Special Education Department; (2) completion of SPE 311, 411, 412, 413, 414, 415 and basic introductory course in at least one area of specialization; and (3) completion of EDF 300 (or equivalent), EDP 310, EDT 405, RDG 314, RDG 315, EED 380. Y grade only.

511 The Exceptional Child. (3) F, S, SS
Educational needs of handicapped and gifted children. (Not available to students who have completed SPE 311.)

512 The Mentally Retarded Child. (3) F, SS
Etiology, diagnosis and management of mentally retarded children. Current trends in prevention, programming, and teacher preparation. (Not available to students who have completed SPE 312.)

514 Methods of Perceptual-Motor Training. (3) N
Development of the sensory-motor skills of handi-
capped children. Prerequisites: SPE 511 or equivalent,
and basic course in one exceptionality.

**515 Methods for the Remediation of Learning
Problems of Exceptional Children.** (3) S, SS
Methods and materials for remediating the basic
academic problems of gifted and mildly-handicapped
children. Prerequisites: SPE 511, or equivalent, a basic
course in one exceptionality, or approval of instructor.

**531 Behavior Management Approaches with
Exceptional Children.** (3) S, SS
Behavior management approaches with maladaptive
behavior of exceptional children. Prerequisite: SPE 511
or equivalent.

536 Behavioral and Emotional Problems of Children.
(3) F, SS
Explores maladaptive behavior of individuals. Variables
contributing to behavior patterns of behavior disor-
dered children.

538 Methods of Teaching the Behaviorally Disordered.
(3) S, SS
Development of methods for managing the academic
and social behavior of behaviorally disordered children
and youth in educational settings. Prerequisites: SPE
336 or 536.

551 Methods Teaching the Young SMH. (3) S
Functional characteristics, methods, and curriculum for
teaching preschool and elementary level severely
/multiply handicapped children. Prerequisites: SPE 311
or 511 and 312 or 512.

**552 Methods Teaching Adolescent and Adult SMH
Individuals.** (3) F
Functional characteristics, methods, materials, and cur-
riculum for educational program management of
severely/multiply handicapped adolescent and adult in-
dividuals. Prerequisites: SPE 311 or 511 and 312 or
512.

**561 Characteristics and Diagnosis of Learning
Disabilities.** (3) F, SS
Background and models comprising the topic of
learning disabilities, identification and characteristics.

562 Methods of Remediating Learning Disabilities. (3)
S, SS
Various methods and intervention strategies for remedi-
ating learning disabilities of children and youth. Prereq-
uisites: SPE 361 or 561.

**563 Methods Teaching the Mildly Handicapped
Adolescent.** (3) A
Identification, remediation, and alternative curriculums
for exceptional students at the secondary school level.
Social and academic variables.

574 Educational Evaluation of Exceptional Children.
(3) F, SS
Design and statistical considerations of normative and
criterion-referenced tests. Collection, recording and
analysis of data from formative evaluation. Prerequi-
sites: SPE 311 or 511 and a methods course in the
teaching of reading and mathematics.

**575 Current Issues in the Education of Exceptional
Children.** (3) F, SS
Mainstreaming, noncategorical, financing, legal diag-
nostic, labeling, legislative and other critical and con-
troversial issues related to the education of exceptional
children.

576 Precision Teaching. (3) S
Theory and techniques which apply to systems of form-
ative evaluation. Emphasis on precision teaching.

578 Methods of Teaching the Mentally Retarded. (3) S,
SS
Specific methods, materials of instruction and curricu-
lum development in teaching educable and trainable
children. Prerequisite: SPE 312 or 512.

579 Vocational Programs for the Mentally Retarded.
(3) F
Curriculum planning and methods of teaching in sec-
ondary school and post-school programs. Work evalua-
tion, work-study, sheltered employment. Prerequisite:
SPE 312 or 512.

582 Classroom Research with Exceptional Children.
(3) S
Introduction to conducting classroom research. Specific
research techniques with primary emphasis on applied
behavior analysis techniques.

585 Creativity: Research and Development. (3) S
Nature of creativity explored in terms of philosophical
underpinnings, empirical evidence, human develop-
ment, self-actualization, and the ecology surrounding
the creative event.

588 The Gifted Child. (3) F, SS
Gifted children's characteristics, identification, needs,
school and home environments, definitions, and mis-
understandings. Research on Terman, Witty, and oth-
ers.

589 Methods in Teaching the Gifted. (3) S, SS
Methods in teaching elementary and secondary school
gifted children. Newer techniques, including pro-
grammed and computer-assisted instruction, team
teaching. Prerequisite: SPE 588.

**674 Identification, Evaluation and Classification of
Exceptional Children.** (3) F
Analysis of the research and theoretical literature
focused on the identification, evaluation, and classi-
fication of exceptional children.

675 Causation of Handicapping Conditions. (3) F
Analysis of the physiological and environmental factors
which lead to handicapping conditions. Emphasis given
to the develoment of primary prevention.

**681 Instructional Program Development in Special
Education.** (3) S
Instructional program planning, implementation, and
evaluation for planning, presentation and evaluation of
both college/university and inservice teacher training.

774 Characteristics of Exceptionality. (3) F
Analysis of the literature describing learning, educa-
tional, personal-social and cognitive characteristics of
exceptional children.

775 Intervention Program in Special Education. (3) S
Analysis of the research literature focused on interven-
tion programs for preschool, school aged, and
adolescent/adult exceptional persons.

781 Research and Evaluation in Special Education. (3)
S
Issues and problems in conducting research and/or
evaluation programs involving exceptional children.

Special Courses: SPE 294, 298, 394, 484, 492, 493,
494, 497, 498, 499, 580, 583, 584, 590, 591, 592, 593,
594, 598, 599, 684, 690, 691, 692, 780, 790, 792, 799.
(See pages 35-36.)

College of Engineering and Applied Sciences

C. R. Haden, Ph.D.
Dean

Purpose

The purpose of the College of Engineering and Applied Sciences is to provide a university education of such fundamental background and scope that a student may achieve competency in engineering, agriculture, technology, computer science, or construction. Every effort is made to carry on well-rounded, well-integrated programs which will not only give the student proficiency for a professional career but also will develop character, judgment, ideals, breadth of view, and appropriate cultural attitudes. Students are taught to recognize the fact that their professional efforts will cause change and that they must accept responsibility for the social consequences of those efforts.

Organization

The material for the College of Engineering and Applied Sciences is presented as follows:

Division of Agriculture

Agribusiness

Environmental Resources in Agriculture

Department of Computer Science

Computer Science

Computer Systems Engineering

Division of Construction

General Building Construction

Heavy Construction

Specialty Construction

School of Engineering

Department of Chemical and Bio Engineering

Department of Civil Engineering

Department of Electrical and Computer Engineering

Department of Industrial and Management Systems Engineering

Industrial Engineering

Manufacturing Engineering

Department of Mechanical and Aerospace Engineering

Aerospace Engineering

Energy Systems Engineering

Engineering Science

Materials Science

Mechanical Engineering

Engineering Special Studies

Bioengineering

Nuclear Sciences

Systems Engineering

Engineering Interdisciplinary Studies

Business and Pre-Law

Geological Engineering

Premedical

Analysis and Systems

Engineering Core

Society, Values, and Technology

Division of Technology

Department of Aeronautical Technology

Aeronautical Engineering Technology

Aeronautical Industrial Technology

Department of Electronics and Computer Technology

Electronic Engineering Technology

Computer Engineering Technology

Microelectronics Engineering Technology

Department of Industrial Technology

Graphic Communications Engineering Technology

Graphic Communications Industrial Technology

Industrial Supervision

Technical Teacher Education

Vocational Teacher Education

Department of Manufacturing Technology

Manufacturing Engineering Technology

Mechanical Engineering Technology

Welding Engineering Technology

Research

The College is committed to become one of national prominence for research at the graduate level. In addition, it is the policy of the College to encourage exceptional upper division undergraduate students, as well as graduate students, to participate with faculty members in research activity. Most faculty members are conducting research on government or industry sponsored programs. Research activities include computer science and applications, computer integrated manufacturing, materials science, solar energy, transportation systems, signal processing, computer design, turbine design, structural systems, bio-mass conversion, solid-state electronic devices, power systems, telecommunications, environmental, biomedical, arid land agriculture, and many others. These activities are carried out under the academic divisions or departments listed in the following catalog material and also through the interdisciplinary research centers listed below:

Center for Advanced Research in Transportation

Center for Arid and Tropical New Crop Applied Science and Technology (NEWCAST)

Center for Automated Engineering and Robotics

Center for Energy Systems Research

Center for Environmental Studies

Center for Research in Engineering and Applied Sciences

Center for Solid State Electronics Research

Center for Professional Development

As the professional "half-life" for engineers and scientists decreases continually in most technical fields, the need for continuing education or "life-long" learning increases with each passing day. In response to this need, the College's Center for Professional Development provides continuing education services to the local and national technical communities. The Center offers a wide variety of technical conferences, institutes, seminars, and short courses for professionals engaged in the rapidly changing areas of science and technology.

Cooperative Education

The co-op program is a study-work plan of education which alternates periods of academic study with periods of employment in business, industry and government directly related to a student's major. Students who choose this program ideally complete 12 months of employment and graduate with both the academic background and practical experience gained from working with professionals in their chosen field.

A student is eligible upon completion of 45 or more hours of classes in a selected engineering, computer science or technology major. Certain positions may require completion of specific courses of study. Transfer students are required to complete at least one semester at ASU before beginning work. All student applicants must have a minimum grade point average of 2.5 and the approval of their advisor. The Division of Technology currently offers part time internships.

To maintain continuous full-time student status in the University, engineering and computer science co-op students must be enrolled in ASE 399 Co-op Work Experience during each work session. The course is required to obtain the co-op education certificate upon graduation, but does not count toward graduation requirements. Interested students should contact the Coordinator of Cooperative Education in the Engineering Center G-Wing. Technology students should contact their coordinator.

Degrees

Baccalaureate Degrees. The completion of a four-year program of study in agriculture, computer science, construction, or technology leads to the degree of Bachelor of Science (B.S.). The completion of a four-year program of study in engineering or engineering-

based interdisciplinary programs leads to the degree of Bachelor of Science in Engineering (B.S.E.) or Bachelor of Science (B.S.). The B.S.E. programs are offered through the engineering departments and the Engineering Special Studies. Course requirements comprising these majors are drawn primarily from the various engineering disciplines. The B.S. programs are offered through the Engineering Interdisciplinary Studies, for which a portion of the specialization course requirements are drawn primarily from non-engineering disciplines.

Integrated B.S.E.-M.S.E. Program. (For School of Engineering students only.) To provide greater program flexibility, qualified students may undertake a program which provides an integrated fourth- and fifth-year sequence of study in one of several fields of specialization in engineering. This gives the student an opportunity to meet the increasing demands of the profession for graduates who can begin their engineering careers at an advanced level.

Students admitted to this program are assigned a faculty committee which will supervise a program of study in which there is a progression in the course work and in which earlier work is given application in the later engineering courses for both the bachelor's and master's degrees. Entry into the integrated program will require an application submitted to the Dean through the faculty advisor and the department chair. Applications will be reviewed by a School committee which will recommend the appropriate action to the Dean. The application may be submitted in the fifth semester.

Graduate Degrees

Deficiencies for admission to the graduate degree programs will be specified at the time of admission. The Graduate Record Examination (V,Q,A) is recommended but not required unless specified by the respective academic unit. TOEFL scores must be submitted by foreign student applicants before admission is considered. The minimum required score is determined by each academic unit.

Master of Science Degree (M.S.)

Agriculture. This program provides competent students with opportunities to complete advanced studies with emphasis on research in Agribusiness and Environmental Resources in Agriculture. Areas of concentration in Agribusiness are management,

marketing, finance, international agriculture, and food quality assurance. Areas of concentration in Environmental Resources in Agriculture are range resource management, land reclamation, resource conservation, and urban horticulture. Admission requires completion of 18 semester hours in agriculture, environmental sciences or closely related course work. Scores from the GRE or MAT are required. A minimum of 30 semester hours of approved graduate course work is required, including a thesis or thesis substitute. An oral examination in defense of thesis or thesis substitute is required.

Computer Science. This graduate program provides an opportunity for qualified students holding a baccalaureate degree in computer science or related fields to complete advanced studies with emphasis on research. Admission requires an appropriate baccalaureate degree. A minimum of 30 semester hours of approved course work is required, including a thesis or thesis substitute. An oral examination in defense of the thesis or thesis substitute is required.

Engineering. This program is a research oriented graduate degree program, providing an opportunity to highly competent students to major in Chemical, Civil, Electrical, Industrial or Mechanical Engineering, or Engineering Science. Admission normally requires an appropriate undergraduate engineering degree and satisfying all Graduate College admission requirements, as well as special department requirements. A minimum of 30 semester hours of approved graduate course work is required, which must include a thesis, or thesis substitute, and an oral examination at completion of the program. Students writing a thesis must enroll in 6 semester hours of thesis, research, or applied project.

Master of Science in Engineering Degree (M.S.E.)

Engineering. This program is a professionally oriented graduate degree program and is intended as a preparation for a career in professional practice. Two options are available: the first is a thesis or thesis substitute (engineering report or research paper); the second is a no thesis, no report degree program. Both options require a minimum of 36 semester hours of approved graduate level course work. Entry into this program requires the satisfying of all Graduate College admission requirements, special department requirements, and a bac-

calaureate degree with a major in engineering or other closely related degree program.

Option 1: Designed primarily for full-time students who plan to major in one of the engineering disciplines. The M.S.E. degree Option 1 is awarded upon successful completion of graduate course work, engineering projects and research endeavor resulting in a thesis or thesis substitute (engineering report or research project). A final oral examination is required in defense of the thesis or thesis substitute.

Option 2: Designed primarily for students who hold full-time jobs and must attend university classes on a part-time basis and who plan to major in one of the engineering disciplines. The M.S.E. degree Option 2 is awarded upon successful completion of graduate course work. A final written comprehensive examination of the graduate course work taken for the degree and over the respective undergraduate prerequisites is required. Students selecting this option must check with the respective department regarding eligibility for financial aid offered by the School of Engineering.

Master of Technology Degree (M.Tech.)

Technology. This degree program is designed for flexibility which permits the student to select a combination of courses in technology and supporting areas to meet individual career goals. Selected areas of concentration are designed to provide graduates with technical and professional skills for use in preparation for and advancement in leadership positions found in industry and education. The areas of concentration include: Aeronautical Engineering Technology and Air Transportation Management; Electronic Communication Systems, Digital/Computer Systems, Systems Control and Instrumentation, Microelectronics and Electronic Engineering Technology Education; Graphic Communications, Industrial Education, Industrial Supervision, Interactive Computer Graphics, and Vocational Education; Manufacturing, Mechanical and Welding Engineering Technology. Admission requires an appropriate baccalaureate degree with a minimum of 30 semester hours in technology or equivalent. Scores from the GRE are required. A minimum of 32 semester hours of approved course work is required, including a practicum or applied project. An oral examination in defense of the practicum or applied project is required.

Doctor of Philosophy Degree

Engineering. The degree Doctor of Philosophy is awarded in engineering and computer science upon the satisfactory completion of an approved program of graduate study, research and dissertation. For specific reference to this degree, see the Graduate College section of this catalog or the *Graduate College Catalog.*

Degrees in Education

Technology. The Division of Technology offers in conjunction with the faculty in the Department of Secondary Education, College of Education, the following degrees in education: Bachelor of Arts in Education, which is open to students preparing to teach Industrial Arts in elementary and secondary schools; Master of Education, Doctor of Education, and Doctor of Philosophy with a concentration in Industrial Education.

Student Academic Services

The Dean's Office in the College of Engineering and Applied Sciences maintains a special office staffed to assist students in the following matters:

Advisement and Counseling. For assistance and counseling in planning a program of study, each student in this college will be assigned a faculty advisor who is familiar with the chosen field of specialization and who must be consulted before registering each semester. In addition, the Associate Director of Student Academic Services is available to all students for counseling and assistance. The office of the Student Academic Services also administers, for the College Standards Committee, the probation, disqualification, and readmission processes for those students who are academically deficient.

International Students. The Student Academic Services office will assist international students in this college encountering special problems related to their college studies and student status.

Student Recruitment and Minority Relations. The Assistant Director of Student Recruitment and Minority Relations is available to assist prospective and newly admitted students with a variety of services related to academic and personal concerns. Advisement and assistance is provided in the procurement of financial aid and scholarships, particularly for top scholars. A concentrated outreach effort is placed in the recruitment of qualified minority students.

Scholarships. Academic scholarships for continuing students in this college may be

applied for through the Student Academic Services Office or the various division offices. Other scholarships may be available through the Student Financial Assistance Office.

General Information

Definition of Terms. The terms used in this College to describe offerings are defined below for purposes of clarity.

Program of Study—A broad term describing the complete array of courses included in the study leading to a degree. Example: engineering, technology, construction, agriculture, computer science.

Major—A specialized group of courses contained within the program of study. Example: program of study—engineering; major—civil engineering. Example: program of study—agriculture; major— agribusiness.

Area of Emphasis (technical electives), Pattern or Concentration is a selection of courses within a major or among one or more majors. The number of technical electives varies from curriculum to curriculum. In a number of the majors the technical electives must be chosen from pre-selected groups. For this reason the choice of specific technical electives for an area of emphasis should be done with the advice and counsel of an advisor. Example: major—mechanical engineering; area of emphasis— thermosciences.

Admission. Students who wish to be admitted to freshman standing in the College of Engineering and Applied Sciences should present certain secondary units which are specified in the requirements of the Department, Divisions and the School of Engineering. Students who have omissions or deficiencies in secondary school subject matter preparation may be required to complete additional university credit course work which may not be applied toward their degree.

Entrance requirements of this College may differ from those of other academic units on campus. Students may be admitted to this College under two different classifications, as follows:

For admission to a professional program in one of the departments, schools, or divisions of the College: Students must meet the following requirements:

	H.S. Rank	Minimum Scores		
		ACT	SAT	TOEFL*
Agriculture	Upper 50%	**	**	500
Computer Science (all degrees)	Upper 20%	24	1100	550
Construction	Upper 50%	23	1050	550
Engineering	Upper 25%	23	1050	550
Technology	Upper 50%	**	**	500

*For international students.
**Same as university requirements, see page 19.

For admission as a pre-professional student to one of the departments, schools, or divisions of the College: Students not admissible to a professional program within the College but who are otherwise admissible to Arizona State University, may be admitted as a pre-professional student for the selected major. Students admitted into this classification will follow the freshman-sophomore sequence of courses as required by their chosen major. Courses will be selected with the assistance of an academic advisor. After completing a minimum of 30 semester hours of required or approved elective courses with a cumulative GPA equivalent to that required of transfer students and corresponding to the chosen major, students may apply for admission to the regular program. Students who are admitted as pre-professional students will not be permitted to register for 300-400 level courses in the College of Engineering and Applied Sciences until their status is changed to the professional classification.

Students admitted to the University by the GED (General Education Development) are required to take either the ACT or the SAT in order to meet the above requirements.

Students not admissible to programs in this college who enroll in another college at ASU may not register for any 300 or 400 level courses in this college, unless such courses are required in their degree programs and students have the proper course prerequisites.

Readmission. Students applying for readmission to professional status for any program in this College must have a cumulative GPA equal to that of the transfer admission requirements shown below. If a student does not meet these requirements, he/she may request admission to the pre-professional program, subject to the restrictions shown under "Admissions" (above).

Transfer Into and Within College. Students transferring into or between departments or divisions within the College or other colleges within the University must have at least a cumulative GPA of 2.0 and meet the catalog requirements of the new department or division in effect at the time of transfer.

Transfer Students. Students who contemplate transferring into this College from other institutions, whether they be community colleges or four-year institutions, should study carefully the pertinent sections under this College pertaining to their particular program and, if possible, consult an advisor in this College prior to enrolling in that other institution. This will assure a smooth transition at the time of transfer. Transfer students may request admission to either pre-professional or professional status in any of the programs offered by this College. The restrictions with regard to pre-professional status are shown under "Admissions" (above). The Department, Divisions, and School may impose additional admission and graduation requirements to those minimums specified by the College.

No grades lower than C will be accepted as transfer credit to meet the graduation requirements of this college.

The minimum requirements for admission of transfer students are as follows:

	Transfer GPA*
Agriculture	2.00
Computer Sciences (all degrees)	2.75
Construction	2.25
Engineering	2.50
Technology	2.25

*The cumulative GPA will be calculated using all credits from ASU and from other colleges and universities.

Credit is granted for transferred courses which are adjudged to be equivalent to corresponding courses in the selected program of study, subject to grade and senior residence requirements. Credits transferred from a community college will be applied only as lower division credits. Prospective Arizona community college transfer students should consult their advisor and refer to the annual *Arizona Higher Education Course Equivalence Guide* for a listing of the acceptable courses transferable to the various College degree programs.

It should be noted that some courses taken in other colleges of this University or other universities may be acceptable for general university credit but may not be acceptable toward the degree requirements of this College. Determination of those particular courses acceptable to a specific degree program will be made within the appropriate department, division or school with the approval of the Dean.

Course Work Currency. Courses taken more than five years before admission to degree programs in this College will not normally be accepted for transfer credit at the option of the department or division in which the applicant wishes to enroll. Courses completed within the five years preceding admission will be judged as to their applicability to the student's curriculum.

Retention. A student is expected to make satisfactory progress toward completion of degree requirements in order to continue enrollment in the College of Engineering and Applied Sciences. Any one of the following conditions will be considered unsatisfactory progress and will result in the student being placed on provisional (probationary) status:
1. A deficiency of 15 grade points.
2. A semester or summer session with grade point average less than 1.50.
3. Two successive semesters with grade point averages below 2.00.
4. Grades of E, W, or I in half the credit hours appearing on the official enrollment record for any semester.

Students on probation will be subject to disqualification (1) if they do *not* attain a 2.25 semester GPA and if their cumulative GPA is below a 2.00 at the end of the probationary semester (items 1, 2 and 3 above); or (2) if they receive any I's, E's or W's during the provisional semester (for item 4 above).

Provisional and probationary students may not register for the next semester without a special permit. They may not participate in early registration.

Disqualification. During a semester on provisional status a student who fails to meet the retention standards specified above will be disqualified. Any disqualified student who is accepted by another college at ASU may not register for courses in this College unless the courses are required for the new major. Further, students at the university who have been disqualified academically by this College are not eligible to enroll in Summer Session courses in this College until the disqualification period has expired and they have been reinstated.

Reinstatement. The College of Engineering and Applied Sciences will not accept an application for reinstatement until the disqualified student has remained out of this college for at least a 12-month period. Merely having remained in a disqualified status for the above period of time does not, in itself, constitute a basis for reinstatement. Proof of ability to do satisfactory college work in the chosen discipline will be required.

English Proficiency Requirement. English proficiency is required. As a minimum each student must complete ENG 101 and ENG 102, or ENG 105, but any student whose written or spoken English in any course is unsatisfactory may be required to take additional course work by the appropriate division director or department chair. See statement on English Proficiency, page 29.

Pass-Fail Grades. Students enrolled in the College of Engineering and Applied Sciences will not receive degree credit for pass-fail courses taken at this institution. In addition, no courses in this college are offered for pass-fail credit. Students requesting credit for pass-fail courses taken at another institution must file a Petition for Variance form. Each request will be judged on its particular merits.

Entry into Upper Division Courses. Prior to enrolling in courses at the 300-level and above, all students in good academic standing must secure the approval of their advisor. Students who are not in good academic standing must secure the approval of their advisor *and* division director or department chair. Students whose grades in 300-level courses are unsatisfactory may be required to retake one or more courses for which credit has previously been granted.

The Department, Divisions and School have certain additional requirements that must be met in addition to the above College requirements. Consult the department or division offering your chosen major.

Academic Honors. Students who maintain a 3.5 or above cumulative index are awarded, at the College Honors Convocation, a Certificate of Scholastic Excellence, and/or are listed in the Honors Convocation program. Students completing baccalaureate degree requirements will receive the appropriate Honors designations on their diplomas consistent with the requirements specified by the University.

Students in the College of Engineering and Applied Sciences are encouraged to seek information concerning entry into those honor societies for which they may qualify. Membership in such organizations enhances the student's professional stature. The following honor societies are active within the College: (1) Alpha Pi Mu—Industrial Engineering Honor Society, (2) Alpha Zeta—Agriculture Honor Society, (3) Eta Kappa Nu—Electrical Engineering Honor Society; (4) Pi Tau Sigma—Mechanical Engineering Honor Society, (5) Sigma Lambda Chi—Construction Honor Society, (6) Tau Alpha Pi—National Honor Society, Engineering Technologies, and (7) Tau Beta Pi—National Engineering Honor Society. Information on any of these organizations may be obtained from the respective Department, Division or School offices, or the Office of the Student Academic Services Coordinator.

ROTC Students. Students pursuing a commission through either the Air Force or Army ROTC programs will be required to take from 12 to 20 hours in the Department of Aerospace Studies or Department of Military Science. To preclude excessive overloads, these students should plan on at least one additional semester to complete degree requirements. ROTC students must also meet all other degree requirements of this College.

General Studies

Higher education should provide the student not only with competency in the chosen subject field, but also with experiences which facilitate the student's growth in ability to perceive significant relationships, to make intelligent value judgments, to express ideas with ease, clarity and good taste, and to develop the qualities of character and personality requisite for a successful career. The development of moral, ethical and social concepts, along with a sound professional attitude, is required. It is expected that the attainment of an interest and pleasure in the above pursuits will be an inspiration to continued study. Courses are selected with the aid of an advisor to provide planned sequences and to place emphasis on the interrelationships that exist among fields of knowledge.

The College requires a minimum of 6 hours in behavioral and social sciences, and a minimum of 6 hours in humanities and fine arts, with a total of 16 hours in these

areas combined; 8 hours of science and mathematics; and 12 hours of General Studies electives to fulfill the General Studies requirement.

Students must select courses from the following lists which are approved and acceptable for *all* undergraduate degree programs in this College. It is recommended that at least 6 of the 16 hours total be 300- or 400-level courses. Students receiving degrees in the *School of Engineering* must select at least two courses from the same subject area in either the Humanities or the Social Sciences categories.

Humanities and Fine Arts

Art History: Any ARH course numbered from ARH 100 through 488

Architectural Philosophy and History: APH 100, 101, 200, 201, 300, 304, 305

Communications: COM 241, 344

Dance History: DAH 100, 300, 301, 401, 402

Decorative Arts: DEH 171

English: ENG literature courses only

Foreign Language: All—up to 10 sem. hrs. (except cannot be student's native language).

History and Philosophy of Science: All HPS courses.

Humanities Education: Any HUE course numbered HUE 101 through 401

Humanities (Interdisciplinary): Any HUM course numbered HUM 110 through 494

Music: MUS 107, 340, 347, 355, 356, 357

Philosophy: All *except* PHI 313

Religious Studies: All REL courses

Theatre: THE 100, 320, 321, 420, 421, 425

Behavioral and Social Sciences

Agriculture: AGB 302, 380, 470; ERA 310

Anthropology: All ASB courses

Civil Engineering: CEE 371

Communications: COM 100, 263, 230, 320, 363, 371

Justice Studies: CRJ 100, 200, 360

Cultural Geography: Any GCU course numbered GCU 102 through 361; 455, 462

Economics: All ECN courses (ECN 111 *required* of all construction and engineering students)

Family Studies: FAS 330, 331, 332, 436

History: Any HIS course numbered HIS 100 through 479

Political Science: Any POS course numbered POS 101 through 474

Psychology: PGS 100, 306, 310, 315, 341, 350, 414, 430, 458

Society, Values and Technology: All STE courses *except* STE 303

Sociology: SOC 101, 251, 301, 305, 332, 351, 352, 360, 432, 452, 453, 454, 455, 456, 483, 485

General Studies and Elective Courses Offered for Students in Other Colleges

This College offers a number of courses in agriculture, computer science, construction, engineering and technology which may be acceptable for General Studies or elective credit in other colleges upon approval of an advisor. The courses in engineering under the heading "Society, Values, and Technology" are specifically oriented to General Studies relating technology to social problems. Students in other colleges should consult with their advisors if they wish to take such courses.

Division of Agriculture

G. J. Seperich, Ph.D., Director

PROFESSORS:
ASHOOR, CHALQUEST, GORDON, METCALF, MILLER, STILES

ASSOCIATE PROFESSORS:
SEPERICH (AG 281), BACKHAUS, BRADY, BROCK, EDWARDS, MADDY, WHYSONG, WOOLVERTON

ASSISTANT PROFESSORS:
BAXTER, DIAZ, HATZELL, MILLER, RACCACH, STUTZ, TOROK

Purpose

The Division of Agriculture provides academic programs directed toward the agribusiness and environmental aspects of agriculture. Agriculture is a dynamic industry which provides employment to about 23 percent of the U.S. labor force. Courses in the Division of Agriculture are designed to prepare students for the wide range of job opportunities which exist in the agricultural industries and governmental agencies. The academic programs are especially designed to include the needs of the urban student who has had little or no previous agriculture experience. An interest in plants, animals or

Reinstatement. The College of Engineering and Applied Sciences will not accept an application for reinstatement until the disqualified student has remained out of this college for at least a 12-month period. Merely having remained in a disqualified status for the above period of time does not, in itself, constitute a basis for reinstatement. Proof of ability to do satisfactory college work in the chosen discipline will be required.

English Proficiency Requirement. English proficiency is required. As a minimum each student must complete ENG 101 and ENG 102, or ENG 105, but any student whose written or spoken English in any course is unsatisfactory may be required to take additional course work by the appropriate division director or department chair. See statement on English Proficiency, page 29.

Pass-Fail Grades. Students enrolled in the College of Engineering and Applied Sciences will not receive degree credit for pass-fail courses taken at this institution. In addition, no courses in this college are offered for pass-fail credit. Students requesting credit for pass-fail courses taken at another institution must file a Petition for Variance form. Each request will be judged on its particular merits.

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foods can be the starting point for career development in agricultural industries or natural resource management. The undergraduate programs also provide the necessary training for students preparing to enter graduate degree programs.

General Information

Admission. See pages 19-23 and 38-39 for information regarding requirements for admission. transfer, retention, disqualification, and reinstatement.

In addition, students who are beginning their initial college work in the Division of Agriculture should present secondary school units in accordance with the minimum University requirements. There are no secondary school agricultural course requirements.

Organization

The Division of Agriculture is comprised of students, faculty, administrators, staff and physical facilities. The academic programs are organized into two separate majors: agribusiness and environmental resources in agriculture. Options for specialization within these majors are as follows:

Agribusiness

Concentration	Area of Emphasis
Agribusiness	Agribusiness Management/Marketing International Agriculture
Pre-Veterinary Medicine	
Food Industry	Food Quality Assurance/Food Industry Management

Environmental Resources in Agriculture

Concentration	Area of Emphasis
Natural Resource Management	Land Reclamation Soil & Water Conservation Range Ecology Range Agribusiness Resource Systems
Urban Horticulture	

Center for Arid and Tropical New Crop Applied Science and Technology (NEWCAST)

The NEWCAST Center carries out research and development leading to commercialization of biotechnologies important to agribusiness. As an interdisciplinary center it draws on collaborators from the entire Arizona State University faculty and both private firms and public agencies. While it specializes in new crops and products derived

therefrom. it will act as a resource and/or manage programs developing new technologies and inventions not directly related to agriculture.

Degrees

Bachelor of Science (B.S.). The Division of Agriculture offers the Bachelor of Science degree in Agribusiness and in Environmental Resources in Agriculture. A minimum of 126 hours of credit, including University General Studies,* the Division and major cores, and area of emphasis courses lead to the Bachelor of Science degree. Forty percent of the semester hours required for graduation must be upper division.

Master of Science (M.S.). The Division of Agriculture offers the Master of Science degree in Agribusiness and in Environmental Resources in Agriculture. Thesis and non-thesis options are offered in the Agribusiness program. A minimum of 30 credit hours of graduate level course work is required for the degree. Additional details for this degree are given in the *Graduate College Catalog.*

Curricula in Agriculture

Curricula in Agriculture include the General Studies* requirement, the Division of Agriculture core requirement, the major core requirement, together with the area of emphasis courses and elective courses to complete the graduation requirement of 126 credit hours. Prior to entering the junior year each student, with the aid of an advisor, is expected to select a concentration and an area of emphasis.

The agribusiness major is an applied, industry-oriented curriculum. The study of animals, plants and their utilization in the food and fiber system forms the base of the program. Students then learn to analyze firms involved in input supply activities, commodity processing, food manufacturing and food distribution. Students also study government agricultural programs and regulatory activities which affect agribusiness. Because of the United States' role in supplying commodity and food products to the world markets, international aspects of agribusiness development and trade are emphasized.

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*See pages 212-213 for specific requirements and approved list of social and behavioral sciences, and humanities and fine arts.

Two concentrations exist within the environmental resources in agriculture major. The natural resource management concentration emphasizes the study of wildland ecosystem management. Students interested in range resources may pursue an ecological emphasis by choosing the range ecology area or they may pursue a business emphasis by choosing the range agribusiness area. Application of the systems approach in a wide variety of resource management situations is the emphasis of the resources systems area. Students with particular interest in soils may choose to pursue either the more general program in soil and water conservation or the program in land reclamation which is more specifically directed toward reclaiming disturbed lands. The urban horticulture concentration emphasizes the production, care and marketing of plant materials for urban environments. The program is designed to be flexible so that individual students can choose areas to emphasize such as commercial horticulture, landscape horticulture or horticultural science.

Agriculture Core

All students pursuing a Bachelor of Science degree in the Division will complete the following general core courses:

			Semester Hours
AGB	300	Livestock Management	3
AGB	310	Crop Management	3
AGB	380	Government Regulations in Agriculture	3
ERA	346	Environmental Conservation	3
		Total	12

Agribusiness

The agribusiness major combines business and technical agriculture as they relate to the management, marketing and financial objectives of agribusiness firms. Topics of interest include the supplying of resources and services to agricultural producers, the management of crop and livestock enterprises, the processing of raw agricultural products and the management and quality assurance of food manufacturing. Food distribution is examined from the points of view of food wholesalers and retailers as well as food service firms which include restaurants and specialized food firms. The study of agribusiness also includes analysis of the critical roles of government in regulating certain aspects of agribusiness and promoting international trade in agribusiness products.

Students selecting agribusiness as a major are required to take the following courses:

			Semester Hours
AGB	101	Food Chain	2
		or AGB 302 Food Supply (2)	
CHM	101	Introductory Chemistry	4
		or CHM 113 General Chemistry (4)	
MAT	115	College Algebra and Trigonometry	4
		or MAT 210 Mathematical Analysis (3)	
ECN	112	Microeconomic Principles	3
ECE	105	Introduction to Languages of Engineering	3
		or CSC 181 Programming in Basic (3)	
		or CSC 183 Programming in Fortran (3)	
AGB	312	Agricultural Marketing	3
AGB	332	Agribusiness Finance	3
AGB	364	Food Technology	3
AGB	442	Agribusiness Management I	3
AGB	490	Recent Advances in Agribusiness	1
		Total	28-29

Agribusiness, as a concentration, contains the following areas of emphasis:

Agribusiness Management/Marketing integrates the knowledge and skills needed to successfully manage people, products and services in agribusiness enterprises. Agribusiness management combines the agricultural sciences, behavioral science and common sense. Functional, institutional and behavioral aspects of marketing are examined while studying the flows of products and services through the various market channels for agricultural inputs, commodities and food. Emphasis is placed on up-to-date management/marketing methods that will allow graduates to successfully meet challenges in the food and fiber industries. Graduates are qualified to make significant contributions in a broad range of career opportunities which exist in agribusiness. Many start career paths which will lead to upper-level agribusiness management/marketing positions.

International Agriculture relates worldwide agricultural resources to the requirements and potentials of the various nations. Particular emphasis is given to economic development and to the international trade of food and fiber products. Special courses are offered to form a unique curriculum which is designed to train either the U.S. or foreign student to work in the enhancement of agricultural programs of foreign coun-

tries. Provided is a basic knowledge of U.S. agricultural techniques which is extended to the global aspects of agriculture. Graduates in this area are particularly qualified to aid in the development of the world's agricultural potential to provide food and fiber to meet the expanding populations. Jobs exist in commercial industries and in government agencies—United States, international and foreign. A language capability in addition to English is recommended.

Pre-Veterinary Medicine is primarily designed to meet the entrance requirements of professional veterinary medical schools in the United States and Canada. Selection of this area will permit students to complete the pre-veterinary requirements for entrance to professional veterinary school. The curriculum permits the student to obtain some course work in agribusiness, especially as it relates to professional practice and industry. This background also provides an important alternative for the student who does not actually enter veterinary school. Completion of all requirements for a Bachelor of Science degree in agribusiness at ASU is provided by completing additional credits, if desired. A pre-veterinary medicine student who elects to earn a Bachelor of Science degree in the Division of Agriculture may do so by taking three years at ASU, completing 94 semester hours of credit, with a minimum of 60 semester hours at ASU, and by completing the agriculture and General Studies requirements. The student may then receive a written statement from the Dean of the College of Engineering and Applied Sciences giving senior-in-absentia privileges. The student will be eligible to receive the B.S. degree after the Registrar's Office receives a recommendation from the dean of the professional school and a transcript of credit indicating the student has completed a total of 126 semester hours with a cumulative index of 2.00 or better.

Although this concentration is primarily intended for the student preparing to enter professional veterinary medicine as a career, it is also an excellent basis for future graduate degree programs or many of the scientifically related jobs in agribusiness and government.

Food Industry, as a concentration, contains the following areas of emphasis:

Food Quality Assurance/Food Industry Management concentrates on the scientific and technical competence required by the food industry. Strong emphasis is given to

basics such as chemistry, analytical techniques and food safety. This unique program offers employment opportunities for graduates in food industries, regulatory agencies and consumer organizations, all of whom maintain continuous quality control and inspection programs to protect our food supply.

Typical Curriculum for Agribusiness

First Year

			Semester Hours
AGB	101	Food Chain	2
AGB	130	Plant Science	3
AGB	150	Animal Science	3
CHM	101	Introductory Chemistry	4
MAT	115	College Algebra and Trigonometry	4
ENG	101	and 102 Freshman Composition	6
		Social and Behavioral Sciences Courses	6
		General Electives Courses	4
		Total	32

Second Year

ECN	111	and 112 Macroeconomic Principles and Microeconomic Principles	6
ECE	105	Introduction to Languages of Engineering	3
		Agribusiness Electives Courses	15
		Humanities and Fine Arts Courses	6
		General Electives Courses	3
		Total	33

Third Year

AGB	312	Agricultural Marketing	3
AGB	332	Agribusiness Finance	3
AGB	364	Food Technology	3
AGB	300	Livestock Management	3
AGB	310	Crop Management	3
AGB	380	Government Regulations in Agriculture	3
ERA	346	Environmental Conservation	3
		Field of Specialization Courses	9
		Total	30

Fourth Year

AGB	442	Agribusiness Management I	3
		Field of Specialization Courses	22

General Electives Courses .... <u>6</u>

Total 31

Environmental Resources in Agriculture

The environmental resources in agriculture major emphasizes the application of principles drawn from basic biology, ecology and soil science. Students in the natural resource management concentration will study application of these principles to wildland ecosystems. Students in the urban horticulture concentration will study the application of these principles in garden, landscape and greenhouse environments.

Students selecting environmental resources in agriculture as a major are required to take the following courses:

			Semester Hours
BIO	181	and 182 Biological Principles and Processes	8
MAT	115	College Algebra and Trigonometry	4
CHM	101	Introductory Chemistry	4
CHM	231	Elementary Organic Chemistry.	4
ERA	325	Soils	3
ERA	326	Soils Laboratory	1
ERA	350	Applied Quantitative Methods .	3
ERA	490	Recent Advances in Environmental Resources	1
		Total	28

Natural Resource Management, as a concentration, includes the following areas of emphasis:

Land Reclamation deals with the physical and chemical problems arising from disturbance of land caused by mining and other activities. The program emphasizes restoration techniques that are compatible with maintaining environmental quality. Training in soil science and plant materials is supported by knowledge in the agricultural, biological and physical sciences. Students choosing this option may find employment in private industry in the areas of mining, petroleum, energy and construction or in regulatory government agencies.

Soil and Water Conservation deals with the wise use of these important resources. Wise use is essential if environmental quality and productivity are to be maintained in view of the hazards posed by erosion, pollution, and sedimentation. Course work in this option emphasizes soil science; however, a strong foundation in the biological and agricultural sciences is required. Students choosing this option can pursue

employment with government agencies or private industries which are concerned with managing, wisely utilizing and protecting these resources.

Range Ecology emphasizes the study of renewable rangeland resources based on a firm background of agricultural and biological sciences. The specific areas of plant, animal and soil sciences with ecology comprises primary training in range ecology. Students completing this option may choose careers as professional range conservationists for federal and state agencies or in private industry. Range conservationists perform work concerned with inventorying, analyzing, improving, protecting and managing the natural resources of rangelands and related grazing lands.

Range Agribusiness combines the technical aspects of the range ecology area with solid background in agribusiness. An emphasis is placed on the combination of a technical background with the knowledge of business concepts and skills which will provide the background for managing people, products and services associated with range-resource related agribusiness. Employment opportunities for students following this option will be primarily with these industries.

Resource Systems emphasizes description of ecological processes within the natural resource management context and application of the principles of systems ecology. These principles provide powerful tools for both understanding ecosystem processes and understanding possible solutions to management problems. By selecting the proper electives, students choosing the resource systems option can pursue employment with government resource agencies or private industries. This option also provides an excellent foundation for students planning future studies in either resource management or fields relating to resource management, such as law or journalism.

Urban Horticulture, as a concentration, is designed to provide a solid foundation in horticultural practice while providing sufficient flexibility for students to emphasize areas of particular interest. For example, students may choose to emphasize the commercial aspects of horticulture by including agribusiness courses in the curriculum to insure financial as well as horticultural knowledge. Students may also choose to emphasize landscape horticulture by concentrating on courses in design and landscape horticulture; horticultural science by directing their

program of study to include courses in botany, genetics and chemistry; or to concentrate on horticultural management of pests, soils and water by including course work in plant diseases, pests, nutrition and water management. Graduates find employment in the nursery industry, landscape management (e.g., park or golf course management), commercial or government laboratories, the agricultural chemistry industry, or may begin their own businesses.

Typical Curriculum for Environmental Resources in Agriculture

First Year

			Semester Hours
ENG	101	and 102 Freshman Composition	6
MAT	115	College Algebra and Trigonometry	4
CHM	101	Introductory Chemistry	4
		Computer Course	3
		Social and Behavioral Sciences Courses	8
		General Electives Courses	6
		Total	31

Second Year

BIO	181	and 182 Biological Principles and Processes	8
CHM	231	Elementary Organic Chemistry	4
ERA	325	Soils	3
ERA	326	Soils Laboratory	1
		Humanities and Fine Arts Courses	8
		*Option Requirements	6
		Total	30

Third Year

AGB	310	Crop Management	3
AGB	300	Livestock Management	3
ERA	350	Applied Quantitative Methods	3
ERA	346	Environmental Conservation	3
AGB	380	Government Regulations in Agriculture	3
		*Option Requirements	18
		Total	33

Fourth Year

ERA	490	Recent Advances in Environmental Resources	1
		General Electives Courses	5
		*Option Requirements	26

Total 32

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Option Requirements as Listed for Individual Programs

AGRIBUSINESS

AGB 101 Food Chain. (2) F
Dependence of the quality, quantity and cost of national food supplies on technology, marketing and world agricultural policies.

130 Plant Science. (3) S
Plant growth and development in the rural and urban environment. Two lectures, 3 hours laboratory.

150 Animal Science. (3) F
Comparative growth, development and propagation of farm animals. Two lectures, 3 hours laboratory.

160 Veterinary Medicine Today. (2) N
Introduction to the role of the veterinarian as related to the fields of food supply and veterinary medicine.

300 Livestock Management. (3) F
Methods of managing livestock enterprises, economics, loss prevention and marketing. Prerequisite: AGB 150.

302 Food Supply. (2) S
Impact of national policy and world agriculture on the cost, quantity and quality of the U.S. food resources.

305 Nutritional Science. (3) N
Energy and nutrients in living systems. Corequisite: CHM 101 or equivalent.

306 Nutritional Science Laboratory. (1) N
Experimental trials involving the principles of nutrition and the physiological roles of nutrients in metabolism. Corequisite: AGB 305. Three hours laboratory.

310 Crop Management. (3) S
Crop production and management principles and their application to crop growth and development. Prerequisite: AGB 130.

312 Agricultural Marketing. (3) F, S
Marketing arrangements for agricultural products.

313 Intermediate Agricultural Marketing Analysis. (3) S
Theory and analysis of marketing in agribusiness. Prerequisite: AGB 312.

320 Anatomy of Agricultural Animals. (4) N
Gross and microscopic structural anatomy of organ systems of agricultural animals; concepts of physiological processes discussed. Prerequisites: AGB 150 or BIO 181, 182. Three lectures, 3 hours laboratory.

332 Agribusiness Finance. (3) S
Agribusiness investment management and financial institutions that serve agriculture. Prerequisite: ECN 111.

333 Agribusiness Purchasing. (2) N
Working with supplies for agribusiness, including standards, inventories and records.

335 Establishing an Agribusiness. (3) F
Establishing entrepreneurship in agriculture, including legal status, financing, planning, marketing and management. Prerequisite: junior standing.

350 Livestock Marketing. (3) S
Livestock marketing functions, including commodities, trading and hedging.

353 Applied Animal Nutrition. (3) S
Feedstuffs, feeding standards and their application in meeting nutritional needs of animals producing food and fiber. Prerequisite: AGB 305.

356 Animal Breeding. (3) S
Genetics applied to animal breeding. Prerequisite: ZOL 110 or AGB 150.

360 Crop Physiology. (4) N
Physiology of crop plants with emphasis on plant nutrition and environmental factors. Prerequisite: AGB 130. Three lectures, 3 hours laboratory.

364 Food Technology. (3) F
Processing and preservation of food products. Prerequisites: CHM 101 or 113; MAT 115 or 210.

365 Food Technology Laboratory. (1) F
Experiments and procedures in processing and packaging foods. Corequisite: AGB 364. Three hours laboratory.

366 Meats. (3) S
Meat purchasing, retail cut identification, meat preparation and preservation for the customer. Prerequisite: AGB 150 or FON 142.

367 Meat Science. (3) F
Basic science of muscle and meat in animal production, processing and utilization. Prerequisite: AGB 150 or FON 142.

368 Food Quality Assurance. (3) F
An introduction to processed food quality assurance, statistical sampling and inspection procedures. Prerequisites: AGB 364; ERA 350.

369 Food Analysis. (3) F
Processing control and scientific instrumentation used in food quality assurance laboratories. Two lectures, 3 hours laboratory. Prerequisites: AGB 368; CHM 115.

370 Companion Animals to Man. (3) S
Selection, breeding, health and care of pets. Includes their social and economic impact on urban living.

371 Pet Nutrition. (3) F
Review and application of nutrition principles in feeding man's companion animals. Prerequisite: CHM 101 or BIO 100.

372 Light Horse Management. (2) N
Breeds, care, selection and handling of horses.

375 Horse Breeding and Management. (3) N
Considers current methods of improving genetic traits and reproductive performance of horses. Prerequisite: AGB 372. Two lectures, 3 hours laboratory.

376 Horse Feeding and Nutrition. (2) N
Ration formulation to meet nutrient requirements for growth, reproduction and performance of horses. Prerequisite: AGB 372.

380 Government Regulations in Agriculture. (3) F
The development and implementation of government regulations that affect the management of agribusiness. Prerequisite: junior standing.

390 Agricultural Accounting. (3) F
Basic accounting applications commonly used by agricultural industries, including tax and management information systems.

402 Agricultural Cooperatives. (3) F
Organization, operation and management of agricultural cooperatives.

403 Agribusiness Public Relations. (3) S
The image of agriculture, including consideration of the agricultural press. Prerequisite: AGB 312.

404 Sales and Merchandising in Agribusiness. (3) F
The principles and techniques of selling and commodity merchandising in the agricultural industries. Two lectures, 3 hours laboratory.

405 Future Food Supply. (3) F
Food and agricultural supply forecasting, scenario development and analysis, and alternative response strategies.

412 Agricultural Commodities. (3) F
Trading on futures markets. Emphasis on the hedging practices with grains and meats. Prerequisite: AGB 312.

413 Financial Commodities. (3) S
Trading on futures markets. Emphasis on the hedging practices with financial and currency instruments. Prerequisite: AGB 332 or FIN 300.

414 Advanced Commodity Trading. (3) N
Advanced analysis of trading techniques with emphasis on hedging in the futures markets. Prerequisite: AGB 412 or AGB 413.

425 Food Safety. (3) S
Food hazards prevention, detection, assessment and neutralization. Regulatory agency enforcement programs are emphasized. Prerequisite: AGB 364.

426 Food Chemistry. (4) S
The biochemical and chemical interactions that occur in raw and processed foods. Prerequisites: AGB 364; CHM 231. Three lectures, 3 hours laboratory.

428 Comparative Nutrition. (3) N
Effects of nutrition on animal systems and metabolic functions. Prerequisites: AGB 305 ; CHM 231.

431 Intensified Livestock Management. (4) N
Management techniques in arid high density animal units. Prerequisites: AGB 150 or 300; AGB 305 or 353. Three lectures, 3 hours laboratory.

432 Feedlot Management. (3) N
Management aspects of feedlot operation. Case studies and management problem analysis will be included.

433 Diseases of Domestic Animals. (3) N
Control and prevention of infectious and noninfectious diseases of domestic animals. Prerequisite: MIC 201 or 210.

434 Endocrinology. (3) N
Functions of the endocrine glands in the regulation of animal physiological processes. Prerequisite: AGB 435 or ZOL 360.

435 Animal Physiology I. (4) N
Control and function of the nervous, muscular, cardiovascular, respiratory, and renal systems of domestic animals. Prerequisites: CHM 113; BIO 181. Three lectures, 3 hours laboratory.

436 Animal Physiology II. (3) N
Control and function of the endocrine, digestive and reproductive systems of domestic animals. Principles of adaptation of animals to their environment. Prerequisite: AGB 435 or ZOL 360.

437 Animal Physiology Laboratory. (1) N
Selected physiological experiments to accompany AGB 436. Three hours laboratory.

438 Physiology of Animal Reproduction. (4) N
Development, function and control of the reproductive system of domestic animals. Prerequisite: AGB 150. Three lectures, 3 hours laboratory.

439 Veterinary Practices. (3) F, S
Observation of and participation in veterinary medicine and surgery supervised by local veterinarians. Open to advanced pre-veterinary students only. Prerequisite: Concurrent or previous credit for AGB 433.

440 Food Marketing. (3) S
Food processing, packaging, distribution, market research, new food R&D and social implications. Prerequisite: AGB 364.

441 Meat Technology. (3) S
Processing and utilization of meat products. Prerequisite: AGB 367. Two lectures, 3 hours laboratory.

442 Agribusiness Management I. (3) S
Principles of management: planning, organizing, integrating, measuring and developing people in agribusiness organizations.

443 Agribusiness Management II. (3) F
Principles of human resource management with emphasis on the special problems of agribusiness systems. Prerequisite: AGB 442.

444 Agribusiness Analysis. (3) F
Identifies the size, scope and organization of the various agriculturally oriented industries.

445 Advanced Crop Management. (3) N
Latest techniques in producing and harvesting major irrigated field crops. Includes crop planning. Prerequisite: AGB 310. Two lectures, 3 hours laboratory.

450 International Agricultural Development. (3) F
Transition of developing countries from subsistence to modern agriculture. Technology transfer and food improvement programs are emphasized. Prerequisite: AGB 312.

451 International Food Resources (3) S
Methods of improving agriculture and food levels in developing regions of the world. Emphasis on actual case studies. Prerequisite: AGB 312.

452 World Food Dynamics. (3) F
Transition and development of raw agricultural commodities into nutritional food products. Emphasis given to food expansion in developing countries. Prerequisite: AGB 302 or AGB 364.

453 World Agricultural Resources. (3) S
World production and consumption of agricultural products, international relationships and agencies concerned with world agricultural development problems. Prerequisite: AGB 101.

454 International Agricultural Trade. (3) F '85
Dimensions, locations, mix, methods and changes of international trade in agricultural products. Prerequisite: AGB 312.

455 Agricultural Marketing Channels. (3) F
Operational stages of agricultural commodities in normal distribution systems and implementation of marketing strategies. Prerequisite: AGB 312.

458 International Agribusiness. (3) F '86
Identification and analysis of methods, problems and future of international agribusiness operations. Emphasizes special problems associated with international agribusiness systems. Prerequisite: AGB 312.

460 Agribusiness Management Systems (4) F
The development and use of decision support systems for agribusiness management and marketing. Prerequisites: ECE 105; AGB 332 and 442. Three lectures, 3 hours laboratory.

470 Advanced Government Regulations (3) F
Implications of current federal regulations on agribusiness management. Prerequisite: AGB 380.

474 Agribusiness Policy. (3) F
Development, implementation and profitability of agribusiness strategy. Prerequisite: AGB 312.

490 Recent Advances in Agribusiness. (1) F, S
Reports and discussions of current topics and problems associated with agribusiness. May be repeated for credit.

492 Recent Advances in Food Sciences (1) F, S
Discussion and critical evaluation of current topics in food and quality control research. May be repeated for credit.

505 Commodity Analysis. (3) F
Analysis of commodity markets. Prerequisite: one year of economics or marketing.

508 Advanced Agricultural Marketing. (3) F
Theory and analysis of marketing farm commodities, risks and effect of future trading on cash prices.

509 Advanced Agribusiness Marketing Channels. (3) S
Analysis of agribusiness market channel systems. Formulation of marketing strategies.

510 Advanced Agribusiness Management I. (3) F
Assessment and current problems in managing human and financial resources in agribusiness. Case studies and analysis of special agribusiness problems. Prerequisite: AGB 442.

511 Advanced Agribusiness Management II. (3) S
Analysis of organization behavior, change and resource requirements within agribusiness systems. Prerequisite: AGB 442.

512 Food Industry Management. (3) N
Operations and management of food processing factories, food distribution centers and retail food handling firms.

516 International Agricultural Techniques. (3) F
Coordination of production and marketing techniques to consumption objectives with agricultural products in foreign countries.

518 World Agricultural Development. (3) F
Factors that influence production, processing and marketing of agricultural products in developing countries.

520 Advanced Agribusiness Analysis I. (4) F
Vertical integration and differentiation in food and agricultural industries. Prerequisites: AGB 508, 510 and 532 or equivalents. Four hours lecture/recitation.

521 Agribusiness Coordination. (4) S
Organizational alternatives for agribusiness with emphasis on cooperatives and trading companies. Prerequisites: AGB 508, 510 and 532 or equivalents. Four hours lecture/recitation

525 Advanced Agribusiness Management Systems. (3) S
Application of computer systems to agricultural management problems and processes. Emphasis on parametric linear programming. Prerequisite: AGB 460.

527 Agribusiness Research Methods. (3) S
The use of model building, hypothesis testing and empirical analysis in solving agribusiness problems.

530 Advanced Agribusiness Policy. (3) S '86
Policymaking history, structure and process. Prerequisite: AGB 508.

532 Advanced Agribusiness Finance. (3) F
Financial management of agribusiness firms; agribusiness financial analysis, investment analysis, agricultural risk management, and introduction to agricultural financial intermediaries.

535 Advanced Food Science. (3) F
Chemical and physical nature of processed foods. Emphasis on food product development. Prerequisite: AGB 364.

536 Advanced Food Quality Instrumentation. (3) S
Food analysis using sensitive laboratory instrumentation and methodology. Prerequisite: AGB 322. Two lectures, 3 hours laboratory.

Special Courses: AGB 484, 494, 498, 499, 500, 580, 584, 590, 591, 592, 593, 594, 598, 599 (See pages 35-36.)

ENVIRONMENTAL RESOURCES IN AGRICULTURE

ERA 301 Arboriculture. (3) S
The establishment, care and maintenance of ornamental trees and shrubs. Prerequisite: AGB 130.

310 Bioeconomics of Natural Resources. (3) N
Economic principles and methods as applied to natural resource evaluation and management. Investigation of alternative strategies of resource use. Prerequisites: ECN 111; ERA 346.

325 Soils. (3) F
Fundamental properties of soils, their relation to plant growth and the nutrition of man and animals. Relation of soils to environmental quality. Prerequisite: CHM 101 or 113, or equivalent.

326 Soils Laboratory. (1) F
Selected exercises to broaden the background and understanding of basic soil principles. Corequisite: ERA 325. Three hours laboratory.

332 Agricultural Chemicals. (3) S
Composition, properties and use of agricultural commercial fertilizers and pesticides and their effects on soil, air and water quality.

333 Water Resources. (3) F
Sources, their development and conservation in arid regions for agricultural and urban uses. Prerequisite: CHM 101 or 113.

346 Environmental Conservation. (3) S
The conservation of wildland and agricultural resources emphasizing the systems approach for studying ecosystem complexity.

350 Applied Quantitative Methods. (3) F
Statistical methods with applications in natural resource management and the agricultural sciences. Use of digital computer. Prerequisite: MAT 115 or equivalent.

360 Range Ecosystems. (4) F
The interrelations of vegetation, soils and grazing animals. Evaluation and simulation of grazing animal impact. Prerequisites: ERA 346; BIO 320, or equivalents. Four hours lecture/recitation.

364 Range Ecosystems II. (3) N
Effects of herbivory, fire and site disturbances on nutrient cycles and energy flows. Range nutrition, multiple-use relationships. Prerequisite: ERA 360.

365 Watershed Management. (3) F '85
Hydrologic, physical, biological and ecological principles applied to watershed management. Impact of ecosystem manipulations on water yield and quality. Prerequisites: ERA 325, 346. One weekend field trip.

367 Range Resource Policy. (2) N
Range management policy as influenced by social, political, economic and ethical factors. Introduction to organizations and agencies concerned with range resources. Prerequisite: ERA 346.

370 Forest Silvics and Management. (3) S '86
Silvicultural principles underlying the practice of forestry. Growth of trees and stands, forest site evaluation, manipulation of stands to direct succession and forest measurements. Prerequisites: ERA 346, 350; BIO 320. Two lectures, 3 hours laboratory.

375 Soil Fertility. (3) S
Overview of habitat situations requiring rehabilitation following man's use and rehabilitation techniques. Prerequisites: ERA 325, 326 and 346. Field trips.

380 Environmental Horticulture. (3) F
Plant culture and use in urban agriculture. Prerequisite: AGB 130.

381 Plant Propagation. (3) S
Principles and skills in propagating landscape trees and shrubs by seminal and vegetative means, including fruit plants. Prerequisites: AGB 130; BIO 182. Two lectures, 3 hours laboratory.

382 Lawns and Greens. (3) S
Selection, establishment and maintenance of turf grasses for lawn, park and sports areas. Prerequisite: AGB 130. Two lectures, 3 hours laboratory.

386 Indoor Landscape Plants. (3) S
Selection and care of container-grown house plants.

400 Range Ecogeography. (3) S
Structure, function and plant composition of range ecosystems. Simulation of change resulting from man's use of resources. Prerequisite: ERA 360.

402 Methods in Range Ecology. (4) F
Vegetation sampling and inventory as related to animal-habitat relations. Prerequisites: ERA 350 and 360. Three lectures, 3 hours laboratory; weekend field trip.

407 Range Plants. (4) F
The distribution, ecological characteristics, identification and values of plants on western rangelands. Laboratory emphasizes taxonomy and identification of grasses. Prerequisite: BOT 370 or equivalent. Three lectures, 3 hours laboratory.

410 Population Habitat Relations. (3) S '87
Interactions among animal populations and their habitat. Systems simulation of population dynamics as influenced by competition and management strategies. Prerequisite: ERA 360. Three lectures, one weekend field trip.

420 Range Improvement Practices. (3) F
Brush and weed control, revegetation, burning, fertilization, fencing, grazing systems, and water development. Emphasis on principles and current improvement practices. Prerequisite: ERA 360. Three lectures, one weekend field trip.

425 Soil Taxonomy. (3) F
Fundamental principles of soil genesis, morphology and classification, including properties of significance in mapping and interpreting soil survey information. Prerequisite: ERA 325.

430 Landscaping Principles. (3) F '86
Planning and planting for maximum beauty and utility, including energy conservation. Prerequisite: ERA 380 or equivalent.

438 Nursery Management. (3) F '85
Production of trees and shrubs for wholesale and retail marketing. Prerequisites: ERA 380, 381. Two lectures, 3 hours laboratory.

440 Crop Growth and Development. (3) F
Environmental factors affecting the adaptation, distribution, growth and development of crops. Prerequisites: BIO 182; CHM 231; ERA 381.

448 Soil Ecology. (3) F '86
Soils viewed in an ecosystem context, soil-plant relationships, nutrient budgets and abiotic factors that influence soil processes. Prerequisites: ERA 325, 326; BIO 320, or approval of instructor.

450 Horticultural Plant Problems. (3) F
Identification and control of biotic and abiotic factors which cause common problems to horticultural plants. Prerequisites: ZOL 354 and a plant pathology course.

452 Soil, Water and Irrigation. (3) S
Water measurement, conveyance and conservation with emphasis on crop production and soil-plant water relations. Prerequisite: ERA 325.

460 Applied Systems Ecology. (3) F '86
The systems approach applied to analysis and management of natural resource ecosystems. Use of simulation models. Prerequisites: ERA 350 or equivalent; one course in ecology.

463 Greenhouse Systems. (3) F
Functional design and integrated management of greenhouse and hydroponic systems. Prerequisites: AGB 130; ERA 325. Two lectures, 3 hours laboratory.

470 Land Reclamation. (3) S
Problems of re-establishing vegetation on disturbed sites. Special revegetation techniques, surface modifications and government regulations. Prerequisites: ERA 375, 407, 420, 448, or approval of instructor. One weekend field trip.

475 Range Livestock Management. (3) S
Operation and management of beef cattle and sheep, emphasizing range conditions. Prerequisites: AGB 300 and 353. Corequisite: ERA 480. Weekend field trips.

480 Natural Resource Planning. (3) S
Principles and techniques of planning for management and conservation of natural ecosystems. Use of optimization models and decision theory. Preparation of management plan. Prerequisites: ERA 402 and senior standing. Three lectures, one weekend field trip.

490 Recent Advances in Environmental Resources. (1) N
Current literature and significant developments involving environmental resources. May be repeated for credit.

540 Plant Responses to Environmental Stresses. (3) F '86
Reaction of plants to environmental stresses; herbivores, fire, pesticides, mechanical treatments, aerial pollutants and soil amendments. Prerequisites: BOT 360; ERA 420, or approval of instructor. One weekend field trip.

548 Plants, Soils and Environmental Quality. (3) N
Effects of air quality on plants and soils, and their role in removing contaminants from the atmosphere. Prerequisite: ERA 325.

550 Vegetation Dynamics. (3) S '87
Succession concept and its use in site evaluation. Habitat type concept. Herbivory as an ecological process. Prerequisites: ERA 364; BOT 420, or approval of instructor.

560 Systems Ecology. (3) F '85
Quantitative description and mathematical modeling of ecosystem structure and function. Techniques for model construction and simulation. Prerequisites: six hours in ecological studies, computer programming, ERA 350 or equivalent. Two lectures, 3 hours laboratory.

570 Reclamation of Critical Habitats. (3) F '85
Characteristics of habitats that pose problems for vegetation re-establishment growth and development. Maintaining the integrity and esthetic value of habitats sensitive to human activity. Prerequisites: ERA 448, 470, 540, 550, or approval of instructor. Two lectures, 3 hours laboratory. Field trips.

581 Plant Tissue and Cell Culture. (3) F
Asceptic, clonal propagation of plants via isolated cells, tissues and organs. Prerequisite: BOT 360; ERA 381 or 440. Two lectures, 3 hours laboratory.

Special Courses: ERA 484, 494, 498, 499, 500, 580, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

Department of Computer Science

PROFESSORS:
LEWIS (EC G-252), BLACKLEDGE, FINDLER, GUENTHNER, WOODFILL

ASSOCIATE PROFESSORS:
COLLOFELLO, HUEY, MILLER, NIELSON, O'GRADY, OZKARAHAN, PAI, PHEANIS, ROBBINS

ASSISTANT PROFESSORS:
COVEY, DATTA, FAUSTINI, FOLEY, GOLSHANI, MADARASZ, MELLON, MUTCH, OUKSEL

INSTRUCTOR:
FRIEBAND, TRANTINA, WALKER

Computers have had a significant impact on our way of life. This impact may even be greater in the future as the full potential of modern computing systems and techniques is realized. Computer science is concerned with the study, design, development, construction, and application of modern machinery, computing techniques and appropriate languages for general information processing, for scientific computation, for the recognition, storage, retrieval and processing of data of all kinds, and for the automatic control and simulation of processes.

The curricula offered by the Department of Computer Science are designed to prepare the student to be a participant in this rapidly changing area of technology by presenting an in-depth treatment of the fundamentals of computer science. The Department offers two undergraduate degrees: a B.S. in Computer Science and a B.S.E. in Computer Systems Engineering.

General Information

Admission. See pages 19-23 and 38-39 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, students who wish to be admitted to full freshman standing in the computer science program should present certain secondary school units in addition to the minimum University entrance requirements. A total of 3 ½ units is required in mathematics, including advanced algebra, geometry and trigonometry. Students who have omissions or deficiencies in subject matter preparation may be required to com-

plete additional university credit course work which may not be applied toward a computer science degree. Courses usually taken to satisfy omissions or deficiencies include one or more of the following: MAT 115 College Algebra and Trigonometry, MAT 117 College Algebra, and MAT 118 Plane Trigonometry.

Minimum Scholastic Requirements. In addition to an overall C (2.00) average, all computer science students are required to obtain a minimum grade of C (2.00) in all required CSC courses and those courses used as Computer Science electives.

Bachelor of Science

The Department of Computer Science offers a B.S. degree designed to give the student in-depth knowledge in computer science. All students pursuing a Bachelor of Science degree in Computer Science will complete the following required core courses:

Computer Science Core

			Semester Hours
CSC	100	Introduction to Computer Science I	3
CSC	101	Introduction to Computer Science II	3
CSC	201	Application Languages Laboratory	1-2
CSC	202	Functional Languages Laboratory	2-1
CSC	220	Computer Organization and Assembly Language Programming	4
CSC	310	Data Structures	3
CSC	320	Computer Architectures and Organization	4
CSC	321	Computer Systems Architecture	4
CSC	340	Structure of Programming Languages	3
CSC	355	Introduction to Theoretical Computer Science	3

Plus 15 hours of CSC prefix 400-level courses, exclusive of CSC 483, with none of these courses having a 400-level prerequisite..... 15

Total 45

In addition to the above computer science core, all B.S. degree students within the College of Engineering and Applied Sciences must complete the following requirements:

Computer Science Electives 12
Courses chosen from the Computer Science elective list and approved by the advisor.

Mathematics Content 20
MAT 270, 271, 272 Calculus with Analytic Geometry I, II, III (or MAT 290, 291 Calculus I & II (10)) 12
MAT 342 Linear Algebra 3
MAT 243 Discrete Mathematical Structures 3
ECE 383 Probability and Statistics for Engineers 2

General Studies 28
PHY 115, 116, 117, 118 University Physics I & II with Lab 10
Humanities and Fine Arts[1] 6-12
Social and Behavioral Sciences[1] 12-6

English Proficiency[2] 6
ENG 101, 102 Freshman Composition (or ENG 105 Advanced Freshman Composition (3)) 6

Technical Writing 3
ECE 400 Engineering Communication (or ENG 301 Writing for the Professionals)

Unrestricted Electives 14
Total Degree Requirements 128

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[1] *See pages 212-213 for the specific requirements and the approved list.*

[2] *See page 212 for English exemption.*

Computer Science Program of Study Typical Four-Year Sequence

Freshman Year

First Semester

			Semester Hours
CSC	100	Intro. to C.S.I.	3
ENG	101	Freshman Composition	3
MAT	270	Calculus w/Analy. Geom. I	4
General Studies Elective			3
Unrestricted Elective			3
			16

Second Semester

CSC	101	Intro. to C.S. II	3
ENG	102	Freshman Composition	3
MAT	271	Calc. w/Analy. Geom. II	4
General Studies Elective			3
Unrestricted Elective			3
			16

Sophomore Year

First Semester

CSC	220	Computer Organization and Assembly Language Programming	4
CSC	310	Data Structures	3

MAT 272 Calc/An. Geom III...................... 4

PHY 115 University Physics 4

PHY 117 Univ. Physics Lab....................... 1

CSC 201 Application Language
Programming Laboratory 1

17

Second Semester

CSC 201 Application Languages
Programming Laboratory or
CSC 202 Functional
Languages Programming
Laboratory 1

CSC 320 Computer Architecture and
Organization 4

CSC 340 Structure Prog. Lang. 3

PHY 116 University Physics 4

PHY 118 Univ. Physics Lab...................... 1

MAT 243 Discrete Math Structures........... 3

16

Junior Year

First Semester

CSC 321 Computer Systems
Architecture 4

CSC 355 Intro to Theoret. Comp. Sci...... 3

MAT 342 Linear Algebra............................ 3

General Studies Elective 3

Unrestricted Elective 3

16

Second Semester

CSC 400-level Course requirement............ 6

Computer Science Electives 3

General Studies Elective 3

Unrestricted Elective 3

15

Senior Year

First Semester

CSC 400-level Course requirement............ 6

ECE 383 Prob./Stat. Engineering.............. 2

Computer Science Electives 3

General Studies Elective 3

CSC 202 Functional Languages
Programming Laboratory 1

15

Second Semester

CSC 400-level Course requirement............ 3

Computer Science Elective..................................6

General Studies Elective 3

ECE 400 Engineering Communications... 3

Unrestricted Elective 2

17

Bachelor of Science in Engineering

The Department of Computer Science administers the B.S.E. Special Programs curriculum with an emphasis in Computer Systems Engineering. The requirements for this degree are the same as those specified by the School of Engineering for the B.S.E. degree. The Computer Systems Engineering emphasis is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Computer Systems Engineering Emphasis

The following courses are required as part of the mathematics requirement and the Engineering Core:

			Semester Hours
MAT	342	Linear Algebra............................	3
CSC	220	Computer Organization & Assembly Language Programming.........................	4
ECE	352	Semi Conductor Devices...........	3
ECE	383	Probability and Statistics for Engineers..........................	2

In addition to the engineering core, the following courses are required for the Computer Systems Engineering program:

CSC	100	Introduction to Computer Science I.................................	3
CSC	101	Introduction to Computer Science II	3
CSC	310	Data Structures	3
CSC	320	Computer Architecture and Organization	4
CSC	321	Computer Systems Architecture	4
CSC	340	Structure of Programming Languages..............................	3
CSC	421	Microcomputer Fundamentals..	4
CSC	422	Microcomputer Systems Design I.................................	4
CSC	423	Microcomputer Systems Design II	3
CSC	430	Elementary Concepts of Operating Systems................	3

MAT 243 Discrete Mathematical
Structures 3

Area of Emphasis (Technical Electives) 12

Technical electives are selected in consultation with an advisor from an approved list.

COMPUTER SCIENCE

CSC 100 Introduction to Computer Science I. (3) F, S
Concepts of problem solving, algorithm design, structured programming, fundamental algorithms and techniques, computer systems concepts. Prerequisite: MAT 115.

101 Introduction to Computer Science II. (3) F, S
Computer systems concepts, advanced programming techniques, file systems concepts and applications, development of large reliable programming systems, team programming. Prerequisite: CSC 100.

180 Computers and Society. (3) F, S
Impact of computers on society; topics including computer technology, privacy, ethics; computers in the home, business, and industry; recent developments.

181 Programming in Basic. (3) F, S
Simple programming language, time-shared communication with computers, elementary data processing. Lecture and laboratory.

183 Programming in Fortran. (3) F, S
A human-oriented, systems approach to problem definition, formulation, and solution, using Fortran. Computer solution required for projects. Non-majors only. Prerequisite: MAT 115.

220 Computer Organization & Assembly Language Programming. (4) F, S, SS
Computer organization, assembly language programming, data representation, data structure and addressing modes, assemblers, linkers. Prerequisite: ECE 105 or CSC 100. Three lectures, 3 hours laboratory. (Also listed as EEE 321.)

300 Concepts of Computer Science. (4) F, S, SS
Accelerated coverage of fundamental concepts of computer science using Pascal for students with a strong background in at least one other high level programming language.

304 Introduction to Cobol. (3) F
Fundamental concepts of the Cobol programming language. Emphasis on structured programming. Prerequisite: CSC 100.

305 Introduction to PL/I. (3) S
Basic concepts of the programming language PL/I. Prerequisite: CSC 100.

310 Data Structures. (3) F, S
Representation of fundamental data types; data structures such as arrays, stacks, queues, linked lists, trees. Data abstraction. Dynamic storage allocation. Prerequisite: CSC 101.

320 Computer Architecture and Organization. (4) F, S, SS
Combinational and sequential logic design, register/bus level CPU design, instruction interpretation and microprogramming, I/O devices, interfaces, and programming. Prerequisite: CSC 220. Three lectures, 3 hours laboratory. (Also listed as EEE 322.)

321 Computer Systems Architecture. (4) F, S
Integration of DMA, I/O, and other processing elements into a single system architecture. Memory hierarchy and subsystems. Processor, context, and memory management. Prerequisite: CSC 320. Three lectures, 3 hours laboratory. (Also listed as EEE 424.)

340 Structure of Programming Languages. (3) F, S
Formal specifications for language syntax and dynamic runtime environments, introduction to language translation. Prerequisites: at least 1 unit of CSC 201 or 202; CSC 220; CSC 310.

355 An Introduction to Theoretical Computer Science. (3) F
An introduction to computability complexity and correctness of algorithms. Uses of algebra, logic and topology in computer science. Theory of computation. Prerequisite: MAT 243, CSC 310.

383 Applied Fortran Programming. (3) F, S
Advanced Fortran: character handling, machine dependency, sorting and merging, plotting, tapes, disks, time-sharing terminals and library programs. Lecture and laboratory. Non-majors only. Prerequisite: CSC 183.

400 Advanced Assembly Language Programming. (3) F
Assembly language treatment of recursion, coroutines, interpretive routines, multiple buffering of I/O, dynamic storage allocation, various data structures. Prerequisites: CSC 220, 310.

408 Introduction to Scene Analysis. (3) A
Image analysis and formation; low-level processing, object segmentation, texture analysis, stereo vision, motion; higher-level interpretation active sensing. Prerequisite: CSC 310 or approval of instructor.

410 Information Processing. (3) A
Primary, secondary file access organizations. Multi-attribute indexing. File processing. Introduction to database management and document retrieval. Prerequisite: CSC 310.

412 Database Management. (3) S
Introduction to DBMS concepts. Data models and languages. Relational database theory. Database security/integrity and concurrency. Prerequisite: CSC 310.

420 Comparison of Computer Architectures. (3) A
Evolution of mainline architectures, instruction sets, addressing modes, control structures. Characterization of computer architectures. Performance evaluation. Prerequisite: CSC 321 or CSC 423.

421 Microcomputer Fundamentals. (4) F, S
Hardware, software and assembly-language programming of a microcomputer system are used as vehicles to teach fundamentals of digital system design. Lecture and laboratory. Prerequisite: CSC 320.

422 Microcomputer Systems Design I. (4) F, S
Design of microcomputer systems using contemporary logic and microcomputer system components. Requires assembly language programming. Corequisite: CSC 321 or CSC 421. (Also listed as EEE 422.)

423 Microcomputer Systems Design II. (3) S
Information and techniques presented in CSC 422 are used to develop the hardware design of a multiprocessor, multi-programming microprocessor-based system. Prerequisite: CSC 422. (Also listed as EEE 423.)

428 Computer-Aided Processes. (3) A
Hardware and software considerations for computerized manufacturing systems. Specific concentration on automatic inspection, numerical control, robotics and integrated manufacturing systems. Prerequisite: CSC 321 or CSC 422. (Also listed as EEE 511.)

430 Elementary Concepts of Operating Systems. (3) F, S
Design and implementation of supervisory system components. Input/output methods, process management, multiprogramming and multiprocessing systems, stor-

age management, file systems. Prerequisites: CSC 310 and CSC 321 or CSC 423.

438 Systems Programming. (3) A
Design and implementation of systems programs: text editors, file utilities, monitors, assemblers, relocating linking loaders, I/O handlers, schedulers, etc. Prerequisite: approval of instructor.

440 Compiler Construction I. (3) F
Introduction to programming language implementation. Implementation strategies: compilation, interpretation, translation. Major compilation phases: lexical analysis, semantic analysis, optimization, code generation. Prerequisite: CSC 340.

450 Analysis of Algorithms. (3) F
Design and analysis of computer algorithms using analytical and empirical methods: complexity measures, design methodologies, survey of important algorithms. Prerequisite: CSC 310.

451 Switching Theory. (3) N
Combinational logic, functional decomposition, NAND (NDR) circuit analysis and synthesis, logic arrays, iterative networks, fault diagnosis, sequential circuit representation, memory devices. Prerequisite: CSC 320. (Also listed as EEE 427.)

457 Theory of Formal Languages. (3) A
Theory of grammar, methods of syntactic analysis and specification, types of artificial languages, relationship between formal languages and automata. Prerequisite: MAT 243. (Equivalent to MAT 401).

460 Software Project Management and Development I. (3) F
Software life cycle analysis; programming teams; project documentation and milestones; requirements and specifications; design, testing, and maintenance tools and techniques. Prerequisite: senior standing.

470 Computer Graphics. (3) S
Display devices, data structures, transformations, interactive graphics, three-dimensional graphics, hidden line problem. Prerequisites: CSC 310, MAT 342.

473 Non-Procedural Programming Languages. (3) S
Functional and logic programming using languages like Lucid and Prolog. (Typical applications would be a Screen Editor and an Expert System.) Prerequisite: CSC 355.

474 Modeling for Computer Simulation. (3) A
Mathematical description of general dynamic systems (discrete event, discrete time, and continuous) in forms suitable for computer implementation. Prerequisites: CSC 310 and ECE 383.

475 Simulation Theory and Languages. (3) A
Statistical background for simulation. Model construction and validation, analysis of results. Languages which support simulation. Prerequisites: CSC 474.

483 Fortran Programming for Graduate Research. (3) F, S
Introductory course for graduate research computing. Subroutines, program libraries, mathematical and statistical applications, batch and time-sharing environments, data files, plotting. Two lectures, 2 hours laboratory. Non-majors only.

508 Digital Image Processing I. (3) F
Digital image fundamentals, image transforms, image enhancement and restoration techniques, image encoding and segmentation methods. Prerequisite: EEE 303 or approval of instructor. (Also listed as EEE 508).

509 Digital Image Processing II. (3) S
Advanced analytical techniques applied to digital image processing, computer vision, and applications including robotics. Prerequisite: CSC 508. (Also listed as EEE 509).

512 Database Systems Design. (3) F
Multi-level, generalized DBMS architectures and design. Distributed databases: transparent functionalities, query processing, update synchronization and concurrency control. Prerequisite: CSC 410, CSC 412.

515 Information Storage and Retrieval. (3) N
Concepts of information storage and retrieval: theory, applications, and case studies. Prerequisite: CSC 410.

516 Digital Testing and Reliability. (3) A
Fault modelling, test generation and simulation for combinational and sequential circuits; memory testing, self-checking logic, fault-tolerant logic, reliability analysis. Prerequisites: CSC 321 or CSC 423, CSC 451 or CSC 355. (Also listed as EEE 515).

517 Digital Design Automation. (3) N
Typical computer-aided design system. Simulation techniques, test generation, microprogrammed control design aids, specification sheet analysis. Applications. Prerequisites: CSC 520 or 524. (Also listed as EEE 516).

518 Hardware Design Languages. (3) N
Introduction to hardware design languages (HDL's). HDL description of integrated circuit components and systems. HDL description of computer organizations. Prerequisite: CSC 321. (Also listed as EEE 514).

519 Minicomputers. (4) N
Organization of minicomputers, with "hands-on" emphasis of one particular design. Prerequisite: CSC 321 or CSC 423. Three lectures, 3 hours laboratory. (Also listed as EEE 520).

520 Computer Architecture II. (3) A
Theoretical structure of computers and computations, SIMD and MIMD systems, performance tradeoffs, memory hierarchies, interconnection networks. Prerequisite: CSC 321 or CSC 423.

521 Microprocessor Applications. (4) S
Microprocessor technology and its application to the design of practical digital systems. Hardware, assembly-language programming, and interfacing of microprocessor-based systems. Lecture and laboratory. Prerequisite: CSC 421.

522 Microprogramming. (3) A
Theory, practice, and application of microprogramming. Prerequisite: CSC 321 or CSC 423. (Also listed as EEE 523).

523 Microcomputer Systems Software. (3) F
Developing system software for a multi-processor, multi-programming microprocessor-based system using information and techniques presented in CSC 421, 422. Prerequisite: CSC 422. (Also listed as EEE 522).

524 Multiprogramming Architectures. (3) N
Main-line computer architectures; multiprogramming, timesharing, multiprocessing, hardware/software tradeoffs, memory hierarchies, input/output structures, communications. Prerequisite: CSC 321 or 423. (Also listed as EEE 524).

526 Parallel Processing. (3) N
Real and apparent concurrency. Hardware organization of multiprocessors, multiple computer systems, scientific attached processors and other parallel systems. Prerequisite: CSC 321 or 423. (Also listed as EEE 526).

527 High Level Language Machines. (3) N
Advantages and disadvantages of high-level-language machines. Languages suitability. Microprogramming and interpretive execution. I/O operations. Examples. Prerequisite: CSC 520 or CSC 524. (Also listed as EEE 513).

529 Bit Slice Processor Design. (4) N
Hardware and software design of a bit-slice computer with writable control store. Prerequisite: CSC 321 or

CSC 423. Three lectures, 3 hours laboratory. (Also listed as EEE 528).

530 Operating System Case Study. (3) F
Organization of small operating system with emphasis on the Unix operating system on a laboratory computer. Prerequisite: CSC 430. Three lectures. (Also listed as EEE 521).

532 Security in Computing Systems. (3) A
In-depth development of the concepts of computer security; impact on computer hardware and software, and on user. Prerequisite: CSC 430.

535 Performance Evaluation. (3) S
Topics in computer system measurement and evaluation: hardware/software monitors, workload characterization, program behavior, adaptive scheduling, simulation models, measurement interpretation. Prerequisite: CSC 430.

536 Theory of Operating Systems. (3) F
Formal methods of control of concurrent processes, process scheduling, memory and auxiliary storage management. Network operating systems. Operating system design. Prerequisite: CSC 430.

540 Compiler Construction II. (3) S
Formal parsing strategies, optimization techniques, code generation, extensibility and transportability considerations, recent developments. Prerequisite: CSC 440.

545 Programming Language Design. (3) N
Language constructs, extensibility and abstractions, runtime support. Language design process. Prerequisite: CSC 440.

550 Combinatorial Algorithms and Intractability. (3) N
Combinatorial algorithms, nondeterministic algorithms, classes P and NP, NP-hard and NP-complete problems, intractability. Design techniques for fast combinatorial algorithms. Prerequisite: CSC 450.

554 Advanced Switching Theory. (3) S
Lattices, Boolean algebras, post algebras, Boolean differential calculus, multivalued logic, fuzzy logic, finite state machines. Prerequisite: CSC 451. (Also listed as EEE 527).

555 Automata Theory. (3)' N
Finite state machines, pushdown automata, linear bounded automata, turing machines, register machines, rams, rasps; relationships to computability, formal languages. Prerequisite: CSC 355.

560 Software Project Management and Development II. (3) S
Software quality measures. Software reliability and maintainability theory. Software configuration management. Analysis of requirement and specification techniques and design methodologies. Prerequisite: CSC 460.

565 Software Reliability. (3) A
Software reliability models and measures, program testing theory, fault tolerant software, program verification, reliable software design and development, regression testing. Prerequisite: CSC 460.

571 Artificial Intelligence. (3) S
Definitions of intelligence; computer problem solving, game playing, pattern recognition, theorem proving, semantic information processing; evolutionary systems; heuristic programming. Prerequisite: graduate standing.

572 Pattern Recognition. (3) N
Pattern classification by distance functions and likelihood functions, deterministic and statistical approaches to trainable pattern classifiers, syntactic pattern recognition. Prerequisite: STP 326 or ECE 383. (Equivalent to EEE 553).

Special Courses: CSC 294, 484, 492, 493, 494, 498, 499, 590, 591, 592, 598, 599, 790, 791, 792, 799. (See pages 35-36.)

Division of Construction
Vernon L. Hastings, M.S.I.E., Director

PROFESSORS:
HASTINGS (COB 268), PETERMAN
ASSOCIATE PROFESSORS:
BURTON, CARR, WARD
ASSISTANT PROFESSORS:
HILLMAN, WILSON

Purpose
The primary purpose of the Division of Construction is to provide students the opportunity to obtain a quality education in construction and qualify them directly for positions of leadership and responsibility in the construction industry.

Every effort is made to provide a well integrated program which will not only give the student proficiency for a professional construction career, but will also develop ideals, judgment, character and breadth of view necessary for a successful constructor as well as significant cultural attitudes. The Division is a member of the Associated Schools of Construction, an organization dedicated to the development and advancement of construction education. The Construction program is accredited by the American Council for Construction Education (ACCE).

General Information
Admission. See pages 19-23 and 38-39 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, the Division of Construction requires secondary school units totalling 3½ units in mathematics, including advanced algebra, geometry and trigonometry. Students having omissions or deficiencies in subject matter preparation will be required to complete additional university credit course work which will not be applied toward a construction degree. These may include MAT 115 College Algebra and Trigonometry, (or MAT 117 College Algebra, and MAT 118 Plane Trigonometry) and PHY 101 Introduction to Physics.

The freshman and sophomore programs of study are designed to facilitate transfer

for junior and community college students or Associate Degree graduates. Vocational and craft oriented courses taught at community colleges will not be accepted for credit towards a bachelor's degree in construction.

Students shall complete the following basic requirements prior to registering for advanced courses:

(1) All first semester first-year courses and the University English requirement (see page 29) must be completed by the time the student has accumulated 48 semester hours of program requirements.

(2) All second semester, first-year courses must be completed by the time the student has completed 64 semester hours of program requirements. Transfer students will be given a one semester waiver.

Any student not making satisfactory progress will be permitted to register for only those courses required to correct any deficiencies.

Further information may be obtained from the Division of Construction, College of Engineering and Applied Sciences, Arizona State University, Tempe, Arizona 85287.

Student Organizations. The Division has a chapter of Sigma Lambda Chi, a national honor society that recognizes high academic achievement in accepted construction programs. The Division is also host to student chapters of the Associated General Contractors of America (AGC) and the Associated Builders and Constructors (ABC).

Requirements for Graduation. In order to qualify for graduation from the Division of Construction a student must have a grade point average of at least 2.00 for all mathematics, science, engineering and construction courses.

Scholarships. Apart from those given by the University generally, a number of scholarships from the construction industry are awarded to students registered in the construction program. They are awarded on the basis of academic achievement and participation in activities of the construction program.

Bachelor of Science Degree in Construction

Students seeking a Bachelor of Science degree in construction must satisfactorily complete a curriculum of not less than 132 semester hours. Construction careers are so broadly diversified that no single curriculum will fit the student for universal entry into

all fields. As an example, heavy construction contractors usually place more emphasis on technical and engineering science skills than do residential contractors/developers, who usually prefer a greater depth of knowledge in management and urban science. To ensure a balanced understanding of the technical, professional and philosophical standards which distinguish modern-day constructors, advisory groups representing leading associations of contractors and builders provide counsel in curriculum development. Construction has a common core of engineering science, management and behavioral courses on which students may build defined areas of emphasis to suit individual backgrounds, aptitudes and objectives. These areas of emphasis are not absolute but generally match major divisions of the construction industry.

Areas of Emphasis

General Building Construction

Heavy Construction

Specialty Construction

The lower division courses are the same for all areas. Each is arranged to accent requisite technical skills and develop management, leadership and competitive qualities in the student. Prescribed are a combination of general studies, technical courses basic to engineering and construction, and a broad range of applied management subjects fundamental to the business of construction contracting. Students must be educated to survive heavy demands for explicit technical performance during their early career years, and they also must understand the functions of their employers and the industry they serve. The students should acquire the motivation for continuing their education which, when combined with experience, will qualify them for top positions of leadership and authority in the construction industry.

Students in all areas of emphasis will be required to complete a construction core of science-based engineering, construction and management courses. Since the credit hours vary for some alternative courses in the core, any differences in credits will be made up in the selected fields of specialization to achieve a minimum of 132 credit hours.

General Studies Requirements (45 Sem. Hrs.)

Humanities and Fine Arts* (7 Sem. Hrs.)

    Architecture (APH) Course Required 2

Electives 5

Behavioral and Social Sciences* (9 Sem. Hrs.)

ECN	111	Macroeconomic Principles........	3
ECN	112	Microeconomic Principles.........	3
COM230		Small Group Comm.	3

*See pages 212-213 for specific requirements and approved list.

Science and Mathematics (22 Sem. Hrs.)

PHY 111/	General Physics	
113	(Mechanics and Heat)................	4
PHY 112/	General Physics	
114	(Electricity, Light, Magnetism)..	4
STP 226	Elements of Statistics.................	3
MAT270	Cal. with Analytic Geom. I	4
ECE 105	Intro to Computer-Aided Engineering	3
	Science/Lab Elective..................	4

English Requirement (6 Sem. Hrs.)

ENG 101	/102	Freshman Composition..	6
or			
ENG 105	Advanced Freshman Composition		3

(Must pass exemption examination - see placement examinations for proficiency, page 29.)

Construction Core Requirements (70 Sem. Hrs.)

ACC	211	Elementary Accounting	3
ECE	105	Intro to Languages of Engineering	3
CON	221	Statics Mechanics......................	3
GNB	233	Business Communication..........	3
GNB	305	Business Law.............................	3
CON	243	Construction Materials and Specifications	2
CON	244	Construction Graphics...............	2
CON	252	Construction Equipment	2
CON	273	Electrical Construction	4
CEE	310	Construction Materials Testing.	3
CEE	341	Surveying....................................	3
CEE	380	Hydraulics and Hydrology	3
CON	323	Strength of Materials	3
CON	331	Construction Safety and Risk Management	2
CON	345	Mechanical Systems...................	3
CON	366	Construction Methods...............	3
CON	374	Systems Management for Construction	2
CON	383	Construction Estimating............	3
CON	389	Construction Cost Accounting and Control...........................	3

CON	395	Construction Planning and Scheduling	3
CON	424	Structural Design	3
CON	453	Construction Labor Management	3
CON	463	Foundations and Concrete Structures...............................	3
CON	496	Construction Contract Administration	3
CEE	450	Soil Mechanics in Construction	3

Advisor-approved alternates/transfer credits for courses listed above may vary from the total required semester hours indicated. Such variances shall not reduce the minimum of 132 semester hours required for the degree.

Construction Areas of Emphasis

General Building Construction
Heavy Construction
Specialty Construction
The course work for the first two years is the same for all three areas of emphasis. The specific lower division requirements are shown below:

First Semester *Semester Hours*

ENG	101	Freshman Composition.............	3
PHY	111	/113 Gen. Physics	4
MAT	270	Calculus	4
ECE	105	Intro to Languages of Engineering	3
Humanities Elective			3
			17

Second Semester

ENG	102	Freshman Composition.............	3
APH	100	Intro to Arch. I...........................	2
PHY	112	/114 Gen. Physics....................	4
CON	243	Intro to Construction Materials	2
CON	244	Construction Graphics...............	2
Science Elective..			4
		Total..................................	17

Third Semester

ECN	111	Macroeconomic Principles........	3
ECE	106	Intro to Computer-Aided Engineering	3
ACC	211	Elementary Accounting	3
CON	221	Statics	3
GNB	233	Business Communication..........	3
CON	252	Construction Equipment	2
		Total	17

Fourth Semester

ECN	112	Microeconomic Principles.........	3
MAT	226	Elements of Statistics.................	3
CON	273	Electrical Construction..............	4
COM	230	Small Group Comm.	3
CON	323	Strength of Materials	3
		Total	16

One of the following three areas of emphasis is to be selected by each student.

General Building Construction. The general building emphasis provides a foundation for students who wish to follow careers as managers or owners of firms engaged in the construction of residential, commercial and institutional structures. While conventional building is still a major factor in this field, modern educational focus is on building systems required for the mass development and production of large scale projects. General construction is treated as an integrated process from conception through delivery of completed facilities to users.

General Building Emphasis Requirements (17 Sem. Hrs.)

REA	251	Real Estate Principles................	3
CON	384	Advanced Building Estimating .	3
REA	411	Real Estate Law	3
CON	472	Land Development Feasibility..	2
Approved technical electives 6			

Heavy Construction. The heavy construction emphasis prepares students for careers with constructors. Typical projects in which they are involved are highways, railroads, airports, power plants, rapid transit systems, process plants, harbor and waterfront facilities, pipelines, dams, tunnels, bridges, canals, sewerage and water works, mass earthwork, and other heavy public works.

Heavy Construction Emphasis Requirements (17 Sem. Hrs.)

GNB	306	Business Law II..........................	3
CEE	344	Route Surveying.........................	3
CON	486	Heavy Construction Estimating	3
CON	482	Cost Engineering........................	2
Approved technical electives 6			

Specialty Construction. Specialty construction includes areas such as mechanical, electrical, air conditioning, roofing, concrete, commercial and industrial refrigeration and fire protection systems. This area of emphasis is also intended to provide an option for those students interested in such areas as utility contracting, quarrying, and land de-

velopment or other specialty areas. Upon application by the student and in consultation with an advisor a specific program of courses to be added to the General Studies and the core sequence may be developed subject to courses offered within the University and the approval of the Division director.

Specialty Construction Requirements (17 Sem. Hrs.)

CON	455	Construction Office Methods....	3
CON	468	Conceptual and Electrical Estimating..............................	3
CON	482	Cost Engineering........................	2
Approved technical electives 9			

CONSTRUCTION

CON 221 Static Mechanics. (3) F, S
Force systems acting on structures. Forces, moments, equilibrium, centroids, trusses, beams, cables, frames, machines, friction, section properties, masses. Both US and SI units of measurement. Field trips. Prerequisites: MAT 270, PHY 111/113.

243 Introduction to Construction Materials and Specifications. (2) F, S
Construction materials and components. Emphasizing material descriptions, usages and incorporation into the structure. Field trips. Prerequisite: Sophomore standing.

244 Construction Graphics. (1) F, S
Sketching and architectural drafting of building materials and systems. Computer graphic applications for construction. Field trips. Lecture and four hours laboratory. Prerequisite: ECE 105 or equivalent.

252 Construction Equipment. (2) F, S
Characteristics, capabilities, limitations and employment of general building and heavy construction equipment. Fleet operations, maintenance programs. Field trips. Prerequisite: Sophomore standing.

273 Electrical Construction Fundamentals. (4) F, S
Circuits and machinery. Power transmission and distribution, with emphasis on secondary distribution systems. Measurements and instrumentation. Field trips. Three lectures, 3 hours laboratory. Prerequisites: PHY 112, 114; MAT 270.

323 Strength of Materials. (3) F, S
Analysis of strength and rigidity of structural members in resisting applied forces. Stress, strain, shear, moment, deflections, combined stresses, connections, moment distribution. Both US and SI units of measurement. Field trips. Prerequisite: CON 221.

331 Construction Safety and Risk Management (2) F, S
Protective equipment and devices, inspection procedures and record keeping. OSHA requirements for construction. Hazard analysis and liability assignment. Economics of accident protection. Field trips. Prerequisite: ECE 106; STP 226; CON 244.

345 Mechanical Systems. (3) F, S
Heating and cooling systems for buildings. Sanitary and water piping layout and simple design. Computer-aided calculations. Field trips. Four hours lecture and laboratory. Prerequisites: CON 243, 244; PHY 111, 113. Co-requisites: CEE 380; ECE 106.

366 Construction Methods. (3) F, S
Analysis of construction projects for the determination of the most appropriate and economic methods. Job organization, pre-planning and site layout. Field trips. Prerequisites: CON 243, 244, 252, or equivalent. Four hours lecture and laboratory.

374 Systems Management for Construction. (2) F, S
Organization and management theory applied to the construction process. Conceptual foundations. Industry environment, processes and management. Leadership functions. Prerequisite: junior standing or approval of instructor.

383 Construction Estimating. (3) F, S
Theories and systems of building estimating. Familiarization of plans and specifications. Quantity survey techniques, standard formats, classification and analysis of work, unit cost determinations, simulated bids. Computer applications. Field trips. Four hours lecture and laboratory. Prerequisites: CSC 181 or equivalent; CON 243, 244; construction majors only or approval of instructor.

384 Advanced Building Estimating. (3) F, S
Methods analysis and cost estimating for construction of general building projects. Continuation of CON 383. Field trips. Four hours lecture and laboratory. Prerequisite: CON 383 or equivalent.

389 Construction Cost Accounting and Control. (3) F, S
Nature of construction cost. Depreciation and tax theory, variable equipment costs. Cash flow theory, investment models, profitability and analysis. Computer applications. Funding sources and arrangements. Builder's insurance. Prerequisites: ECE 106 or equivalent, ACC 211, CON 383.

395 Construction Planning and Scheduling. (3) F, S
Various network methods of project scheduling, such as AOA, AON, CPM, PERT and PDM, using manual and computer systems. Other graphic methods including bar-charting, line-of-balance, and VPM, resource allocation and time/cost analysis. Prerequisites: computer programming; CON 244, 389, 383.

401 Construction Firm Management and Control. (3) F
Application of construction management principles by the small or specialty contractor. Directed experience in the analysis and evaluation of small contractor problems. Prerequisites: CON 374, 383, 389, 395.

424 Structural Design. (3) F, S
Economic use of steel, reinforced concrete, and wood in building and engineered structures. Design of beams, columns, and connections. Elastic and ultimate strength design. Student design projects. Field trips. Prerequisite: CON 323.

453 Construction Labor Management. (3) F, S
Labor and management history, union and open shop organization of building and construction workers; applicable laws and government regulations; goals, economic power, jurisdictional disputes, and grievance procedures. Four hours lecture and laboratory. Prerequisites: ECN 112; CON 374.

455 Construction Office Methods. (3) S
Administrative systems and procedures for the construction company office including methods improvement and work simplification, office layout, business forms and design, office manuals. Prerequisites: GNB 233; CON 389.

463 Foundations and Concrete Structures. (3) F, S
Subsurface construction theory and practice for foundations of buildings and engineered facilities. Concrete form design for foundations and structural frames. Underpinning, piling, dry and wet excavating, dewatering,

cofferdams, caissons. Field trips. Three lectures, 1 recitation. Prerequisites: CON 323, 424, CEE 450.

468 Conceptual and Electrical Estimating. (3) F
System of estimating construction costs before design has been initiated. Cost estimating for large projects. Analysis and organization of electrical estimate. Prerequisite: CON 383.

472 Land Development Feasibility. (2) S
Economic location theory. Analysis of the profitability of land developments. Computer applications. Prerequisites: ECE 106; CON 383, 389. Field trips.

474 Power and Process Plant Construction. (2-3) S
Review of selected industrial processes. Design isometric drawings, and estimating costs for pipe, electrical, pressure vessels, and instrumentation. Project management of major industrial projects. Two-three hours lecture. Field trips. Prerequisites: CON 244, 345, 389, or approval of the instructor.

482 Cost Engineering. (2) S
The time-value of money. Comparison of alternative, depreciation methods and impact on taxes, replacement and break-even analysis. Construction financing and analysis. Prerequisite: CON 389.

486 Heavy Construction Estimating. (3) F, S
Methods analysis and cost estimation for construction of highways, bridges, tunnels, dams and other engineering works. Prerequisites: CON 383, CEE 344, or approval of instructor. Field trips.

496 Construction Contract Administration. (3) F, S
Case studies. Effects of organization on construction contract operations. Essentials of construction law. Prime contracts, sub-contracts, joint venture and consortium agreements, and change orders. Documentation. Claims, arbitration, and litigation. Quality control requirements. Bonding, insurance, indemnification procedures. Ethical practice, licensing, codes, etc. Field trips. Prerequisites: Senior standing; GNB 233 or equivalent; CON 374, or approval of instructor.

531 Economics of the Construction Industries. (3) F
The economic environment of construction with emphasis on unique aspects; critical review of economic literature dealing with the construction industries. Prerequisites: ECN 111, 112 and CON 496 or approval of instructor.

551 Facilities Operation and Maintenance. (3) S
Analysis of maintenance work. Structure of the maintenance work and organization. Contract maintenance and force account economics. Maintenance control and supervision of operations. Field trips. Prerequisites: CON 389, CON 395 or approval of instructor.

577 Construction Systems Engineering. (3) F
Systems theory as applied to the construction process. Alternates for structuring information flows and the control of projects. Prerequisite: IEE 476 or equivalent.

Special Courses. 294, 394, 484, 494, 498, 499. (See pages 35-36.)

School of Engineering

C. R. Haden, Ph.D., Director

Purpose

A large percentage of all engineering degree holders are found in leadership positions in a wide variety of industrial settings. Although an education in engineering is generally considered to be one of the best of technical educations, it also provides an opportunity for the development of many additional activities, aptitudes and interests, including moral, ethical, and professional concepts. In this era of rapid technological change, an engineering education will serve our society well as a truly liberal education. Society's needs in the decades ahead call for engineering contributions on a scale not previously experienced. The well-being of our civilization as we know it may well depend upon how effectively this resource is developed.

Students studying engineering at Arizona State University are expected to acquire a thorough understanding of the fundamentals of mathematics and the sciences and their applications to the various engineering fields. The program is designed to develop a balance between science and engineering and an understanding of the economic and social consequences of engineering activity. The goals include the promotion of the general welfare of the engineering profession.

The courses offered are designed to meet the needs of the following students: (1) those who wish to obtain a degree in engineering and who plan careers in which science, mathematics, and analytical methods are of special value; (2) those who wish to do graduate work in engineering; (3) those who wish one or two years of training in mathematics, applied science, and engineering in preparation for a technical career; (4) those who desire pre-engineering for the purpose of deciding which program to undertake or those who desire to transfer to another college or university; (5) those who wish to take certain electives in engineering while pursuing another program in the University.

General Information

Admission

See pages 19-23 and 38-39 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, beginning college students who are beginning their initial college work in the School of Engineering should present certain secondary school units in addition to the minimum University requirements. A total of 3½ units is required in mathematics. Included must be: college algebra, geometry and trigonometry. The laboratory sciences chosen must include at least one unit in physics and one unit in chemistry. Calculus and biology are recommended.

Students who have omissions or deficiencies in subject matter preparation may be required to complete additional university credit course work which may not be applied toward an engineering degree. One or more of the courses—MAT 115 College Algebra and Trigonometry, PHY 111, 113 College Physics (or PHY 101 or PHY 105), ENG 101 Freshman Composition*, CHM 113 General Chemistry—are taken to satisfy omissions or deficiencies.

Requirements for Graduation. In order to qualify for graduation from the School of Engineering a student must have a grade point average of at least 2.00 for the 51 semester hours of required courses in the major field.

General Studies
47 sem. hrs.

Engineering Core
32 sem. hrs.

Major
(including Area
of Emphasis)
51 sem. hrs.

BSE Degree
130 sem. hrs.

*See statement on Placement Examinations for Proficiency—English, page 29.

Programs of Study. The composition of the Bachelor of Science (B.S.) and Bachelor of Science in Engineering (B.S.E.) degrees is made up of three parts: University General Studies, an Engineering Core, and a major. This combination is illustrated in the chart shown on the previous page.

The General Studies satisfy a University requirement and include basic studies in the humanities and fine arts, the social and behavioral sciences, the engineering and physical sciences, and mathematics (see page 39-40). These courses comprise approximately 36 percent of the degree program.

The Engineering Core is a specific and organized body of knowledge that will serve as a foundation to engineering and for further specialized studies in a particular engineering major. These courses comprise approximately 25 percent of the degree program.

The majors available are of two types: (1) those associated with a particular department within the School of Engineering (for example, electrical and computer engineering, civil engineering, etc.), and (2) those offered as Special and Interdisciplinary Studies (for example, Bioengineering, Nuclear Sciences, Premedical Engineering, etc.). In general, the departmental curricula are extensions beyond the Engineering Core and cover a wide variety of subject areas within each field. In each case several courses are set aside for the student's use as technical electives to support an area of emphasis.

For convenience, the departments are designated as CEE (Civil Engineering), CHE (Chemical and Bio Engineering), EEE (Electrical and Computer Engineering), IEE (Industrial and Management Systems Engineering), and MAE (Mechanical and Aerospace Engineering). The majors of Engineering Special and Interdisciplinary Studies are administered by the Office of the Dean and are designed for those students whose educational objectives require more intensity of

concentration or flexibility than is possible in the traditional departmental fields (see pages 253-256).

The first two years of study are concerned primarily with the General Studies and the Engineering Core, with more time being spent with General Studies. The final two years of study are concerned with the Engineering Core and the major, with a considerable part of the time being spent with the major. This arrangement can be illustrated by the chart below.

The sequential arrangement of all course work for the B.S. and B.S.E. degrees into the three categories shown below is especially helpful to the beginning student. The semester by semester selection of courses will vary from one field to another. An example of a typical freshman engineering schedule is shown below.

Typical Freshman Year

Semester Hours

Fall Semester

CHM	114[1]	or CHM 116 General Chemistry	4
MAT	290[2]	Calculus I	5
ECE	105	Intro to Languages of Engineering	3
Social Sciences or Humanities (or ENG 101)			5
Total			17

Spring Semester

ECE	106	Intro to Computer-Aided Engineering	3
MAT	291[3]	Calculus II	5
PHY	115[4]	University Physics	4
PHY	117	Univ. Physics Lab	1
ENG	102[5]	or ENG 105 English	3
Total			16

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[1] Chemical Engineering students will take CHM 113.
[2] Some students may desire a math review and take MAT 115 Algebra and Trigonometry; others may desire a less intense calculus sequence and take MAT 270.

First Year	Second Year	Third Year	Fourth Year
GENERAL STUDIES			
ENGINEERING CORE			
		MAJOR	**AREA OF EMPHASIS**

[3] Students who elect to take MAT 270 must also complete MAT 271 and 272.

[4] Students who have not completed one unit of physics in high school should complete PHY 111 and 113 (or PHY 105 or PHY 101) in the preceding semester.

[5] Students not eligible for ENG 105 should complete ENG 101 in the preceding semester.

Well-prepared students usually can complete the program of study leading to an undergraduate degree in engineering in four years, or fewer than four by attending Summer Sessions. Many students, however, may find it advantageous or necessary to devote more than four years to the undergraduate program by pursuing, in any semester, fewer studies than are regularly prescribed. Where omissions or deficiencies exist, i.e., in chemistry, English, physics, or mathematics, the student must complete more than the minimum of 130 semester hours. Therefore, in cases of inadequate secondary preparation, poor health, or financial necessity requiring much time for outside work, the undergraduate program should be extended to five years or longer.

Professional Accreditation

All the undergraduate engineering majors—chemical, civil, computer systems, electrical, industrial, and mechanical engineering and the Engineering Special and Interdisciplinary Programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Master of Science programs are accredited by ABET in the fields of electrical, civil, industrial, and mechanical engineering, and in engineering science.

Degree Requirements

The degree programs in engineering at Arizona State University are intended to develop habits of quantitative thought having equal utility for both the practice of engineering and other professional fields. It is the intent of the faculty that all students be prepared in:

(1) *Competency in oral and written communication* in the English language which is considered to be essential for the engineering graduate. Although the requirement of specific course work may serve as a foundation for such competency, the development of communication skills should be demonstrated by student work in engineering courses. As a minimum and in addition to the 130 semester hour course requirements,

all students must satisfy the University English proficiency requirements (see page 29).

(2) *General Studies* to ensure that the engineer will acquire a satisfactory level of basic knowledge in the humanities and fine arts, social and behavioral sciences, and sciences and mathematics. These subjects are so selected as to give the engineer an increased awareness of social responsibilities, to provide an understanding of related factors in the decision-making process, and to provide a foundation for the study of engineering (see pages 212-213 for approved list).

(3) *Fundamental studies* in engineering and related subjects that will further develop the foundation for engineering and to provide the base for specialized studies in a particular engineering discipline.

(4) *Major studies* that provide a depth of understanding for a more definitive body of knowledge appropriate to a particular aspect of societal concern. These studies include technical elective course work in an area of emphasis that may be selected by the student.

The specific course requirements for the three parts of the B.S. and B.S.E. degrees are listed below.

B.S. and B.S.E. Degree Requirements

Semester Hours

University English Proficiency
Requirement ....(See page 29)

General Studies

Humanities and Fine Arts Courses ......6 to 10*

Behavioral and Social Sciences Courses.7 to 3*

ECN	111	Macroeconomic Principles........	3
CHM	114	or CHM 116 General Chemistry..............................	4
PHY	115	University Physics.....................	4
PHY	116	University Physics.....................	4
PHY	117	University Physics Laboratory..	1
PHY	118	University Physics Laboratory..	1
MAT	290	Calculus I....................................	5
MAT	291	Calculus II..................................	5
MAT	274	Elementary Differential Equations..............................	3
		Approved Mathematics Content Electives.......	4
		Total General Studies................	47

* See pages 212-213 for the specific requirements and the approved list. School of Engineering students must select two courses from the same subject area in either the Hu-

manities and Fine Arts or in the Behavioral and Social Sciences.

Note: The mathematics sequence MAT 270, 271, 272 may be substituted for the 10 semester-hour mathematics requirement. However, the extra 2 semester hours may not be used to satisfy graduation requirements.

Engineering Core

The courses included in the Engineering Core are taught in such a manner that they serve as basic background material (1) for all engineering students who will be taking subsequent work in the same and related subject areas, and (2) for those students who may not desire to pursue additional studies in a particular subject area. Thus, subjects within the Engineering Core are taught with an integrity and quality appropriately relevant to the particular discipline, but always with an attitude and concern for both engineering in general and for the particular major(s). The courses required are listed below:

Semester Hours

Engineering Core

ECE	105	Intro to Languages of Engineering	3
ECE	106	Intro to Computer-Aided Engineering	3
ECE	211	Engineering Mechanics I: Statics	2
ECE	301	Electrical Networks I	3
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	314	Introduction to Deformable Solids	2
ECE	334	Electronic Devices and Instrumentation	4
ECE	340	Thermodynamics	3
		or CHM 441 General Physical Chemistry	
ECE	350	Structure and Properties of Materials	3
		or ECE 351 Engineering Materials or ECE 352 Semiconductors and Devices or CHM 442 General Physical Chemistry	
ECE	400	Engineering Communications	3
Microcomputer/Microprocessor Elective			3

Select one:

CHE	461	Chemical Engineering Process Control (3)	
CEE	400	Microcomputers in Civil Engineering (3)	
CSC	220	Computer Organization & Assembly Language Programming (4)	
CSC	421	Microcomputer Fundamentals (4)	
IEE	463	Computer Aided Processes (3)	

MAE	405	Microcomputer Aided Processes for Mechanical Engineers (3)	
		Total Engineering Core	32

Major

Majors and areas of emphasis are offered by the six engineering departments: Chemical and Bio Engineering, Civil Engineering; Electrical and Computer Engineering, Industrial and Management Systems Engineering, Mechanical and Aerospace Engineering, and Special and Interdisciplinary Engineering. About one-fourth of the major credits are reserved for the student's use as an area of emphasis. These credits are traditionally referred to as "technical electives." Requirements for each of the majors offered are described on the following pages.

Major (including area of emphasis) 51 semester hours

Total Degree Requirements*..................130 semester hours

*These requirements are in addition to the University English proficiency requirements.

Department of Chemical and Bio Engineering

PROFESSORS:
ZWIEBEL (COB B-210L), BERMAN, DORSON, GUILBEAU, KUESTER, SATER

ASSOCIATE PROFESSORS:
BECKMAN, BELLAMY, TORREST, TOWE

ASSISTANT PROFESSORS:
BEZANSON, CALE, RAUPP

PROFESSOR EMERITUS:
REISER

Chemical engineers are generally concerned with processes involving chemical change. Students aspiring to become chemical engineers must prepare to solve a wide variety of problems utilizing chemistry, physics, mathematics, and the engineering sciences. As professionals in industry they shall apply these fundamentals to creatively develop, economically design and productively operate processes and their constituent equipment.

In addition to the chemical industry, chemical engineers find challenging opportunities in the petroleum, energy, plastics, solid state, metals, space, food, drugs,

and health care industries, where they practice in a wide variety of occupations like environmental control, energy and materials transformations, biomedical applications, fermentation, protein recovery, extractive metallurgy, and separations. A large percentage of the industrial positions are filled by graduates with bachelor's degrees. However, there are lucrative and creative opportunities in research and development for those who acquire post-graduate education.

While subspecializations have developed within the profession, the same broad body of knowledge is generally expected of all chemical engineers for maximum flexibility in industrial positions. The preparation for chemical engineering is accomplished by a blend of classroom instruction and laboratory experience. The courses for the undergraduate degree can be classified into the following categories (in semester hours):

General Studies[1] 16
Humanities and Social Science
courses, plus English proficiency

Science and Mathematics Fundamentals 35
CHM 113, CHM 116
PHY 115, PHY 116
PHY 117, PHY 118
MAT 290, MAT 291
MAT 274, MAT 242
ECE 383 or ECE 384

Advanced Chemistry 14
CHM 331, CHM 332, CHM 335
CHM 343, CHM 441, CHM 442

Engineering Core 26
ECE 105, ECE 106, ECE 211,
ECE 312, ECE 314, ECE 301
ECE 334, ECE 400, CHE 461

Chemical Engineering Fundamentals 22
CHE 311, CHE 312, CHE 331, CHE 332,
CHE 333, CHE 342, CHE 351, CHE 352

Chemical Engineering Design 11
CHE 432, CHE 442, CHE 451, CHE
462

Technical Electives 6
A selection from among CHE undergraduate courses 411, 412, 413, 458, 473, 487 or CHE graduate courses, or appropriate technical courses in other departments with advisor's approval. One elective course must have chemical content and must be selected from among CHM 361, CHE 473, or any three credit hour 400 level CHM course.

_____

[1] See page 213 for approval of humanities and social sciences.

To fulfill accreditation requirements and to adequately prepare for the advanced chemistry courses, chemical engineering majors are required to take the CHM 113 and CHM 116 introductory chemistry sequence (CHM 117 and CHM 119 are acceptable substitutes). Other freshman chemistry courses are *not acceptable*, and transfer students who have taken another chemistry course may be required to enroll in CHM 113 and/or CHM 116.

The Chemical and Bio Engineering Department also offers graduate programs leading to the M.S.E., M.S. and Ph.D. degrees. These programs provide a blend of classroom instruction and research. A wide variety of topical and relevant research projects are available for thesis topics. Students interested in these programs should contact the department for up-to-date descriptive literature.

Chemical Engineering Areas of Emphasis

Most students interested in pursuing a career in chemical engineering will follow the typical sequence of courses outlined below. However, those students who wish to specialize may select to follow one of the following areas of emphasis through the elective courses. Also, substitutions may be made from selected required courses by petitioning the department faculty. For those students who wish to emphasize biomedical or premedical studies the preferred and already approved substitutions are given below. In order to establish an area of emphasis the student must declare his/her intention in writing at least one year prior to graduation.

The following are possible areas of emphasis with a suggested list of elective courses.

Biomedical: Students who wish an emphasis in biomedical engineering should make the following substitution in the undergraduate Chemical Engineering curriculum: CHE 411 or AGB 435 for CHE 462. Students may select CSC 220, IEE 463 or MAE 405 in place of CHE 461 in the Engineering Core.

Additionally, students pursuing this area of emphasis will take CHM 361 or AGB 435 as a technical elective in the first semester, fourth year, and CHE 413 as a technical elective in the second semester, fourth year.

Premedical: Students who wish to satisfy requirements for medical school should make the following substitution in the un-

dergraduate Chemical Engineering curriculum: CHE 411 or AGB 435 for CHE 462. Students may select CSC 220, IEE 463 or MAE 405 in place of CHE 461 in the Engineering Core.

Additionally, students pursuing this area of emphasis will take either CHM 361, AGB 435, or an upper level biology course as a technical elective in the first semester, fourth year, and CHE 413 as a technical elective in the first semester, fourth year. The student is also required to take BIO 181 and 182 to meet medical school admission requirements; however, these courses will not be counted towards the engineering bachelor's degree.

Energy Conversion and Conservation: CHE 553, 554, 556; MAE 436, 437, 438, 583.

Environmental Control: CHE 553, 554, 556, 562; CEE 361, 362, 561.

Plant Administration: CHE 553, 581; IEE 431; MGT 301, 300.

Simulation, Systems Control, and Design: CHE 487, 556, 562, 563, 581; IEE 463.

Semiconductor Processing: CHE 458, ECE 352, EEE 435, EEE 436.

Chemical Engineering Program of Study
Typical Four-Year Sequence
First Year

			Semester Hours
First Semester			
CHM	113	General Chemistry	4
MAT	290	Calculus 1	5
ENG	101	Freshman Composition	3
ECE	105	Lang. of Engr.	3
General Studies			3
CHE	496	Professional Seminar	0
			18
Second Semester			
CHM	116	General Chemistry	4
MAT	291	Calculus II	5
ECE	106	Comp.-Aided Engr.	3
PHY	115	University Physics	4
PHY	117	Univ. Physics Lab	1
CHE	496	Professional Seminar	0
			17

Second Year

First Semester			
CHE	311	Material Balances	3
ENG	102	Freshman Composition	3
CHM	331	Gen. Organic Chemistry	3
MAT	274	Elem. Diff. Eqns.	3
PHY	116	University Physics	4
PHY	118	Univ. Physics Lab	1
CHE	496	Professional Seminar	0
			17
Second Semester			
CHE	312	Intro. to Thermo	3
CHE	331	Transp. Phen. I: Fluids	3
CHM	332	Gen. Organic Chemistry	3
CHM	335	Gen. Org. Chem. Lab	1
ECE	211	Engr. Mech. I: Statics	2
MAT	242	Lin. Alg.	2
SS or HUM Elective			3
CHE	496	Prof. Seminar	0
			17

Third Year

First Semester			
CHE	332	Tr. Ph. II: Energy Trans.	3
CHE	342	Applied ChE Thermo	3
CHM	441	Gen. Physical Chem.	3
CHM	343	Phys. Chem. Lab	1
CHE	351	Measurements Lab	2
ECE	312	Engrg. Mech. II/Dynam.	3
SS or HUM Elective			3
CHE	496	Prof. Seminar	0
			18
Second Semester			
CHE	333	Tr. Ph. III: Mass Trans.	3
CHE	352	Transport Laboratory	2
CHM	442	Physical Chemistry	3
ECE	301	Elect. Networks I	3
ECE	383	Prob./Stats. Engrg.	2
		or ECE 384 Num. Anal.	
ECE	314	Intro/Deformable Sol.	2
SS or HUM Elective			3
CHE	496	Prof. Seminar	0
			18

Fourth Year

First Semester			
CHE	432	Princ. of ChE Design	3
CHE	442	Chemical Reactor Design	3
CHE	461	Process Control	3
CHE	451	ChE Laboratory	2
Tech. Elective			3
SS or HUM Elective			3
CHE	496	Prof. Seminar	0
			17
Second Semester			
CHE	462	Process Design	3
ECE	334	Elec. Devices/Instru.	4

ECE	400	Engrg. Communications............	3
Tech. Elective...			3
SS or HUM Elective			3
CHE	496	Prof. Seminar	0
			17

Graduation Requirements: 130 semester hours plus English proficiency.

Department of Civil Engineering

PROFESSORS:
O'BANNON (EC G-120D), BETZ, BLACKBURN, W. HOUSTON, KLOCK, LUNDGREN, MATTHIAS, RUFF, SINGHAL, TUMA

ASSOCIATE PROFESSORS:
DUFFY, MAMLOUK, RADWAN

ASSISTANT PROFESSORS:
FAFITIS, HINKS, S. HOUSTON, RAJAN, UPCHURCH

PROFESSOR EMERITUS:
BORGO, PIAN, WILSON

Civil engineers are responsible for the planning, design, construction, research and management of many transportation, structural, urban and environmental projects which form the basis of our modern civilization. These projects include buildings, bridges, highways, airports, dams, canals, irrigation projects, water and waste treatment plants and various multipurpose systems. Education in this field is established on scientific fundamentals with extensive training and practice in one or more areas of emphasis.

Civil Engineering Core

The following courses are required as a part of the Engineering Core:

			Semester Hours
ECE	351	Engineering Materials................	3
CEE	400	Microcomputers in Civil Engrg.	3

The additional requirements for science, engineering sciences, and design specified in the engineering core are satisfied within the civil engineering core.

			Semester Hours
CEE	296	Introduction to Civil Engineering...........................	1
CEE	321	Structural Analysis....................	3
CEE	322	Steel Structures...........................	3

CEE	323	Concrete Structures....................	3
CEE	351	Soil Mechanics...........................	4
CEE	361, 362	Environmental Engineering.......	6
CEE	372	Transportation Engineering.......	3
CEE	381	Hydraulic Engineering...............	4
CEE	496	Topics in CE Practice	1
MAE	371	Fluid Mechanics.........................	3
IEE	300	Economic Analysis for Engineers...............................	2

Special Requirements. Civil engineering core courses may not be taken without permission until:
(1) The engineering core (except electrical and communications courses) has been completed with an average grade of C or better;
(2) MAT 290, 291, or MAT 270, 271, 272, and MAT 274, ECE 211, 312 and 314 have all been completed with minimum grades of C; and
(3) For international students, an official TOEFL score of 550 (in addition to the successful completion of the English Composition requirements) has been received.

Entering freshmen must have completed one year of high school chemistry and one year of high school physics with grades of B or better in each subject. Students who do not meet these requirements will take CHM 113 (4) CHM 116 (4) sequence in lieu of CHM 114 (4) and PHY 111/113 (3/1) as a prerequisite to PHY 115/117.

A student must have earned a cumulative GPA of 2.50 or better to be eligible to take a 500-level course for credit toward the BSE degree.

Bachelor's Degree Program. Requirements for the bachelor's degree include the completion of the Civil Engineering Core courses and 18 credit hours of design and technical electives with an average grade of C or better. Course selections will be made by the student with the advisor's approval. For those students wishing to enter an area of emphasis, the technical electives should be selected from the elective area of particular interest. The graduate courses listed under the elective areas may, with appropriate approvals, be taken for undergraduate credit by students whose cumulative GPA is 2.50 or better.

Civil Engineering Designated Design Electives (minimum of 2 required)

Semester Hours

CEE	423	Structural Design	3
CEE	452	Foundations	3
CEE	466	Sanitary Systems Design	3
CEE	475	Highway Geometric Design	3
CEE	481	Water Resources Engineering	3

Civil Engineering Technical Electives (minimum 9 hrs. required). A maximum 6 hrs. may be selected outside Civil Engineering. Only one Construction course may be used for technical elective credit.

Civil Engineering Elective Areas of Emphasis with Suggested Courses

Structural Engineering—Analysis and design of structures for buildings, bridges, space frames, structural mechanics: CEE 423, 432, 521, 531.

Geotechnic Engineering—Assessment of engineering properties and design utilizing soils and rocks as engineering materials. CEE 452, 552, 555, 556, 557.

Environmental Engineering—Water treatment. Industrial and domestic waste treatment and disposal. Public health engineering. Industrial hygiene. CEE 466, 563, CHM 231, MIC 210, or MIC 201, 202.

Transportation Engineering—Analysis and design of transportation facilities. Transportation planning and economics. Transportation in the urban environment. CEE 475, 412, 471, 574, 575, 576.

Water Resources Engineering—Planning and design of facilities for collection, storage, and distribution of water. Water systems management. Estimating availability of water resources. CEE 481, 579, 581, 582, 583.

Construction Engineering: CEE 344, CON 383, 395, 496. Only one course may be selected from CON 383, 395, 496.

Civil Engineering Program of Study Typical Four-Year Sequence

Freshman Year

Semester Hours

First Semester

PHY	115	University Physics	4
PHY	117	Univ. Physics Lab	1
MAT	290	Calculus I	5
CHM	114	General Chemistry	4
ECE	105	Lang. of Engrg.	3
			17

Second Semester

PHY	116	University Physics	4
PHY	118	Univ. Physics Lab	1
MAT	291	Calculus II	5
ECE	106	Comp. Aid. Engrg.	3
CEE	296[5]	Intro to CE	1
Social Science Elective[2]			3
			17

Sophomore Year

First Semester

MAT	274	Elem. Diff. Eqns.	3
ECE	211	Engrg. Mech. I/Statics	2
ECE	301	Elec. Networks I	3
ECN	111[2]	Macroecon. Prin.	3
ENG	101[1]	Freshman Composition	3
Humanities Electives[2]			3
			17

Second Semester

ECE	312	Engrg. Mech. II/Dynamics	3
ECE	314	Mech. Deformable Sol.	2
ECE	334	Electr. Device/Instru.	4
ECE	340	Thermodynamics	3
ENG	102[1]	Freshman Composition	3
ECE	383	Prob. Stat. Engrs.[3]	2
			17

Junior Year

First Semester

ECE	351	Engrg. Materials	3
MAE	371	Fluid Mechanics	3
CEE	321[5]	Structural Analysis	3
CEE	400	Microcomp in CE	3
ECE	384	Num. Anal. Engrs.[3]	2
Humanities Elective[2]			3
			17

Second Semester

CEE	322[5]	Steel Structures	3
CEE	351[5]	Soil Mechanics	4
CEE	361[5]	Environmental Engrg.	3
CEE	372[5]	Transportation Engrg.	3
CEE	381[5]	Hydraulic Engineering	4
			17

Senior Year

First Semester

CEE	323[5]	Concrete Structures	3
CEE	362[5]	Environmental Engrg.	3
CEE	496[5]	Topics in CE Pract.	1
IEE	300[5]	Econ Anal Engrs.	2
Design Elective[4]			3

Technical Elective[6]... 3

Social Science Elect[2] 2
                                                          17

Second Semester
ECE   400   Engrg. Communications............ 3

Design Elective[4] 3

Technical Elective[6]... 9

Humanities Elective[2] 2
                                                          17

Concurrent Studies in Architecture and Civil Engineering

Undergraduate. Qualified lower division students interested in combining studies in architecture and Civil Engineering may prepare for upper division and graduate courses in both programs by taking courses listed in Option "B" of the Department of Architecture (pages 145-146).

Graduate. Qualified students may develop a program of study that leads to the concurrent degrees Master of Architecture and MSE with a focus in Civil Engineering. The student's program of study is developed in conjunction with advisors in both departments. For specific details consult with advisors in both departments.

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[1] With sufficient ACT or SAT scores, ENG 105 substitutes for both ENG 101 and 102.
[2] ECN 111 is included in the required 6 hrs. of social science which makes up part of the 16 hrs. of social science and humanities (at last 6 of which must be humanities). See page 213 for approved list.
[3] Suitable math electives must have MAT 291 or MAT 274 as a prerequisite.
[4] Design electives must be chosen from CEE 423, 452, 466, 475 or 481.
[5] Civil Engineering Core Courses.
[6] Technical electives may be selected from, but are not restricted to, any of the courses listed for the areas of emphasis.

Department of Electrical and Computer Engineering

PROFESSORS:
SAEKS (EC G-127), BACKUS, BALANIS, BYRNES, CADZOW, DeMASSA, FERRY, HADEN, HIGGINS, KAUFMAN, KELLY, McKLVEEN, PALAIS, PATTERSON, RUSSELL, SCHRODER, SCHWUTTKE, SIRKIS, TICE, E. Y. WANG, WELCH

ASSOCIATE PROFESSORS:
AKERS, BLAKEY, BOSE, DAVIS, GREENEICH, ROEDEL, SHEN, ZIMMER

ASSISTANT PROFESSORS:
GOLIO, GRONDIN, KEARFOTT, MARACAS, SOHIE, TYLAVSKY, VARHUE

The professional activities of electrical engineers directly affect the lives of most of the world's population every day. They are responsible for the design and development of radio and television transmitters and receivers, telephone networks and switching systems, and electric power generation and distribution. Less well known, but perhaps equally important in terms of their impact on society, are the design and application of digital computers. Within the broad scope of these systems, the electrical engineer is concerned with a challenging and diverse array of design and development problems.

Electrical engineers design miniscule semiconductor integrated circuits which contain many thousands of elementary devices. They design systems for automatically controlling mechanical devices and a variety of processes. They are responsible for the design of satellite communication links as well as patient monitoring systems for hospitals. The development of the microprocessor has expanded the opportunities for electrical engineers to improve the design of familiar products since these devices are now incorporated in automobiles, consumer and office products, entertainment systems, and a vast variety of test and measurement instruments and machine tools.

A student can earn a B.S.E. degree in electrical engineering by choosing one of two options: the regular electrical engineering option or the computer engineering option. Many students of electrical engineering will be involved in a variety of electrical and electronic problems in the course of their

careers. For these students, the regular electrical engineering option which includes a broad background in the diverse aspects of electrical engineering, is the appropriate choice to meet career objectives. On the other hand, recent advances in solid state electronics and digital systems have produced a need for electrical engineers who are specialists in digital computer systems. The computer engineering option, offered in cooperation with the Computer Science Department, is intended for those students who are planning to pursue a career in the computer industry. The curriculum of each option is structured so that courses required in one may be chosen as technical electives in the other.

Academic Requirements

The curriculum in electrical and computer engineering builds upon the base provided by the engineering core. Beyond the engineering core, the curriculum is divided into three sections: the electrical and computer engineering core courses, the courses required for the option, and the technical elective courses. Approved technical elective courses serve to provide students with an opportunity to either broaden their background in electrical and computer engineering or to study, in greater depth, technical subjects in which they have special interests. Successful completion of the curriculum leaves the student prepared to embark on a career in electrical and computer engineering or to pursue advanced education in graduate school.

The attention of the student is directed to the retention and graduation requirements of the University and the School of Engineering. In addition to those requirements, a student must earn a grade of C or better in the mathematics and physics courses listed in the first two years of the program of study given below. The student must also have a grade point average of at least 2.00 for the following group of courses: ECE 301, 334, 352; all courses with an EEE prefix; and all other courses used as technical electives.

Electrical and Computer Engineering Core

The following courses are required for students in electrical and computer engineering to fulfill the requirements of the engineering core and the mathematics electives.

			Semester Hours
MAT	274	Elementary Differential Equations	3
MAT	242	Elementary Linear Algebra	2
MAT	362	Adv. Math for Engineers and Scientists	3
ECE	352	Semiconductors and Devices	3
CSC	220	Computer Organ. and Assembly Lang. Prog.	4

In addition, the following courses are required to fulfill the electrical and computer engineering core:

			Semester Hours
EEE	302	Electrical Networks II	3
EEE	303	Signals and Filters	3
CSC	320	Computer Organ. and Arch.	4
EEE	340	Electromagnetic Engineering I	3
EEE	396	Professional Seminar	0
Pascal Language			1

Electrical Engineering Option Core

The following courses are required by the regular electrical engineering option.

			Semester Hours
EEE	360	Electromechanics	3
EEE	436	Fundamentals of Solid State Devices	3
EEE	440	Electromagnetic Engineering II.	4
EEE	455	Communication Systems	4
EEE	480	Feedback Systems	4

Computer Engineering Option Core

The following courses are required by the computer engineering option.

			Semester Hours
CSC	321	Computer Systems Arch.	4
CSC	422	Microcomputer Systems Design I	4
CSC	423	Microcomputer Systems Design II	3
EEE	425	Digital Systems Circuits	4

Technical Electives in Electrical and Computer Engineering

The regular program in electrical engineering has a minimum total of 14 semester hours of approved technical elective courses. The computer engineering option has a total of 17 semester hours of approved technical electives. Both degree options require a 3 credit hour design laboratory course in the senior year. The senior design laboratory requirement is normally satisfied

by either EEE 428 or EEE 432. Students who have demonstrated outstanding ability may satisfy the 3 credit design requirement by arranging special projects or courses with individual members of the faculty. Technical electives may be selected from one or more of the following technical areas of emphasis:

Electromagnetic Fields and Waves: EEE 440, 441, 443, 445, 448.

Solid State Electronics: EEE 434, 435, 436.

Networks and Electronic Circuits: EEE 405, 406, 425, 433.

Communication and Control: EEE 451, 455, 459, 480, 482.

Power Systems: EEE 360, 460, 461, 462, 463, 464, 470, 471, 473.

At least half of the total technical elective credits must be Electrical Engineering (EEE) courses.

With the approval of their faculty advisor, qualified students may choose technical electives from other courses in engineering, mathematics, and the sciences at or above the 300-level including graduate courses. In addition up to six credit hours of technical electives may be chosen from the approved list of courses from the College of Business.

Program of Study. The first two years of course work are identical for students in either the regular or computer options. Slight differences occur in the junior year, and the senior year is considerably different for the two options.

Electrical Engineering Program of Study Typical Four-Year Sequence

Freshman Year

Semester Hours

First Semester

MAT	290	Calculus	5
CHM	114	or 116 Chemistry	4
ECE	105	Intro/Languages of Engr.	3
ENG	101	Freshman Composition	3
HU/SS[1] Elective			2
			17

Second Semester

MAT	291	Calculus II	5
PHY	115	Univ. Physics	4
PHY	117	Physics Lab	1
ECE	106	Computer-Aided Engr.	3

ENG	102	Freshman Composition	3
			16

Sophomore Year

First Semester

MAT	274	Differential Eq.	3
MAT	242	Linear Algebra	2
CSC	220	Computer Organ. and Assembly Lang. Prog.	4
ECE	211	Statics	2
PHY	116	Univ. Physics	4
		Pascal Prog.	1
PHY	118	Physics Lab	1
			17

Second Semester

MAT	362	Adv. Math for Engrs.	3
ECE	301	Electrical Networks I	3
CSC	320	Computer Organ. and Arch.	4
ECE	312	Dynamics	3
ECE	314	Deformable Solids	2
ECN	111	Macroeconomic Principles	3
			18

Regular Option, Electrical Engineering:

Junior Year

Semester Hours

First Semester

EEE	340	Electromagnetics I	3
ECE	334	Electronic Dev. & Inst.	4
EEE	302	Electrical Networks II	3
ECE	340	Thermodynamics	3
EEE	396	Professional Seminar	0
HU/SS[1] Elective			3
			16

Second Semester

EEE	440	Electromagnetics II	4
EEE	360	Electromechanics	3
EEE	303	Signals & Filters	3
ECE	352	Semiconductors	3
HU/SS[1] Elective			4
			17

Senior Year

First Semester

EEE	480	Feedback Sys.	4
EEE	455	Comm. Sys.	4
EEE	436	Solid State Dev.	3
Tech. Electives			3
Design Lab			3
			17

Second Semester

Tech Electives		11
HU/SS[1] Elective		4
ECE	400 Engrg. Commun.	3
		18

Computer Option, Electrical Engineering

Junior Year

First Semester

CSC	321	Computer Syst. Arch.	4
ECE	334	Electronic Dev. & Inst.	4
EEE	302	Electrical Networks II	3
ECE	340	Thermodynamics	3
EEE	396	Professional Seminar	0
HU/SS[1] Elective			3
			17

Second Semester

CSC	422	Microcomputer Syst. Des. I	4
EEE	340	Electromagnetics I	3
EEE	303	Signals & Filters	3
ECE	352	Semiconductors	3
Tech. Electives			3
HU/SS[1] Elective			2
			18

Senior Year

First Semester

CSC	423	Microcomputer Syst. Des. II	3
EEE	425	Digital Ckts.	4
Tech. Electives			3
Design Lab			3
HU/SS[1] Elective			3
			16

Second Semester

EEE Tech. Electives			11
HU/SS[1] Elective			3
ECE	400	Engrg. Commun.	3
			17

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[1] See pages 212-213 for approved list of humanities and social sciences.

Department of Industrial and Management Systems Engineering

PROFESSORS:
SMITH (EC G-120B), BEDWORTH, SULLIVAN, YOUNG
ASSOCIATE PROFESSORS:
ANDERSON, BAILEY, DEAN, KEATS, KNIGHT, MOOR, POLLOCK, ROLLIER, SHUNK
ASSISTANT PROFESSOR:
COCHRAN, HUBELE, MACKULAK
PROFESSOR EMERITUS:
HOYT

Industrial engineering provides a multi-disciplinary approach for analyzing, understanding and resolving problems within organizations. Emphasis is on objective and analytical procedures that facilitate sound decision making for problem solution. Industrial engineering has applications in all areas of the economy (industrial, service, commercial and government). It is the branch of engineering concerned not only with things but with people, making industrial engineers a prime source of management talent. Typical organizations employing industrial engineers include hospitals, government at all levels, transportation, construction, banks, processing, facilities design, manufacturing and warehousing.

Since modern industrial engineering approaches for designing effective operational systems are universally applicable to all forms of enterprise, students must gain competence in a number of areas of knowledge and be capable, through application of such knowledge, of understanding complex systems. The curricula is designed to provide students with instruction in the latest technology including CAD, CIM, CAM, robotics, controls, data-base, graphics, and microtechnology with particular emphasis on factory automation.

The purpose of the Industrial Engineering major, therefore, is to provide each student with an understanding of (1) how operational systems are designed, (2) how each component of a system contributes to overall system effectiveness, (3) the methodologies of systems analysis, (4) the probabilistic nature of events, (5) the human component in complex systems and (6) organization

and management to facilitate planning and control.

Industrial Engineering

The following courses are required as a part of the mathematics requirement and the Engineering Core:

			Semester Hours
ECE	383	Probability and Statistics for Engineers	2
IEE	463	Computer-Aided Manufacturing Processes	3

In addition, the following courses are required for the Industrial Engineering major:

ACC	498	Pro-Seminar: Cost Accounting for Engineers	3
ASE	485	Engineering Statistics	3
IEE	300	Economic Analysis for Engineers	2
IEE	330	Intro to Data Base Design	2
IEE	362	Work Analysis and Design	3
IEE	372	Facilities Analysis and Design	3
IEE	374	Quality Control	3
IEE	422	Info. Sys. Design	3
IEE	431	Engineering Administration	3
IEE	461	Integrated Production Control	3
IEE	475	Fundamentals of Simulation	3
IEE	476	Introduction to Operations Research Models	3
IEE	492	Project in Design and Development	3
MAE	351	Production Processes	3
Area of Emphasis (technical electives)			11

Technical Electives in Industrial Engineering

In consultation with an advisor, technical electives may be selected from one or more of the following areas of emphasis. The graduate courses listed under these areas may, with appropriate approvals, be taken for undergraduate credit.

Production Systems: IEE 464, MET 301, MET 306, MGT 331, MGT 432, IEE 561, IEE 570.

Computer-aided Processes: IEE 464, CHE 461, CSC 383, MET 306, MET 403.

Quality Control/Reliability: IEE 474, AET 309, ASE 483, MAE 441, MAE 442, IEE 570.

Engineering Management: IEE 411, ADS 305, FIN 300, MGT 413, MGT 432, IEE 510, IEE 531.

Information Systems: IEE 464, CSC 304, CSC 410, CSC 412, IEE 577.

With the approval of the student's advisor, technical electives may also be chosen from other courses in engineering, mathematics, the sciences, and business administration at or above the 300-level. A minimum of six hours of technical electives must be taken from this department.

Industrial Engineering Program of Study Typical Four-Year Sequence

Freshman Year

First Semester

			Semester Hours
ECE	105	Languages of Engrg	3
ENG	101[1]	Freshman Composition	3
MAT	270	Calc I	4
CHM	114	Gen Chemistry	4
Gen'l Studies Electives[3]			3
			17

Second Semester

ECE	106	Computer-Aided Engrg	3
ENG	102[1]	Freshman Composition	3
MAT	271	Calc II	4
PHY	115	University Physics	4
PHY	117	Univ. Physics Lab	1
Gen's Studies Electives[3]			3
			18

Sophomore Year

First Semester

PHY	116	University Physics	4
PHY	118	Univ. Physics Lab	1
IEE	300	Econ Analysis for Engr	2
ECN	111[3]	Macroeconomic Principles	3
MAT	242	Elem. Linear Algebra	2
MAT	272	Calc III	4
			16

Second Semester

ECE	211	Engrg. Mech. I/Statics	2
ECE	383	Prob. & Stat./Engrs.	2
MAT	274	E. em. Diff. Equations	3
MAE	351	Production Processes	3
IEE	372	Facil. Anal & Design	3
Gen'l Studies Electives[3]			4
			17

Junior Year

First Semester

ECE	301	Elec. Ntwks. I	3
ECE	312	Engrg Mech II Dynamics	3
IEE	330	Intro to Data Base Design	2
IEE	362	Ind. Engrg. Analysis	3
IEE	374	Quality Control	3

ASE	485	Engrg Statistics	3
			17

Second Semester

ACC	498	PS: Cost Acctg/Engrs	3
ECE	314	Intro to Deform Solids	2
ECE	340	Thermodynamics	3
IEE	463	Computer-Aided Processes	3
Technical Electives[4]			3
Gen'l Studies Elective[3]			3
			17

Senior Year

First Semester

ECE	350	Struc/Prop of Mat'ls	3
IEE	431	Engrg. Administration	3
IEE	461	Integ. Prod. Control	3
IEE	422	Info. Sys. Design	3
IEE	475	Fund. of Simulation	3
Technical Elective[4]			3
			18

Second Semester

ECE	334	Electr. Device/Instru	4
ECE	400	Engrg. Communication	3
IEE	476	Intro. Oper. Res. Models	3
IEE	492	Proj. in Design & Dev.	3
Technical Elective[4]			5
			18

Graduation Requirements: 130 semester hours minimum (excluding English requirement). Scholastic index of 2.0 or better (C average)

[1] Students with ACT English test score of 25 (SAT 650) or better take ENG 105.

[2] No high school chemistry, take CHM 113 and CHM 116.

[3] General Studies courses should be selected from the list of humanities and social science courses (see page 213) approved for School of Engineering and must include ECN 111.

[4] Technical electives should be selected from an area of emphasis.

Manufacturing Engineering. Manufacturing engineering is concerned with the application of the principles of science to increase productivity in industry. This involves the design of systems that allow for the best utilization of men, machines, material, and money. Modern manufacturing engineering is concerned with the application ot technology including computers, robots, graphics, mathematical and digital models, information and data base systems, microtechnology, and systems theory.

Emphasis is placed on management and economics as well as technology. Graduates of the program will be well qualified to participate in the introduction of CAD/

CAM/CIM and factory automation technology to industry.

The following courses are required as part of the mathematics requirement and the Engineering Core:

			Semester Hours
ECE	350	Structure and Properties of Materials	3
ECE	383	Probability and Statistics for Engineers	2
IEE	463	Computer Aided Manufacturing Processes	3

In addition, the following courses are required:

IEE	300	Economic Analysis for Engineers	2
IEE	330	Introduction to Data Base Design	2
IEE	374	Quality Control	3
IEE	422	Info Sys Design	3
IEE	431	Engineering Administration	3
IEE	464	Computer Integrated Design Applications	3
MAE	317	Dynamic Systems and Control	4
MAE	422	Mechanics of Materials	3
MAE	441	Principles of Design I	3
MAE	447	Robotics and Its Influence on Design	3
MAE	452	Manufacturing Engineering	3
MAE	351	Production Processes	3
MET	403	N/C Computer Programming	3
Technical Electives			9
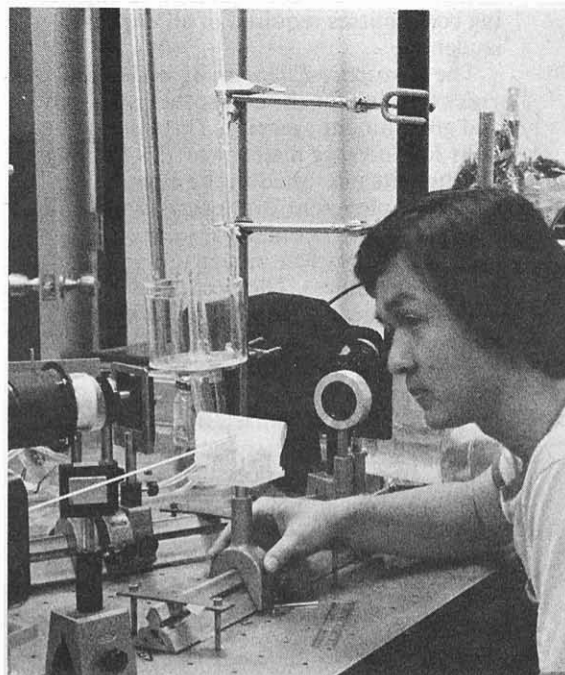
Department of Mechanical and Aerospace Engineering

PROFESSORS:
METZGER (EC G-346E), AVERY, BEAKLEY, BICKFORD, CARPENTER, CHEN, DAVIDSON, DITSWORTH, EVANS, FLORSCHUETZ, JACOBSON, JANKOWSKI, LOGAN, NELSON, RICE, SARIC, SHAW, SO, STANLEY, WAGNER, WALLACE, WOOD, YAO

ASSOCIATE PROFESSORS:
COGHLAN, HENDRICKSON, HIRLEMAN, LAANANEN, LIU, NEITZEL, PECK, RANKIN, ROY

ASSISTANT PROFESSORS:
CASTELAZO, CHANG, CHYU, FERNANDO, HASSAN, HENDERSON, KRAUSE, KUO, LIMBERT, McNEILL, MURTHY, RAJAN, SHAH, SHIN

The Mechanical and Aerospace Engineering Department is the administrative home for five undergraduate majors:
Aerospace Engineering
Energy Systems Engineering
Engineering Science
Materials Science
Mechanical Engineering
All five majors build on the broad exposure to the engineering, chemical and physical sciences as well as the mathematics embodied in the General Studies and engineering core courses required of all engineering students.

The *Aerospace Engineering* major provides training for the aerospace industries and government agencies. The *Energy Systems Engineering* major provides training for students interested in the energy field and in employment with energy companies (i.e., petroleum companies, solar energy agencies, the nuclear industry, and with utility companies). The *Engineering Science* major is intended for students who prefer more emphasis in the science and analysis side of engineering than is generally available in more traditional engineering programs. The specialized *Materials Science* major is designed for students who want extensive training in processing, use and creation of materials. The *Mechanical Engineering* major is, perhaps, one of the most broadly applicable programs in engineering, providing training for a wide variety of employment opportunities. All of these majors are discussed in more detail below.

The above majors can serve as entry points to immediate professional employment or to graduate study. The emphasis in all fields is on development of fundamental skills which will have long-lasting utility in our rapidly changing technical society. Employers' desire for this emphasis is a strong point in favor of these choices of curricula over technology programs or special programs which emphasize primarily current applications or specific industries.

Minimum Scholastic Requirements. All degree programs in the department require that students attain at least a C (2.00) average in the engineering core and major in order to be eligible for graduation. Also, the department may require additional or remedial work for those students who have demonstrated a trend of academic difficulty.

Engineering Core Options

Among the options listed on page 235 as part of the engineering core requirements, Mechanical and Aerospace engineering students are required to select the following:

			Semester Hours
ECE	340	Thermodynamics	3
ECE	350	Structure and Properties of Materials	3

Selections for the Microcomputer/Microprocessor Elective are limited to:

			Semester Hours
CSC	220	Computer Organization and Assembly Language Programming	4
IEE	463	Computer Aided Processes	3
MAE	405	Microcomputer-Aided Processes for Mechanical Engineers	3

The first two years are usually totally devoted to the General Studies and engineering core requirements. Thus, all the degree programs in the department share essentially the same course schedule for that period of time. A typical schedule is given below:

Program of Study
Typical First-and Second-Year Sequence
Freshman Year

			Semester Hours
First Semester			
MAT	290	Calculus I	5
CHM	114	or CHM 116 General Chemistry	4

ECE   105   Introduction to Languages of
                     Engineering 3
ENG   101   Freshman Composition 3
SS or HUM Elective[1] 3
                                                                            18

Second Semester
MAT   291   Calculus II 5
PHY   115   Univ. Physics 4
PHY   117   Univ. Physics Lab...................... 1
ECE   106   Introduction to Computer-Aided
                     Engineering 3
ENG   102   Freshman Composition 3
                                                                            16

Sophomore Year

First Semester
MAT   274   Elem. Diff. Equations 3
PHY   116   Univ. Physics 4
PHY   118   Univ. Physics Lab...................... 1
ECE   211   Engrg. Mech. I: Statics............... 2
MAT   242   or ECE 384 (Check Program).... 2
SS or HUM Elective[1] 4
                                                                            16

Second Semester
ECE   301   Ntwks. I 3
ECE   312   Engrg. Mech. II: Dynamics 3
ECE   314   Intro./Deformable Solids........... 2
ECE   340   Thermodynamics 3
ECE   386   Part. Diff. Equations.................. 2
ECE   350   Stru./Proprts. of Matls.............. 3
                                                                            16

[1]See pages 212-213 for specific requirements and ap-
proved list of behavioral and social sciences (SS) and
humanities and fine arts (HUM).

Aerospace Engineering

The primary concern of aerospace engineers is the design and development of a wide variety of aircraft and space vehicles. The current challenges to the aerospace engineer include the design of a new generation of high efficiency transport aircraft, the development of the next generation of space transports and the design of large space systems. In addition to the design of vehicles, the aerospace engineer is involved in the further development of the many spin-offs of the aerospace industry. These include contributions to communications, air and water pollution monitoring, management of the earth's resources, and the understanding and control of weather. Future contributions are anticipated in the area of zero gravity manufacturing of high purity materials and med-

icines, and the design of solar power satellites.

The undergraduate curriculum includes the study of flight mechanics, aerospace structures, aerodynamics, and propulsion. These subjects provide the foundation necessary for aerospace design.

Aerospace Engineering Major

Aerospace Engineering students are required to fill their four-hour General Studies approved mathematics content electives with:

			Semester Hours
MAT	242	Elementary Linear Algebra........	2
ECE	386	Part. Diff. Eqns. Engr................	2

The Aerospace Engineering major consists of:

ECE	384	Numerical Analysis....................	2
MAE	317	Dynamic Systems and Control .	4
MAE	371	Fluid Mechanics.........................	3
MAE	413	Intermediate Dynamics.............	3
MAE	415	Vibration Analysis.....................	4
MAE	422	Mechanics of Materials.............	4
MAE	426	Aerospace Structures	3
MAE	460	Gas Dynamics............................	3
MAE	461	Aerodynamics	3
MAE	462	Dynamics of Flight	3
MAE	463	Propulsion	3
MAE	464	Aerodynamics Laboratory.........	2
MAE	468	Aerospace Systems Design	3
Area of Emphasis (Technical) Elec. ....10 or 11			

Aerospace Engineering Areas of Emphasis.

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Aerodynamics. MAE 372, 382, 402, 471, 474, 475, 488.

Computer Science. CSC 305, 320, 383, 422; EEE 321, 421, MAE 404, 405.

Engineering Mathematics. ASE 582, 586; CSC 383; ECE 383, 384; MAE 527.

Flight and Space Dynamics. MAE 417, 474, 475, 492, 513.

Propulsion. MAE 382, 435, 456.

Stress Analysis. MAE 355, 404, 441, 442, 492, 523, 528, 529, 555.

Structural Dynamics. MAE 410, 416, 492, 511, 515, 528, 502, 555.

**Aerospace Engineering
Program of Study
Typical Last Two-Year Sequence**

Junior Year

Semester Hours

First Semester

ECE	334	Electr. Device/Instru..................	4
MAE	371	Fluid Mechanics..........................	3
MAE	413	Intermediate Mechanics............	3
MAE	415	Vibrations..................................	4
MAE	422	Mechanics of Materials.............	4
			18

Second Semester

MAE	317	Dynamic Systems and Control .	4
MAE	426	Aerospace Structures	3
MAE	460	Gas Dynamics...........................	3
MAE	461	Aerodynamics	3
Microcomputer Elective.........................			3 or 4
			16 or 17

Senior Year

First Semester

ECE	384	Numerical Analysis....................	2
MAE	462	Dynamics of Flight	3
MAE	463	Propulsion	3
MAE	464	Aerodynamics Laboratory.........	2
Technical Electives.............................			5
SS or HUM Electives[1]			3
			18

Second Semester

ECE	400	Engineering Communications...	3
MAE	468	Aerospace Systems Design	3
Technical Electives			5 or 6
SS or HUM Electives[1]...............................			6
			17 or 18

[1]See page 213.

Energy Systems Engineering

There is little doubt that the long range future of the United States is contingent upon our ability to deal effectively with our chronic energy problems. In an effort to solve these problems and to lessen their impact on economics and lifestyles, both government and industry have increased their commitments to energy production, conservation and research. This in turn has stimulated employment of engineers and scientists trained in fields that relate to this problem area.

Of the established fields of engineering, the field of mechanical engineering is the most closely allied to energy, its production (i.e., conversion of one form to another),

transportation and end use. In this context, it is natural to find energy systems engineering housed in the same department with mechanical engineering at ASU.

It is the purpose of this option to build on the traditional mechanical engineering areas of fluid mechanics, thermodynamics, heat transfer, design and controls with student-selected courses in the following areas of emphasis: alternative sources and conversion (including solar energy); conventional sources and conversion; electrical power and distribution; environmental; and nuclear power. A general area of emphasis is also available to allow a student to generate a pre-approved sequence of interest.

Energy Systems Engineering Major

Energy Systems students are required to fill their four-hour General Studies approved mathematics content electives with:

ECE	384	Numerical Analys. Engr.	2
ECE	386	Part. Diff. Eqns. Engr................	2

The Energy Systems Engineering major consists of:

EEE	360	Electrodynamics.........................	3
IEE	300	Economic Analysis for Engr......	2
PHY	361	Modern Physics..........................	3
MAE	317	Dynamic Systems and Control .	4
MAE	371	Fluid Mechanics.........................	3
MAE	372	Fluid Mechanics.........................	4
MAE	382	Thermodynamics.......................	3
MAE	430	Introduction to Nuclear Engr....	3
MAE	433	Nuclear Plant Systems Design ..	3
		or	
MAE	446	Thermal System Design	(3)
MAE	488	Heat Transfer	3
MAE	498	Energy Sources and Systems	3
MAE	491	Experimental Mechanical Engr.	3
MAE	492	Projects.......................................	2
Area of Emphasis (Technical) Electives .11 or 12			

Energy Systems Engineering Areas of Emphasis

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Alternative Sources and Conversion. EEE 436; GLG 301; MAE 336, 437, 438.

Conventional Sources and Conversion. ECE 384; MAE 415, 416, 417, 422, 435, 436.

Electrical Power and Distribution. EEE 302, 470, 471, 473, MAE 415, 417, 422, 435, 437, 442.

Environmental. BIO 320, 330; CEE 361, 362, 461; EEE 461; GLG 302; MAE 336, 417.

Nuclear. EEE 439, 461; GLG 321; MAE 415, 417, 422, 431, 433, 435, 437, 442.

Energy Systems Engineering
Program of Study
Typical Last Two-Year Sequence

Junior Year

Semester Hours

First Semester

ECE	334	Electr. Device/Instru..................	4
MAE	371	Fluid Mechanics.........................	3
MAE	382	Thermodynamics........................	3
Microcomputer Elective ....3 or 4			
PHY	361	Modern Physics..................	3
			16 or 17

Second Semester

EEE	360	Electromechanics	3
MAE	372	Fluid Mechanics.........................	4
MAE	430	Intro. to Nuclear Engrg..............	3
MAE	488	Heat Transfer............................	3
MAE	317	Dynamic Sys. and Contrl.	4
			17

Senior Year

First Semester

IEE	300	Econ. Analysis for Engineers.....	2
MAE	446	or MAE 433...............................	3
MAE	491	Exp. Mechanical Engineering....	3
Technical Electives			4 or 5
SS or HUM Electives[1]			6
			18 or 19

Second Semester

ECE	400	Engineering Communications...	3
MAE	498	Energy Sources and Systems	3
MAE	492	Projects.......................................	2
Technical Electives............................			7
SS or HUM Electives[1]			3
			18

[1]See page 213.

Engineering Science

The engineering science curriculum is designed for those who wish a more general background in engineering than is typically available in more specialized curricula paths and who wish to gain a depth of understanding in underlying disciplines which are the scientific bases of engineering. The program is developed around fundamental course work in the broad fields of engineering mechanics, materials science, physics and mathematics. A major emphasis is placed on engineering mechanics which includes many important specialized areas such as acoustics and vibrations, elasticity of conventional and composite materials, rotor and gyrodynamics, finite element modeling of complex mechanical systems, and biomechanics of prostheses, just to name a few.

An engineering science graduate has the fundamental education which provides the flexibility and understanding required to cope with rapidly occurring changes in technology and needs of society. Problems in urban noise, vibration control in space vehicles at launch, optimal design of composite materials for aerospace and automotive structures, computer-aided modeling of structures ranging from surgical implants in the body to space satellites are some examples of problems an engineering science graduate may encounter.

Engineering Science Major

Engineering Science students are required to fill their four-hour General Studies approved mathematics content electives with:

MAT	242	Elementary Linear Algebra........	2
ECE	386	Part. Diff. Eqns. Engr.................	2

The Engineering Science major consists of:

ECE	384	Numerical Analysis....................	2
PHY	361	Modern Physics..........................	3
MAE	355	Introduction to Metallurgy........	3
MAE	371	Fluid Mechanics.........................	3
MAE	372	Fluid Mechanics.........................	4
MAE	402	Intro. to Continuum Mechanics.............................	3
MAE	404	Finite Elements in Engineering.	3
MAE	410	Acoustics and Noise Control.....	3
MAE	413	Intermediate Dynamics.............	3
MAE	415	Vibration Analysis	4
MAE	422	Mechanics of Materials	4
MAE	488	Heat Transfer............................	3
MAE	492	Projects.......................................	2
Area of Emphasis (Technical) Elect.....			10 or 11

Engineering Science Areas of Emphasis

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of

courses that would support a career objective not covered by the following categories.

Biomechanics. CHE 411, 412; EEE 434; MAE 341, 526.

Computer Science. CSC 305, 320, 383, 422; EEE 321, 421, IEE 463; MAE 405.

Engineering Mathematics. ASE 483, 485; CSC 383; ECE 383, 384; MAE 527.

Engineering Mechanics. MAE 416, 426, 523, 529, 555.

Manufacturing Engineering. IEE 300, 374, 431, 463; MAE 351, 452, 450.

Materials Science and Metallurgy. MAE 450, 452, 453, 455.

Vibration and Acoustics. CEE 536, 537; MAE 416, 511, 512, 513.

Engineering Science Program of Study
Typical Last Two-Year Sequence
Junior Year

			Semester Hours
First Semester			
ECE	334	Electr. Device/Instru	4
MAE	371	Fluid Mechanics	3
MAE	413	Intermediate Dynamics	3
MAE	422	Mechanics of Materials	4
PHY	361	Modern Physics	3
			17
Second Semester			
MAE	355	Introduction to Metallurgy	3
MAE	372	Fluid Mechanics	4
MAE	410	Acoustics and Noise Control	3
MAE	402	Intro. to Continuum Mechanics	3
MAE	415	Vibration Analysis	4
SS or HUM Electives[1]			2
			19

Senior Year

First Semester			
ECE	384	Numerical Analysis	2
MAE	404	Finite Elements in Engineering	3
MAE	488	Heat Transfer	3
Technical Electives			3
Microcomputer Elective			3 or 4
SS or HUM Elective[1]			3
			17 or 18
Second Semester			
ECE	400	Engineering Communications	3
MAE	492	Projects	2
SS or HUM Elective[1]			4
Technical Electives			8 or 7
			17 or 16

[1]See page 213.

Materials Science

Historically, man's knowledge of materials has had a tremendous impact on the advancement of civilization as reflected in the names "stone," "bronze," and "iron" attached to various ages of the development of our society. Today as in the past, engineering development and scientific advancement are often limited by the availability of materials to meet design requirements, and technological breakthroughs often result from the development of some new material or new materials processing technique.

Materials Science is the engineering and scientific discipline that is concerned with the study of fundamental relationships between the structure of materials and their properties. The program provides students with the knowledge necessary to make decisions concerning the optimum utilization of existing materials or to develop and process new materials.

Essentially all major industries and research laboratories are involved to some extent with the selection, utilization, and development of materials in designing and producing engineered systems. Students who major in Materials Science find employment opportunities in a variety of industries and research facilities associated with aerospace, solid state electronics, energy conversion, transportation, manufacturing and chemical processing. The responsibilities of a materials scientist or materials engineer include research and development of materials to meet some new demand brought about by advancing technology, or to select the best choice of existing materials for a specific application. Materials scientists also develop new techniques for processing materials to reduce costs of products or to create new products. Also, they are often responsible for analyzing data on field tested materials to determine the effects of the environment on materials performance.

The tools of a materials scientist include highly sophisticated analytical equipment. Since a considerable emphasis in Materials Science is placed on the microscopic world, instruments such as transmission and scanning electron microscopes, X-ray diffractometers, and Auger spectrometers, are a necessary part of the field.

The undergraduate curriculum requires that students take a series of interdisciplinary courses of fundamental importance to an understanding of all materials.

Materials Science Major

Materials Science students are required to select the following chemistry course under General Studies.

CHM 116 General Chemistry* 4

The Materials Science major consists of:

CHM	441	General Physical Chemistry	3
CHM	442	General Physical Chemistry	3
ECE	352	Semiconductors and Devices	3
MAE	355	Metallurgy	3
MAE	371	Fluid Mechanics.........................	3
MAE	450	Mechanical Properties of Solids	3
MAE	451	X-ray & Electron Diffraction.....	3
MAE	453	Corrosion and Corrosion Control.................................	3
MAE	455	Physical Metallurgy...................	4
MAE	488	Heat Transfer	3
MAE	489	Thermodynamics of Materials..	3
MAE	492	Projects.....................................	2

Area of Emphasis (Technical) Elect..... 14 or 15

*Requires CHM 113 be taken as a pre-engineering course or proficiency exam in chemistry must be passed. Check with MAE department for details.

Materials Science Areas of Emphasis

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Physical Metallurgy. PHY 471, 481 required. Remainder chosen from CHE 311; CHM 471; MAE 422, 452, 492; PHY 361, 362, 363.

Electronics. PHY 471, 481 required. Remainder chosen from CHM 471, EEE 435, 539; MAE 437, 438; PHY 461, 471, 481.

Manufacturing and Materials Processing. CHE 311; MAE 351, 372, 415, 422, 441, 442, 452.

Polymer Science. CHM 331, 332, 438, 471; MAE 372, 452, 492.

Mechanical and Energy Systems. MAE 372, 415, 422, 430, 433, 438, 441, 442; EEE 464.

Materials Science Program of Study
Typical Final Two-Year Sequence
Junior Year

Semester Hours

First Semester

ECE	352	Semiconductors and Devices	3
CHM	441	Gen. Physical Chem.	3
ECE	334	Electr. Devices/Instru.	4
MAE	355	Introduction to Metallurgy........	3
MAE	371	Fluid Mechanics.........................	3
			16

Second Semester

CHM	442	Gen. Physical Chem.	3
MAE	455	Physical Metallurgy...................	4
MAE	488	Heat Transfer	3
Microcomputer Elective			3 or 4
Technical Elective.................................			3
			16 or 17

Senior Year

First Semester

MAE	489	Thermodynamics of Materials..	3
MAE	450	Mech. Properties of Solids	3
MAE	451	X-ray and Electron Diffraction .	3
Technical Elective			3
SS or HUM Electives[1]			5
			17

Second Semester

ECE	400	Engineering Communications...	3
MAE	453	Corrosion and Corrosion Control.................................	3
MAE	492	Projects.....................................	2
Technical Electives			6 or 5
SS or HUM Electives[1]			4
			18 or 17

[1]See page 213.

Mechanical Engineering

Mechanical Engineering is a creative discipline that draws upon a number of basic sciences to design the devices, machines, processes, and systems which involve mechanical work and its conversion from, and into, other forms. It includes the conversion of thermal, chemical and nuclear energy into mechanical energy through various engines and powerplants; the transport of energy via devices like heat exchangers, pipelines, gears, and linkages; and the use of energy to perform a variety of tasks for the benefit of society, such as in transportation vehicles of all types, manufacturing tools and equipment, and household appliances. Furthermore, since all manufactured prod-

ucts must be constructed of solid materials and because most products contain parts that transmit forces, Mechanical Engineering is involved in the structural integrity and materials selection of almost every product on the market.

Mechanical engineers are employed in virtually every kind of industry. They are involved with seeking new knowledge through research, with doing creative design and development, and with the construction, control, management, and sales of the devices and systems needed by man. Therefore, a major strength of a Mechanical Engineering education is the flexibility it provides in future employment opportunities for its graduates.

The undergraduate curriculum includes the study of principles governing the use of energy; principles of design, instruments, and control devices; and the application of these studies to the creative solution of practical, modern problems.

Mechanical Engineering Major

Mechanical Engineering students are required to fill the four-hour General Studies approved mathematics content electives with:

MAT	242	Linear Algebra	2
ECE	386	Part. Diff. Eqns. Engr.	2

The Mechanical Engineering major consists of:

ECE	384	Numerical Analysis	2
MAE	317	Dynamic Systems & Control	4
MAE	371	Fluid Mechanics	3
MAE	372	Fluid Mechanics	4
MAE	382	Thermodynamics	3
MAE	415	Vibrations	4
MAE	422	Mechanics of Materials	4
MAE	441	Principles of Design	3
MAE	443	Engineering Design	3
MAE	488	Heat Transfer	3
MAE	491	Experimental Mechanical Engineering	3
MAE	492	Projects	2
Area of Emphasis (Technical) Electives.			12 or 13

Mechanical Engineering Areas of Emphasis

Technical electives may be selected from one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of

courses that would support a career objective not covered by the following categories.

Aerospace. MAE 410, 413, 435, 436, 437, 446, 460, 461, 462, 463, 464, 471.

Biomechanical. CHE 411, 412, 517 (recommended); EEE 302, 434; MAE 321, 526.

Computer Methods. ASE 483, 485; CHE 581; CSC 320, 422; ECE 383; IEE 463, 475; MAE 403, 404, 405, 471; MAT 464, 465.

Control and Dynamic Systems. CSC 320; ECE 383; EEE 360; IEE 463; MAE 413, 416, 417, 418, 419, 462.

Design. ECE 351, 383; MAE 333, 341, 351, 403, 404, 405, 417, 438, 442, 447.

Engineering Mechanics. MAT 464, 466; MAE 341, 410, 413, 416, 426, 430, 442, 471.

Manufacturing. IEE 300, 374, 411, 431, 461, 463; MAE 341, 355, 401, 403, 404, 442, 447, 450, 453, 455.

Stress Analysis, Failure Prevention and Materials. ECE 383; MAE 341, 355, 404, 426, 447, 450, 451, 453, 455.

Thermosciences. MAE 333, 336, 430, 435, 436, 437, 446, 460, 461, 463, 471, 489.

Mechanical Engineering
Program of Study
Typical Last Two-Year Sequence

Junior Year

Semester Hours

First Semester

ECE	334	Electr. Device/Instru	4
ECE	384	Numerical Analysis	2
MAE	371	Fluid Mechanics	3
MAE	383	Thermodynamics	3
MAE	422	Mechanics of Materials	4
			16

Second Semester

MAE	317	Dynamic Systems and Control	4
MAE	372	Fluid Mechanics	4
MAE	441	Preliminary Design	3
MAE	488	Heat Transfer	3
Microcomputer Elective			3 or 4
			17 or 18

Senior Year

First Semester

MAE	445	Engineering Design	3
MAE	491	Exp. Mech. Engrg.	3
Technical Electives			7 or 6
SS or HUM Electives[1]			6
			19 or 18

Second Semester

ECE	400	Engineering Communications...	3
MAE	415	Vibrations	4
MAE	492	Projects	2
		Technical Electives	6
		SS or HUM Electives[1]	3
			18

[1]See page 213.

Programs in Engineering Special and Interdisciplinary Studies

The majors of Engineering Special Studies and of Engineering Interdisciplinary Studies accommodate students whose educational objectives require more intensity of concentration on a particular subject or more curricular flexibility within an engineering discipline than the traditional departmental majors generally permit. These majors are School of Engineering programs. Unlike the departmental major areas, however, there is not a separate faculty. The faculty teaching and advising in these programs are from the School of Engineering.

For many students, engineering studies form the basis of preparation for professional engineering work where proficiency in the application of science and the physical and social technologies are brought to bear on problems of large scope. The necessary breadth that these students seek often is not obtainable by branching from existing engineering fields. Rather, especially designed programs of course work that merge the required principles and approaches drawn from all fields of engineering and other pertinent disciplines are desired. As an answer to this need, two types of course arrangements are available: (1) the Bachelor of Science in Engineering degree special programs; and (2) engineering interdisciplinary programs that lead to the degree Bachelor of Science.

The B.S.E. Engineering Special Programs are designed primarily for students intending to pursue engineering careers at a professional level in industry or graduate studies. The B.S. Engineering Interdisciplinary Programs accommodate those students who desire the integrity of an engineering education but plan to enter professions other than engineering, or particularly to serve society in socially relevant activities. Both are developed beyond the General Studies and the engineering core.

The curricula leading to both the Bachelor of Science in Engineering (B.S.E.) and the Bachelor of Science (B.S.) have been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Engineering Special Studies—B.S.E.

Bioengineering. Bioengineering bridges the engineering, physical, and life sciences. Engineers, physicists and mathematicians routinely join with the biologist and physician in developing techniques, equipment and materials. The multidisciplinary approach to solving problems in medical treatment and research has evolved from exchanges of information between specialists of the concerned areas. Advanced study beyond the bachelor's degree is acutely needed in bioengineering, requiring a depth of knowledge from at least two diverse disciplines. This program emphasis is especially designed for entry into this type of work.

The following courses are required as a part of the science and mathematics requirement and the engineering core:

			Semester Hours
CHM	116	General Chemistry	4
CHM	441	General Physical Chemistry	3
CHM	442	General Physical Chemistry	3
ECE	383	Probability and Statistics	2
CHE	461	Chemical Engrg Process Control	3

or CSC 220 Computer Org & Assembly Language Programming (4)

or IEE 463 Computer Aided Processes (3)

or MAE 405 Microcomputer Aided Processes in Mech Engrg (3)

In addition, the following courses are required:

AGB	435	Animal Physiology	4
BIO	181	Biological Principles & Processes	4
CHE	331	Transport Processes I: Fluids	3
		or MAE 371 Fluid Mechanics	
CHE	411	Biomedical Engineering I	3
CHE	412	Biomedical Engineering II	3
CHE	413	Physiological Instrumentation	3
CHE	492	Chemical Engineering Projects	2

CHM   113   General Chemistry...................... 4

CHM   331   General Organic Chemistry....... 3

CHM   332   General Organic Chemistry....... 3

CHM   335   General Organic Chemistry
                     Lab.. 1

CHM   361   Principles of Biochemistry 3

EEE   465   Clinical Nuclear Engineering I.. 3
                     or CHE 518 Biomaterials (3)

ASE   496*   Professional Seminar.................. 0

Technical Electives (including two courses of
    engineering science and one course of
    engineering design type content) 12

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*Students must register for ASE 496 each semester.

Computer Systems Engineering. This program is administered by the Department of Computer Science (see page 221).

Manufacturing Engineering. This program is administered by the Department of Industrial and Management Systems Engineering (see page 243).

Nuclear Sciences. The nuclear sciences curriculum encourages an individualized program based on the student's own career interests and objectives. The program provides a strong foundation in basic engineering and nuclear concepts. Electives are generally taken during the junior and senior years and must be approved by a designated faculty advisor. The electives should focus on a technical or environmental area associated with the (1) discovery, development or utilization of energy, or (2) materials or products which use, release or may be affected by radiation.

Individual elective programs may also be aligned with a traditional discipline such as chemical, civil, electrical or mechanical engineering. They may be tailored toward specific energy resources such as those associated with fission, fusion, solar, geothermal, fossil fuels or synthetic fuels such as oil shale. They may be structured for specific high-demand areas such as radiation health physics, power systems engineering, corrosion and radiation effects on materials, computer-aided operation and accident analysis at power generation facilities, or designing better man-machine interfaces. Finally, there are opportunities to pursue selected areas such as waste disposal, radiation effects on electronics in space, nuclear applications in forensics, low-level radiation measurements of our natural radiation environment, or anomalies from trace amounts

of natural radioactivity in computer microprocessing circuits.

Motivated students who have demonstrated scholastic excellence will be encouraged to participate in summer research programs at national laboratories or with an appropriate industry. In addition, students may elect an independent study or senior research project. The exercise provides an opportunity to assemble and apply the newly acquired engineering knowledge and laboratory skills to an in-depth investigation of a real world problem.

The following courses are required as a part of the engineering core:

<table>
<tr><td></td><td></td><td></td><td>Semester
Hours</td></tr>
<tr><td>ECE</td><td>350</td><td>Structure and Properties of
        Materials ....</td><td>3</td></tr>
<tr><td></td><td></td><td>or ECE 352 Semiconductors and
        Devices</td><td></td></tr>
<tr><td>CSC</td><td>220</td><td>Computer Org & Assembly
        Language Processes ....</td><td>4</td></tr>
<tr><td></td><td></td><td>or MAE 405 Microcomputer Aided
        Processes for Mechanical Engrs (3)</td><td></td></tr>
</table>

. In addition, the following courses are required:

<table>
<tr><td>MAE</td><td>371</td><td>Fluid Mechanics.........................</td><td>3</td></tr>
<tr><td>MAE</td><td>382</td><td>Thermodynamics.......................</td><td>3</td></tr>
<tr><td>EEE</td><td>460</td><td>Nuclear Engineering ....</td><td>3</td></tr>
<tr><td></td><td></td><td>or MAE 430 Introduction to Nuclear
        Engineering</td><td></td></tr>
<tr><td>EEE</td><td>461</td><td>Health Physics Principles and
        Radiation Measurements.....</td><td>3</td></tr>
<tr><td>EEE</td><td>462</td><td>Reactor Safety Analysis.............</td><td>3</td></tr>
<tr><td>EEE</td><td>463</td><td>Electric Power Plant Systems....</td><td>3</td></tr>
<tr><td></td><td></td><td>or MAE 433 Nuclear Plant Systems
        Design</td><td></td></tr>
<tr><td>EEE</td><td>464</td><td>Nuclear Engineering
        Experiments..........................</td><td>3</td></tr>
<tr><td>MAE</td><td>415</td><td>Vibration Analysis.....................</td><td>4</td></tr>
<tr><td></td><td></td><td>or EEE 480 Feedback Systems</td><td></td></tr>
<tr><td>MAE</td><td>422</td><td>Mechanics of Materials ....</td><td>4</td></tr>
<tr><td>PHY</td><td>361</td><td>Modern Physics.........................</td><td>3</td></tr>
<tr><td colspan="3">Technical Electives...</td><td>18</td></tr>
</table>

Systems Engineering. Systems Engineering deals with the integration of diverse components into a functioning whole. This curriculum combines the more traditional studies of electrical and industrial engineering with contemporary analytical and computer-based problem solving skills. The program also has a strong computer science component. Graduates are prepared for a broad variety of industrial, manufacturing, and design engineering career opportunities.

After completing a basic core of fundamental courses in mathematics, physical sciences, and engineering sciences, each Systems Engineering student undertakes a major which includes courses in computer science, electronic circuits, operations research, computer simulation, microprocessors, engineering economics, digital system design, microcomputer fundamentals, and integrated production control. Technical electives may be selected to allow the student to acquire concentrated knowledge in electrical engineering, industrial engineering, or computer science.

The following courses are required as a part of the mathematics requirement and the engineering core:

			Semester Hours
CSC	421	Microcomputer Fundamentals..	3
ECE	352	Semiconductors and Devices....	3
or ECE 350		Structure and Properties of Materials..............................	3
ECE	383	Probability & Statistics for Engineers.............................	2
MAT	242	Linear Algebra...........................	2

In addition, the following courses are required:

CSC	220	Computer Org. and Assembly Programming.......................	4
CSC	320	Computer Arch.	4
CSC	422	Microcomputer System Design.	4
EEE	302	Electrical Networks II................	3
EEE	303	Signals and Filters......................	3
EEE	455	Communication Systems...........	4
EEE	480	Feedback Systems......................	4
IEE	300	Economic Analysis for Engineers...............................	2
IEE	461	Integrated Production Control..	3
IEE	475	Introduction to Simulation	3
IEE	476	Introduction to Operations Research Models	3
ASE	492	Project in Design and Development	3
Technical Electives..			10

Engineering Interdisciplinary Studies—B.S.

Business and Pre-Law. This program accommodates especially those engineering students whose primary intent is to earn a law degree (J.D.) or a graduate degree in business administration (M.B.A.). The success with which engineers have risen to positions of leadership in business and government is well established. It is predicted that with the rapid increase in technological advance on every hand, opportunities for engineers to enter business and legal careers will be enhanced to an even greater degree in the future.

The following course is required as a part of the General Studies requirement:

			Semester Hours
ECN	112	Microeconomic Principles.........	3

The following courses are required as a part of the mathematics requirement and the engineering core:

MAT	242	Elementary Linear Algebra........	2
IEE	463	Computer Aided Processes........	3

In addition, the following courses are required:

ACC	211	Elementary Accounting	3
ACC	212	Elementary Accounting	3
GNB	305	Business Law..............................	3
ASE	485	Engineering Statistics.................	3
CSC	304	Introduction to Cobol...............	3
FIN	300	Fundamentals of Finance..........	3
IEE	300	Economic Analysis for Engineers...............................	2
IEE	362	Work Analysis and Design........	3
		or IEE 422 Information Acquisition	
IEE	461	Integrated Production................	3
IEE	473	Systems Applications of Linear Programming........................	3
IEE	492	Project in Design and Development.........................	3
MGT	301	Principles of Management.........	3
MKT	300	Principles of Marketing	3
Engineering Technical Electives (including three courses of engineering science and one of engineering design type content)....			13

Geological Engineering. This program incorporates the joint application of engineering and geological principles to the planning, analysis and design of engineering projects directly related to the earth, its materials, structures and forces. The goal of the program is to investigate the physical properties of the shallow portions of the earth's crust which influence the design and construction of engineering structures such as foundations, excavations, dams, highways and sites for waste disposal. Additionally, the geological factors associated with land use planning and with the occurrence of petroleum and mineral deposits are encompassed within the program.

The following courses are required as a part of the engineering core:

			Semester Hours
ECE	351	Engineering Materials	3
CEE	450	Microcomputers in Civil Engineering	3

In addition, the following courses are required:

			Semester Hours
CEE	351	Soil Mechanics	4
CEE	452	Foundations	3
CEE	552	Geological Engineering	3
GLG	101	Physical Geology	3
GLG	103	Introduction to Geology Lab	1
GLG	310	Structural Geology	3
GLG	321	Mineralogy	4
GLG	323	Optical and X-Ray Techniques.	3
GLG	418	Geophysics	3
GLG	424	Petrology-Petrography	4
MAE	371	Fluid Mechanics	3
ASE	492	Project in Design and Development	3

Engineering Technical Electives (including two courses of engineering science and two courses of engineering design type content) (An approved summer engineering-geology field course is also highly recommended) . 14

Pre-Medical. In the past decade the interrelation between engineering and medicine has become vigorous and exciting. Our rapidly expanding technology dictates that engineering will continue to become increasingly involved in all branches of medicine. As this develops, so will the need for physicians trained in the engineering sciences—medical men and women with a knowledge of computer technology, operations research, electronics and cybernetics. This program emphasis would be of special interest to students desiring entry into a medical college and whose medical interests lie in research, aerospace and undersea medicine, artificial organs, prostheses, or biophysics. Since both engineering and medicine have as their goal the well-being of man, this program could be compatible with any field of medical endeavor.

The following courses are required as a part of the science and mathematics requirement and the engineering core:

			Semester Hours
CHM	116	General Chemistry	4
CHM	441	General Physical Chemistry	3
CHM	442	General Physical Chemistry	3

ECE	383	Probability and Statistics	2
CHE	461	Chemical Engrg Process Control	3

or CSC 220 Computer Organization & Assembly Language Programming (4)

or IEE 463 Computer Aided Processes (3)

or MAE 405 Microcomputer Aided Processes for Mechanical Engrs (3)

In addition, the following courses are required:

BIO	181	Biological Principles and Processes	4
BIO	182	Biological Principles and Processes	4
CHE	311	Material Balances	3
CHE	331	Transport Processes I: Fluids	3

or MAE 371 Fluid Mechanics

CHE	411	Biomedical Engineering I	3
CHE	412	Biomedical Engineering II	3
CHE	413	Physiological Instrumentation	3
CHE	492	Chemical Engineering Projects	2
CHM	113	General Chemistry	4
CHM	331	General Organic Chemistry	3
CHM	332	General Organic Chemistry	3
CHM	335	General Organic Chemistry Laboratory	1
CHM	336	General Organic Chemistry Laboratory	1
EEE	465	Clinical Nuclear Engineering	3

or CHE 513 Biomaterials (3)

ASE	496*	Professional Seminar	0

Approved Pre-Medical Elective 3

Engineering Technical Electives (including one course of engineering science and two of engineering design type content) 8

*Students must register for ASE 496 each semester.

Analysis and Systems

ASE 399 Cooperative Work Experience. (1) F,S
Usually involves two 6-month work periods with industrial firms or government agencies alternated with full-time semester and summer sessions studies. Prerequisites: At least 45 hours completed in major area with minimum 2.50 GPA; approval of instructor. Not open to students from other colleges on campus.

450 Entrepreneurial Engineering. (3) F
Innovation, strategy development, planning; market opportunity identification, fiscal responsibility, and operations start-up for new engineering ventures. Prerequisite: Junior standing.

460 Project in Entrepreneurship. (3) S
Preparation of plans for new-venture start up. Identification and evaluation of new venture opportunities. Selection of legal form of organization, drafting offering statement, sources of venture capital, cash flow projections. Prerequisite: ASE 450 or approval of instructor.

483 Probability for Engineers. (3) S
First course in applied stochastic processes. Special emphasis on applying theory developed for Markov and renewal processes to queueing, reliability, time series and social and behavioral problems. Prerequisite: ECE 383.

485 Engineering Statistics. (3) F, S, SS
Statistical methods applied to engineering problems. Estimation, tests of hypotheses, regression, correlation, analysis of variance and nonparametric statistics. Prerequisite: ECE 383.

492 Project in Design and Development. (2,3) F, S, SS
Individual project in creative design and synthesis. Prerequisite: Senior standing.

496 Professional Seminar. (0) F,S
Topics of interest to students in the engineering special and interdisciplinary studies.

582 Linear Algebra in Engineering. (3) F
Development and solution of systems of linear algebraic equations. Applications from mechanical, structural and electrical fields of engineering. Prerequisite: MAT 242 or equivalent.

586 Partial Differential Equations in Engineering. (3) S
Development and solution of partial differential equations in engineering. Applications in solid mechanics, vibrations, heat transfer. Prerequisites: MAT 242, 274; ECE 386.

Special Courses: ASE 294, 394, 484, 494, 498, 499, 591. (See pages 35-36.)

Chemical and Bio Engineering

CHE 311 Material Balances. (3) F, S
Principles of physics and chemistry applied to the formulation of material balances. Prerequisites: CHM 116; MAT 291 or MAT 271.

312 Introduction to Thermodynamics. (3) F, S
Energy balance calculations and introduction of thermodynamic principles. Prerequisite: CHE 311.

331 Transport Phenomena I: Fluids. (3) F, S
Transport phenomena with emphasis on fluid systems. Prerequisites: MAT 274; PHY 116; CHE 311

332 Transport Phenomena II: Energy Transfer. (3) F, S
Continuation of transport principles with emphasis on energy transport in stationary and fluid systems. Prerequisite: CHE 312, 331

333 Transport Phenomena III: Mass Transfer. (3) F, S
The application of transport phenomena to mass transfer and the design of mass transfer equipment. Prerequisite: CHE 312, 331; Corequisite: CHE 332, 342

342 Applied Chemical Thermodynamics. (3) F, S
Energy relations and equilibrium conversions based on chemical potentials and phase equilibria. Prerequisite: CHE 312.

351 Measurements Laboratory. (2) F
Introduction to laboratory practices and the use of measurement devices. Prerequisite: CHM 116; Corequisite: CHE 311, CHM 335

352, 353 Transport Laboratories. (2,2) S
The demonstration of transport phenomena principles with experiments in fluid flow, heat and mass transfer. Prerequisite: CHE 331 for CHE 352; CHE 332 for CHE 353; Corequisite: CHE 333 for CHE 353

411 Biomedical Engineering I. (3) F
Review of diagnostic and prosthetic methods using engineering methodology. Introduction to transport, metabolic and autoregulatory processes in the human body. Prerequisite: approval of instructor.

412 Biomedical Engineering II. (3) S
Review of electrophysiology and nerve pacing applications, introduction to biomechanics and joint/limb replacement technology, cardiovascular and pulmonary fluid mechanics, application of mathematical modeling. Prerequisite: approval of instructor.

413 Physiological Instrumentation. (3) S
Problems, concepts and techniques of biomedical instrumentation in static and dynamic environments. Prerequisite: ZOL 360 or AGB 435 or equivalent. Lecture and laboratory.

432 Principles of Chemical Engineering Design. (3) F
Sizing of unit operations equipment, such as fractionators, strippers, absorbers, and extractors, with applications to complex industrial processes. Prerequisites: CHE 333, 342.

442 Chemical Reactor Design. (3) F, S
Application of kinetics to chemical reactor design. Prerequisites: CHE 342, Corequisite: CHE 333.

451 Chemical Engineering Laboratory. (2) F
Operation, control and design of experimental and industrial process equipment; independent research projects. Prerequisites: CHE 333, 352. Six hours laboratory.

458 Semiconductor Material Processing. (3) N
Introduction to the processing and characterization of electronic materials for semiconductor applications. Prerequisite: CHE 333 and CHE 342.

461 Process Control. (3) F
Process dynamics, instrumentation and feedback applied to automatic process control. Prerequisite: ECE 301. Lecture and laboratory.

462 Process Design. (3) S
Application of economic principles to optimize equipment selection and design; development and design of process systems. Prerequisites: CHE 432 and 442.

473 Industrial Chemistry. (3) S
Reaction systems as encountered in large scale operations. Typical examples from inorganic, organic, polymer, biochemical, fermentation, and electrochemical industries. Prerequisites: CHM 318 or 332 and CHM 442.

487 Applied Mathematics in Chemical Engineering. (3) S
Mathematical formulation of complex chemical engineering problems. Analytical and numerical solution of the resulting linear or non-linear, ordinary and partial differential equations. Prerequisites: MAT 274, CHE 332 and 342.

492 Chemical Engineering Projects. (1-5) S
Individual projects in chemical engineering operations and design. Prerequisite: Approval of instructor.

496 Professional Seminar. (0) F, S
Professional and ethical aspects with a discussion of employment opportunities and responsibilities. Lectures and field trips.

501 Introduction to Transport Phenomena. (3) F, S
Transport phenomena with emphasis on fluid systems.
Open only to transition students with approval of instructor.

502 Introduction to Energy Transport. (3) F, S
Continuation of transport principles with emphasis on energy transport in stationary and fluid systems. Open only to transition students with approval of instructor.

503 Introduction to Mass Transport. (3) F, S
The application of transport phenomena to mass transfer and the design of mass transfer equipment. Open only to transition students with approval of instructor.

504 Introduction to Chemical Thermodynamics. (3) F, S
Energy relations and equilibrium conversions based on chemical potentials and phase equilibria. Open only to transition students with approval of instructor.

505 Introduction to Chemical Reactor Design. (3) F, S
Application of kinetics to chemical reactor design. Open only to transition students with approval of instructor.

515 Physiological Transport Processes. (3) N
Analysis of heat, mass, momentum and electrical energy transfer in mammals, derivation of both microscopic and macroscopic models based on current research.

517 Prosthetic and Diagnostic Engineering. (3) N
Criteria for mechanical replacement or assistance of organ functions; diagnostic methods, equipment and usage; existing methodology and future requirements, including detailed designs.

518 Introduction to Biomaterials. (3) F
Topics include structure property relationships for synthetic and natural biomaterials, biocompatibility and uses of materials to replace body parts.

527 Advanced Applied Mathematical Analysis in Chemical Engineering. (3) F
Formulation and solution of complex mathematical relationships resulting from the description of physical problems in mass, energy, and momentum transfer, and chemical kinetics.

528 Process Optimization Techniques. (3) S
Method for optimizing engineering processes. Experimental design and analysis; linear and non-linear regression methods; classical, search, and dynamic programming algorithms.

533 Transport Processes I. (3) F
Unified treatment of momentum, heat and mass transfer from molecular theory and continuum points of view. Continuum equations of microscopic and macroscopic systems, multicomponent and multiphase systems.

534 Transport Processes II. (3) S
Continuation of CHE 533 emphasizing mass transfer. Prerequisite: CHE 533.

535 Turbulent Mixing. (3) N
Turbulence and mixing in multicomponent systems with/without chemical reactions. Computational models applied to chemical processes. Prerequisite: CHE 533.

536 Convective Mass Transfer. (3) N
Turbulent flow for multicomponent systems including chemical reactions with applications in separations and air pollution. Prerequisite: CHE 533 or MAE 571.

543 Thermodynamics of Chemical Systems. (3) F
Classical and statistical thermodynamics of non-ideal physicochemical systems and processes; prediction of optimum operating conditions.

544 Chemical Reactor Engineering. (3) S
Reaction rates, thermodynamics, and transport principles applied to the design and operation of chemical reactors. Prerequisite: CHE 543.

548 Topics in Catalysis. (3) N
Engineering catalysis emphasizes: adsorption, kinetics, characterization, diffusional considerations, and reactor design. Other topics: mechanisms, surface analyses and electronic structure.

553 Air and Water Quality Control. (3) N
Origins of pollutants; environmental interactions, and concerns. Physical and chemical processes including dispersion, particle mechanics, filtration, sampling, sedimentation, coagulation, flotation, absorption. Control technology.

554 New Energy Technology. (3) N
Gasification, liquefaction pyrolysis and combustion processes for coal, wastes, other raw materials. In-situ processes for coal, oil, shale and geothermal energy. Environmental quality issues.

556 Separation Processes. (3) N
Topics in binary/multicomponent separation, rate governed and equilibration processes, mass transfer criteria, energy requirements, separating agents and devices, staged operations.

558 Electronic Materials. (3) N
Processing and characterization of electronic materials for semiconductor type uses. Thermodynamics and transport phenomena, phase equilibria and structure, mass transfer, diffusion and thermal properties.

561 Advanced Process Control. (3) S
Dynamic process representation, linear optimal control, optimal state reconstruction, parameter and state estimation techniques for continuous and discrete time systems.

562 Chemical Systems Engineering. (3) N
Process dynamics, systems analysis, computer applications, process control.

563 Chemical Engineering Design. (3) N
Computational methods; the design of chemical plants and processes.

Special Courses: CHE 484, 494, 498, 499, 584, 590, 591, 592, 593, 594, 598, 599, 792, 799. (See pages 35-36.)

Civil Engineering

CEE 296 Introduction to Civil Engineering. (1) F, S
Introduction to the profession. Description of areas of specialization. Degree requirements, academic standing and advising procedures. Introduction to lab facilities. Prerequisite: Freshman standing.

310 Testing of Materials for Construction. (3) F, S
Structural and behavioral characteristics, engineering properties, measurements and application of construction materials. *Not open to engineering students.* Prerequisite: CON 323 or equivalent. Lecture and laboratory.

321 Structural Analysis. (3) F, S
Statically determinate and indeterminate structures by classical and matrix methods: trusses, beams, and frames. Prerequisite: same as CEE 322 except ECE 351 and MAE 371. Two lectures, 2 hours recitation.

322 Steel Structures. (3) F, S
Behavior of structural components and systems. Design of steel members and connections. Partial design of a steel building system. Prerequisite: CEE 321 and completion of the Engineering Core (except electrical and communications courses) with an average grade of C or better, plus at least a C in MAT 290 and 291, ECE 211, 312, 314, and MAT 274 (or equivalent), and an offi-

cial TOEFL score of at least 550 if an international student. Two lectures, 2 hours recitation.

323 Concrete Structures.(3) F, S
Behavior of concrete structures. Design of reinforced and prestressed concrete members including footings. Partial design of concrete building system. Prerequisite: Same as CEE 322. Two lectures, 2 hours recitation.

341 Surveying. (3) F, S
Theory and field work in construction and land surveys. Prerequisite: MAT 118. Two lectures, 3 hours laboratory.

344 Route Surveying. (3) S
Simple, compound and transition curves; reconnaissance, preliminary and location surveys. Calculation of earthwork. Solar observations for azimuth. Prerequisite: CEE 341. Two lectures, 3 hours laboratory.

351 Soil Mechanics. (4) F, S
Index properties and engineering characteristics of soils. Compaction, permeability and seepage, compressibility and settlement, and shear strength. Prerequisite: Same as CEE 322. Three lectures, 3 hours laboratory.

361 Environmental Engineering. (3) F, S
Natural environment, water resources, hydrologic cycle, chemistry of natural waters, quality requirements and water treatment, water distribution systems. Prerequisite: Same as CEE 322. Corequisite: CEE 381.

362 Environmental Engineering. (3) F, S
Natural environment, the carbon cycle and biochemistry of wastes, principles of waste treatment, drainage systems. Prerequisite: Same as CEE 322. Corequisite: CEE 381.

371 Urban Problems. (3) F
Problems of the modern urban environment. Concepts of comprehensive planning. History of urban development, transportation, public service, zoning, land division, urban renewal, neighborhood planning. Not acceptable as a technical elective for CEE students. (Also listed as PUP 301.)

372 Transportation Engineering. (3) F, S
Highway, rail, water and air transportation. Operational characteristics and traffic control devices of each transport mode. Impact on urban form. Prerequisite: Same as CEE 322.

380 Hydraulics and Hydrology. (3) F, S
Application of hydraulic engineering principles to flow of liquids in pipe systems and open channels; hydrostatics; characteristics of pumps and turbines. Introduction to hydrology. Not open to engineering students. Prerequisite: CON 221. Two lectures, 3 hours laboratory.

381 Hydraulic Engineering. (4) F, S
Fundamental principles and methods of fluid mechanics forming analytical basis for water resources engineering. Flow in conduits and open channels. Introduction to hydrology. Prerequisite: MAE 371. Three lectures, 3 hours laboratory.

400 Microcomputers in Civil Engineering. (3) F, S
Microcomputer applications to analysis and design problems in Civil Engineering. Prerequisite: ECE 106.

412 Pavement Analysis and Design. (3) F
Design of flexible and rigid pavements for highways and airports. Surface, base, subgrade courses. Cost analysis and pavement selection. Prerequisites: ECE 351; CEE 351.

423 Structural Design. (3) F, S
Analysis and design of structural systems. Prerequisite: CEE 322, 323. Two lectures, 3 hours laboratory.

432 Matrix and Computer Applications in Structural Engineering. (3) S
Matrix and computer applications to structural engineering and structural mechanics. Stiffness and flexibility methods, finite elements, differences. Prerequisite: CEE 321.

450 Soil Mechanics in Construction. (3) F, S
Soil mechanics as applied to the construction field: foundations, highways, retaining walls and slope stability. Relationship between soil characteristics and geologic formations. Not open to engineering students. Prerequisite: CON 323. Lecture and laboratory.

452 Foundations. (3) F, S
Applications of soil mechanics to foundation systems, bearing capacity, lateral earth pressure, slope stability. Prerequisite: CEE 351.

466 Sanitary Systems Design. (3) F
Capacity, planning and design of water supply, domestic and storm drainage, and solid waste systems. Prerequisite: CEE 361 or 362.

471 Planning and Design of Urban Systems. (3) F
For students in city planning, urban systems, civil engineering and related areas working as interdisciplinary planning and design teams. Effect of economic base, employment and population on urban land use requirements. Location and required capacity of urban systems to serve urban land uses. Prerequisite: senior standing. Two lectures, 3 hours laboratory.

475 Highway Geometric Design. (3) S
Design of the visible elements of the roadway. Fundamental design controls with application to rural roads, at-grade intersections, freeways and interchanges. Prerequisite: CEE 372. Two lectures, 2 hours recitation.

481 Water Resources Engineering. (3) S
Application of the principles of hydraulics and hydrology to the engineering of water resources projects; design and operation of water resources systems; water quality. Prerequisite: CEE 381.

496 Topics in Civil Engineering Practice. (1) F, S
Professional engineering practice. Interviewing and resume writing, professional registration requirements, continuing education, graduate study, financial planning and employment. Prerequisite: Senior standing.

512 Pavement Performance and Management. (3) S
Dynamic response of flexible and rigid pavements to highway and airport loading. Pavement evaluation, maintenance, rehabilitation. Pavement management systems. Prerequisite: CEE 412.

514 Bituminous Materials and Mixtures (3) F
Types of bituminous materials used in pavement mixtures. Chemical composition and physical properties, desirable aggregate characteristics, optimum asphalt contents. Two hours lecture and 3 hours lab. Prerequisite: ECE 351.

515 Design and Behavior of Portland Cement Concrete Mixtures. (3) S
Properties of cements and aggregates. Mix design for strength and durability requirements. Failures caused by chemical reaction, weathering, and loading. Prerequisite: ECE 351.

521 Stress Analysis. (3) F
Advanced topics in the analytical determination of stress and strain. Prerequisite: CEE 321.

524 Advanced Steel Structures. (3) S
Strength properties of steel and their effects on structural behavior. Elastic design of steel structures. Plastic analysis and design of beams, frames and bents. Plastic deflections. Plastic design requirements. Multistory buildings. Prerequisite: CEE 322.

526 Finite Element Methods in Civil Engineering. (3) F
Finite element formulation for solutions of structural, geotechnic, and hydraulic problems. Prerequisite: CEE 432.

527 Advanced Concrete Structures. (3) F
Elastic, ultimate strength and yield line theory. Deflection, torsion, shrinkage and plastic flow. Prestressed concrete; special systems. Prerequisite: CEE 323.

528 Stability of Structures. (3) F
Elastic and inelastic buckling of rolled and cold-formed columns and beams. Stability of plates, rigid frames and trusses. Prerequisite: CEE 322 and permission of instructor.

529 Complex Structures. (3) S
Classical and numerical investigations of linear and non-linear structures composed of flat and curved surfaces, and linear or curvilinear elements. Prerequisite: CEE 323.

531 Theory of Structures. (3) F
General theorems relating to elastic systems; deflection of trusses and beams; statically indeterminate trusses, beams, rings, arches, and frames by consistent deformation, least work and elastic center; horizontally curved members in bending and torsion. Prerequisite: CEE 322, 323.

536 Dynamics of Structures. (3) S
Structures and structural members subjected to dynamic loadings; response spectra theory emphasizing earthquake applications; investigations of the response of multi-degree of freedom structures; matrix methods of analysis. Two lectures, 2 hours recitation. Prerequisite: CEE 322, 323 and permission of instructor.

537 Topics in Structural Engineering. (1-3) F, S
Advanced topics including wind engineering, earthquake engineering, probabilistic concepts, optimization and behavior of structural systems. Prerequisite: CEE 322, 323 and permission of instructor.

552 Geological Engineering. (3) S
Geological investigations for engineering purposes, case histories, geologic structure, weathering, remote sensing, geophysics, airphoto interpretation for engineering site locations. Prerequisite: CEE 351. Three hours lecture, field trips required.

553 Advanced Soil Mechanics. (3) S
Application of theories of elasticity and plasticity to soils, theories of consolidation, failure theories, response to static and dynamic loading. Corequisite: CEE 452. Prerequisite: CEE 557B. Three hours lecture.

554 Shear Strength and Slope Stability. (3) F
Shear strength of saturated and unsaturated soils strength-deformation relationships, time-dependent strength parameters, effects of sampling, advanced slope stability. Corequisites: CEE 452 and 557B. Three hours lecture.

555 Applied Soil Mechanics. (3) S
Deep foundations, braced excavations, anchored bulkheads, reinforced earth, underpinning, and dewatering. Corequisite: CEE 452. Three hours lecture.

556 Seepage and Earth Dams. (3) F
Transient and steady state fluid flow through soil, confined and unconfined flow, pore water pressures, and application to earth dams. Prerequisite: CEE 351. Corequisite: CEE 554. Three hours lecture.

557 *Topics in Soil Mechanics and Foundations.* (3) F, S
  (a) Soil Behavior (S)
  (b) Advanced Soil Mechanics Laboratory (F)
  (c) Numerical Methods (F'86)
  (d) Earthquake Engineering (F'85)

May be repeated for credit by using different sections.

561 Physical-Chemical Treatment of Water and Waste. (3-4) F
Theory and design of physical and chemical processes for the treatment of water and waste waters. Prerequisite: CEE 361 or equivalent.

562 Environmental Biochemistry and Waste Treatment. (3-4) S
Theory and design of biological waste treatment systems. Pollution and environmental assimilation of wastes. Prerequisite: CEE 362 or equivalent.

563 Environmental Chemistry Laboratory. (3) S
Analysis of water, domestic and industrial wastes, laboratory procedures for pollution evaluation and the control of water and waste treatment processes. Prerequisite: CEE 361 or 362. One lecture, 5 hours laboratory.

564 Industrial Hygiene. (2-4) F
Survey methods, legal and physiological aspects of occupational health hazards. Methods of measurement and analysis and physiological actions of such contaminants as toxic gases, mineral dusts, metals and their compounds, and industrial solvents.

574, 575 Traffic Engineering. (3,3) F, S
Operator and vehicle characteristics, street capacity, *signals, signs and markings, etc.* All phases of traffic engineering as applied to urban areas. Prerequisite: CEE 372.

576 Airport Engineering. (3) F
Planning and design of airport facilities. Effect of aircraft characteristics, air traffic control procedures, and aircraft demand for runway and passenger handling facilities, on site selection, runway configuration and terminal design. Prerequisite: CEE 372.

577 Urban Transportation Planning. (3) S '86
Application of land use parameters traffic generation theory, traffic distribution and assignment models, transit analysis and economic factors to the solution of the urban transportation problem. Prerequisite: CEE 372.

578 Highway Engineering, Planning and Economics. (3) S '87
Highway transportation including design, operation, planning, environmental impact, economic feasibility and financing. Highways as a regional system. Prerequisite: CEE 372.

579 Groundwater Hydrology. (3) F
Physical properties of aquifers; groundwater exploration, well construction and pumping; subsurface flow modelling; land subsidence, groundwater pollution and water rights. Prerequisite: CEE 381 or approval of instructor.

581 Surface Water Hydrology. (3) S '87
Hydrologic cycle and mechanisms, including precipitation, evaporation and transpiration; hydrograph analysis; flood routing; statistical methods in hydrology, hydrologic design. Prerequisite: CEE 381 or approval of instructor.

582 Free Surface Hydraulics. (2) S '87
Derivation of one-dimensional equations used in open channel flow analysis. Computations for uniform and nonuniform flows; unsteady flow; flood routing. Mathematical and physical models. Prerequisite: CEE 381.

583 Water Resources Systems Planning. (2) F '85
Philosophy of water resources planning; economic, social and engineering interaction; introduction to the theory and application of quantitative planning methodologies in water resources planning. Guest lecturers and case studies. Prerequisite: approval of instructor.

584 Foundations of Hydraulic Engineering. (2) F '86
Review of incompressible fluid dynamics. Flow in pipes
and channels; unsteady and varied flows; wave motion.
Prerequisites: CEE 381.

585 Principles of River Engineering. (2) F '85
Uses of rivers, study of watershed and channel pro-
cesses. Sediment sources, yield and control; hydrologic
analysis. Case studies. Prerequisites: CEE 381 or ap-
proval of instructor.

586 Water Resources Systems I. (3) S '86
Theory and application of quantitative planning
methodologies for the design and operation of water
resources systems; class projects using computer;
case studies Corequisite: CEE 583 or approval of in-
structor.

587 Water Resources Systems II. (3) F '86
Advanced computer-oriented workshop in the applica-
tion of quantitative planning techniques to the design
and operation of water resources systems. Prerequi-
site: CEE 586.

588 Sedimentation Engineering. (2) S '86
Introduction to the transportation of granular sedimen-
tary materials by moving fluids. Degradation, aggrega-
tion and local scour in alluvial channels. Mathematical
and physical models. Prerequisite: CEE 585 or approval
of instructor.

Special Courses: CEE 484, 494, 498, 499, 580, 584, 590,
591, 592, 594, 598, 599, 792, 799. (See pages 35-36.)

Students enrolled in CEE 580, 584, 590, 592, 599, 792
and 799 are required to attend graduate student
seminars at time shown in class schedule. Each
semester, every graduate student enrolled for more
than 6 credit hours is to enroll for at least 1 credit hour
of CEE 592, 599, 792 or 799. Each civil engineering
graduate student holding an appointment as a Teaching
or Research Assistant or Associate is to enroll for 1
credit hour of CEE 580; such credit does not apply
toward graduation.

Electrical and Computer Engineering

EEE 302 Electrical Networks II. (3) F, S, SS
Analysis of linear and nonlinear networks. Analytical
and numerical methods. Prerequisite: ECE 301.

303 Signals and Filters. (3) F, S, SS
Filtering and spectral analysis in continuous and dis-
crete systems. Prerequisite: EEE 302.

321 Digital Computer Fundamentals I. (4) F, S, SS
Combinational and sequential logic network design.
Data representations and arithmetic unit operations. In-
troduction to microcomputer programming and opera-
tion. Prerequisite: ECE 105 or CSC 100. Three lectures,
3 hours laboratory. (Also listed as CSC 220.)

322 Digital Computer Fundamentals II. (4) F, S
Continuation of EEE 321. Microcomputer system or-
ganization and operation, I/O device operation, I/O pro-
gramming and interfacing. Memory systems, Microcom-
puter applications. Prerequisite: EEE 321. Three lec-
tures, 3 hours laboratory. (Also listed as CSC 320.)

340 Electromagnetic Engineering I. (3) F, S, SS
Static and time varying vector fields; boundary value
problems; dielectric and magnetic materials. Maxwell's
equations; boundary conditions; uniform plane waves.
Prerequisites: PHY 116; MAT 362.

360 Electromechanics. (3) F, S
The ac and dc operations of magnetic circuits, per-
manent magnets, transformers, incremental motion
electromechanical systems, dc machines, induction ma-
chines, synchronous machines, control of electrical ma-
chines. Prerequisite: ECE 301.

396 Professional Seminar. (0) F, S
Topics of interest to upper division electrical engineers.
Prerequisite: junior standing. One lecture.

405 Filter Design. (3) N
Principles of active and passive filter design. Time and
frequency domain approximations. Prerequisite: EEE
303 or equivalent.

406 Computer-Aided Design. (3) N
Principles and application of modern CAD techniques
to solve engineering problems; includes independent
project. Prerequisite: EEE 303 or equivalent.

422 Digital Computer Design I. (3) F, S
Logical design and internal operation of processing and
control units of a computer. Data representations. Rela-
tion to memory and I/O units. Prerequisite: EEE 322. (Al-
so listed as CSC 422).

423 Digital Computer Design II. (4) F, S
Computer organization emphasizing interface to memo-
ry and I/O. Interrupt structures, bussing, I/O, memory
technology and hierarchy. Hardware/software interface.
Prerequisite: EEE 422. Three lectures, 3 hours labora-
tory. (Also listed as CSC 423).

424 Computer Structures I. (3) F, S
Evolution of main-line architectures. Instruction sets,
addressing modes, and control structures. Character-
ization of computer architectures. Performance evalua-
tion. Prerequisite: EEE 423. (Also listed as CSC 321).

425 Digital Systems Circuits. (4) F, S
Analysis of saturating and non-saturating logic families
including TTL, Schottky TTL, ECL, IIL, NMOS and
CMOS. Selected MSI/LSI/VLSI topics including me-
mories, A/D and D/A converters. Prerequisites: ECE
334; EEE 322. Three lectures, 3 hours laboratory.

427 Digital Switching Theory. (3) S
Combinational logic, functional decomposition, NAND
(NOR) circuit analysis and synthesis, logic arrays, itera-
tive networks, fault diagnosis, sequential circuit repre-
sentation, memory devices. Prerequisite: EEE 322. (Al-
so listed as CSC 451).

428 Digital Electronics Laboratory. (3) F, S
Project oriented laboratory. Each student will complete
several digital design projects during the semester. Pre-
requisite: EEE 322, One lecture, 6 hours laboratory.

432 Analog Design Laboratory. (3) F, S
Project oriented laboratory. Each student will complete
several design projects during the semester. Prerequi-
site: ECE 334, One lecture, 6 hours laboratory.

433 Analog Circuit Design. (4) A
Design of electronic circuits including amplifiers, mix-
ers, waveform generators and active filters. Prerequi-
site: EEE 302 or equivalent. Three lectures, 3 hours lab-
oratory.

434 Quantum Mechanics for Engineers. (3) N
Probability, Schroedinger equation, eigenfunctions, har-
monic oscillator, periodic potential, superposition, an-
gular momentum, scattering, tunneling, perturbation
theory. Prerequisite: EEE 340.

435 Microelectronics. (3) S
Practice of solid state device fabrication techniques in-
cluding thin film and integrated circuit fabrication princi-
ples. Prerequisite: EEE 436 or equivalent. Two lectures,
3 hours laboratory.

436 Fundamentals of Solid State Devices. (3) F, S
Metal-semiconductor contacts, P-N junctions, light interacting devices. Schottky diodes, bipolar and field effect transistors, planar and thin film integrated circuit (I-C) devices. Prerequisite: ECE 352.

440 Electromagnetic Engineering II. (4) F, S
Coaxial and waveguide transmission lines; matching techniques; plane waves in lossy media; polarization; reflection and refraction; electromagnetic system concepts; radiation. Prerequisites: EEE 340, ECE 105 and ECE 301 or equivalent. 3 lectures, 3 hours laboratory.

441 Advanced Engineering Electromagnetics. (3) N
Polarization. Magnetization. High frequency impedance. Propagation. Reflection. Radiation. Guided waves. Slow waves. Anisotropic media. Resonators. Prerequisite: EEE 340.

443 Antennas. (3) N
Fundamental parameters; engineering principles, radiation integrals; linear wire antennas; loops, arrays; numerical computations; measurements. Prerequisite: EEE 440 or equivalent.

445 Microwaves. (4) N
Waveguides; circuit theory for waveguiding systems; microwave devices, systems, and energy sources; striplines and microstrips. impedance matching transformers; measurements. Prerequisite: EEE 440 or equivalent. Three lectures, 3 hours laboratory.

448 Fiber Optics. (4) F
Principles of fiber-optic communications. Prerequisites: EEE 303, 340. Three lectures, 3 hours laboratory.

451 Error-Correcting Codes. (3) N
Application of modern algebra to the analysis and synthesis of random error-detecting and error-correcting block codes. Prerequisite: EEE 321.

455 Communication Systems. (4) F, S
Signal analysis. Linear, exponential, and pulse modulation. Comparative analysis of circuits and systems. Prerequisite: EEE 303. Three lectures, 3 hours laboratory.

459 Data Communication Systems. (3) N
System characteristics. Communications media. Communication codes. Data validity checking. Line protocols, terminals, system configurations. Examples. Prerequisites: EEE 303, 322.

460 Introduction to Nuclear Engineering. (3) F
Neutron interactions with matter. Principles of neutron chain reacting systems. Neutron diffusion and moderation. Heat removal from nuclear reactors. Point reactor kinetics. Prerequisite: PHY 361. (Also listed as MAE 430).

461 Health Physics Principles and Radiation Measurements. (3) S
Sources, characteristics, dosimetry, shielding and measurement techniques for natural and man-made radiation. Philosophy of radiation protection. Emphasis on instrumentation, detectors, and environmental monitoring. Two lectures, 3 hours laboratory. Prerequisite: ECE 301.

462 Reactor Safety Analysis. (3) S
Power reactor safety and licensing methodologies. Reactor transient and accident analysis. Time dependent solution to neutron diffusion equation. Use of industry codes to assess fission product build up, emergency core cooling behavior, reactivity, offsite releases and dose calculations. Prerequisite: EEE 460.

463 Electric Power Plant Systems. (3) F
Nuclear and fossil fuel steam supply system, electrical generating system, and pollution control system design. Theory of machinery and component design. Power plant efficiencies. Prerequisites: ECE 301, 340.

464 Nuclear Engineering Experiments. (3) F
Theory and applied concepts in reactor design, instrumentation, electronics, and shielding. Experimental measurements of nuclear parameters using subcritical reactors and fusion neutron generator. Fast and thermal activation analysis. Primary coolant analysis. Mossbauer spectrometry. Two lectures, 3 hours laboratory. Corequisite: EEE 460.

465 Clinical Nuclear Engineering I. (3) N
Fundamentals of clinical nuclear engineering and medical health physics practice. Radiation biology, dosimetry and shielding for radiotherapy and diagnostic procedures. Prerequisite: Approval of instructor.

470 Power System Fundamentals. (3) F
Basic power system analytical concepts, three phase systems, phasors, impedance, steady state network analysis, normalization, transmission lines, transformers, synchronous machines, power flow. Prerequisite: EEE 302 or equivalent.

471 Power System Analysis. (3) F
Introduction to symmetrical components, faulted system analysis, protection and stability. Prerequisite: EEE 470 or equivalent.

473 Electrical Machinery. (3) F
Fundamentals of transformers and rotating machines: dc, induction, and synchronous machines. Prerequisite: EEE 360 or equivalent.

480 Feedback Systems. (4) F, S
Analysis and design of linear feedback systems. Frequency response and root locus techniques, series compensation and state variable feedback. Prerequisite: EEE 303. Three lectures, 3 hours laboratory.

482 Digital Simulation of Continuous Systems. (3) N
System representation, continuous system simulation languages, operational and numerical methods. Prerequisite: EEE 303.

504 Filter Synthesis. (3) N
Synthesis of active and passive filters. Methods of approximation in the time and frequency domains. Sensitivity and optimization. Prerequisite: EEE 405 or equivalent.

505 Signal Processing of Time Series I. (3) F
Time and frequency domain characterization of deterministic time series. Linear operators, Fourier and z-transforms, digital filter synthesis, system modeling. Prerequisite: EEE 303.

506 Signal Processing of Time Series II. (3) S
Study of random time series, autocorrelation sequence, power spectral density, optimum filters, spectral analysis, rational modeling of stationary time series. Prerequisite: EEE 505.

508 Digital Image Processing I. (3) F
Digital image fundamentals, image transforms, image enhancement and restoration techniques, image encoding and segmentation methods. Prerequisite: EEE 303. (Also listed as CSC 508).

509 Digital Image Processing II. (3) S
Advanced analytical techniques applied to digital image processing problems. Prerequisite: EEE 508. (Also listed as CSC 509).

511 Hardware/Software Integration. (3) N
The engineering design process applied to the integration of hardware and software in systems design. Applications, including real-time systems. Prerequisites: EEE 424. Lecture and laboratory. (Also listed as CSC 428).

513 High-Level-Language Machines. (3) N
Advantages and disadvantages of high-level-language machines. Language suitability. Microprogramming and interpretive execution. I/0 operations. Examples. Prerequisites: EEE 511, 523, 524. (Also listed as CSC 527).

514 Hardware Design Languages. (3) N
Introduction to hardware design language (HDL). HDL description of integrated circuit components and systems. HDL description of computer organizations. Prerequisite: EEE 424. (Also listed as CSC 518).

515 Digital Testing and Reliability. (3) N
Fault modeling, test generation and simulation for combinational and sequential circuits; memory testing, self-checking logic, fault-tolerant logic, reliability analysis. Prerequisite: EEE 321. (Also listed as CSC 516).

516 Digital Design Automation. (3) F, S
Typical computer-aided design system. Simulation techniques. Test generator. Microprogrammed control design aids. Specification sheet analysis. Applications. Prerequisites: EEE 514. (Also listed as CSC 517).

520 Minicomputers I. (4) F
Organization of minicomputers, with "hands on" emphasis of one particular design. Prerequisite: EEE 423 or equivalent. Three lectures, 3 hours laboratory. (Also listed as CSC 519).

521 Minicomputers II. (4) S
Organization of minicomputer operating system with emphasis on the Unix operating system on the laboratory computer. Prerequisite: EEE 520. Three lectures, 3 hours laboratory. (Also listed as CSC 530).

522 System Design Using Microprocessors. (4) N
Hardware, software, and interface considerations in the design of microprocessor applications. Prerequisite: EEE 423 or equivalent. Three lectures, 3 hours laboratory. (Also listed as CSC 523).

523 Microprogramming. (3) N
Control unit functions, instruction sets and microcode implementation, interpretation and emulation, LSI hardware, case studies. Prerequisite: EEE 423 or equivalent. (Also listed as CSC 522).

524 Computer Structures II. (3) N
Main-line computer architectures; multiprogramming, timesharing, multiprocessing, hardware/software tradeoffs, memory hierarchies, input/output structures, communications. Prerequisite: EEE 424. (Also listed as CSC 524).

525 VLSI Design. (3) F
Analysis and design of Very Large Scale Integrated Circuits (VLSI). Physics of small devices, fabrication, regular structures, and system timing. Open only to graduate students.

526 Parallel Processing. (3) S
Real and apparent concurrency. Hardware organization of multiprocessors, multiple computer systems, scientific attached processors and other parallel systems. Prerequisite: EEE 424. (Also listed as CSC 526).

527 Advanced Switching Theory. (3) F
Lattice approach to Boolean algebra, post algebras, Boolean differential calculus, multivalued logic, fuzzy logic, finite state machines. Prerequisite: EEE 427. (Also listed as CSC 554).

528 Bit Slice Processor Design. (4) A
Hardware and software design of a bit-slice computer with writable control store. Prerequisite: EEE 423 or equivalent. Three lectures, 3 hours laboratory. (Also listed as CSC 529).

531 Semiconductor Device Theory I. (3) F
Transport and recombination theory, pn and Schottky barrier diodes, bipolar and junction field-effect transistors, MOS capacitors and transistors. Prerequisite: EEE 436 or equivalent.

532 Semiconductor Device Theory II. (3) S
Advanced MOSFETs, charge-coupled devices, solar cells, photodetectors, light-emitting diodes, microwave devices, modulation-doped structures. Prerequisite: EEE 531.

533 Integrated Circuit Design. (3) F
Integrated circuit fabrication, device modeling, active and passive parasitics. Comparison of integrated and discrete circuits. Characterization and design of integrated logic and small-signal circuits. Prerequisite: EEE 436 or equivalent.

535 Solar Cells. (3) F
Photovoltaic devices including homojunctions and heterojunctions. Photogeneration of carriers, spectral response, electrical characteristics, efficiency. Prerequisite: EEE 436.

536 Semiconductor Characterization. (3) N
Measurement techniques for semiconductor materials and devices. Electrical, optical, physical and chemical characterization methods. Prerequisite: EEE 436 or equivalent.

537 Semiconductor Optoelectronics I. (3) F
Electronic states in semiconductors, quantum theory of radiation, absorption processes, radiative processes, non-radiative processes, photoluminescence, photonic devices. Prerequisite: EEE 434.

538 Semiconductor Optoelectronics II. (3) S
Material and device physics of semiconductor lasers, light emitting diodes, photodetector, etc. Emerging material and device technology in III-V semiconductors. Prerequisite: EEE 537.

539 Introduction to Solid State Electronics. (3) F
Crystal lattices, reciprocal lattices, quantum statistics, lattice dynamics, equilibrium and nonequilibrium processes in semiconductors. Prerequisite: ECE 334.

541 Electromagnetic Fields and Guided Waves. (3) S
Polarization and magnetization; electrical properties of dielectric, conducting, anisotropic and semiconducting media; duality, uniqueness, image theory, equivalence principle and reciprocity. Prerequisite: EEE 440 or equivalent.

542 Selected Microwave Devices. (3) N
Use of ferrite, semiconductor and piezoelectric materials in microwave systems. Prerequisites: ECE 352 and EEE 445 or equivalent.

543 Antenna Analysis and Design. (3) F
Impedances; broadband antennas; frequency independent antennas; miniaturization; aperature antennas; horns; reflectors; lens antennas; continuous sources design techniques. Prerequisite: EEE 443 or equivalent.

545 Microwave Circuit Design. (3) S
Analysis and design of microwave attenuators, in-phase and quadrature-phase power dividers, magic tee's, directional couplers, phase shifters, DC blocks, equalizers, etc. Prerequisite: EEE 445 or approval of instructor.

547 Microwave Solid State Circuit Design I. (3) F
Application of semiconductor characteristics to practical design of microwave mixers, detectors, limiters, switches, attenuators, multipliers, phase shifters, and amplifiers. Prerequisite: EEE 545 or approval of instructor.

548 Coherent Optics. (3) N
Diffraction, lenses, optical processing, holography, electro-optics, lasers. Prerequisite: EEE 440.

549 Lasers. (3) N
Theory and design of gas, solid and semiconductor lasers. Prerequisite: EEE 448 or approval of instructor.

550 Transform Theory and Applications. (3) A
Applications of complex variables to Fourier, Laplace, and z-transforms. Oriented to applications in control, network, communication, and linear system theory. Prerequisite: EEE 303.

551 Information and Coding Theory. (3) N
Fundamental theorems of information theory for sources and channels; convolutional and burst codes. Prerequisites: EEE 451, 554.

552 Coherent Communications. (3) N
Systems analysis and design of telecommunication systems using phase-locked loops. Prerequisite: EEE 554.

553 Pattern Recognition. (3) N
Pattern classification by distance functions and likelihood functions, deterministic and statistical approaches to trainable pattern classifiers, syntactic pattern recognition. Prerequisite: EEE 554. (Also listed as CSC 572.)

554 Random Signal Theory I. (3) F
Application of statistical techniques to the representation and analysis of electrical signals and to communication systems analysis. Prerequisite: EEE 303.

555 Random Signal Theory II. (3) S
Processing of signals in the presence of noise. Random signals, correlation, frequency spectra, estimation, filtering, noise, prediction, transients. Prerequisite: EEE 554.

556 Detection and Estimation Theory. (3) N
Combination of the classical techniques of statistical inference and the random process characterization of communication, radar and other modern data processing systems. Prerequisites: EEE 455, 554.

558 Modulation Theory. (3) N
Noise performance of analog and digital modulation systems. Emphasis on modern digital techniques in terrestrial and satellite communications systems. Prerequisites: EEE 455, 554.

559 Computer Communication Networks. (3) N
Introduction to computer networks. Hardware elements. Data link protocols. Packet and message switching software elements. Network control. Examples. Prerequisites: EEE 459.

566 Advanced Medical Instrumentation. (3) N
Design and analysis of imaging systems and nuclear devices for medical diagnosis, therapy and research. Prerequisite: Approval of instructor.

570 Symmetrical Components. (3) F '85
Power system parameters; analysis of phase and sequence impedances for lines, machines, and transformers. Prerequisite: EEE 471 or equivalent.

571 Fault Analysis. (3) S '86
Symmetrical component applications; changes in symmetry, simultaneous faults, two-component method, computer solution of faulted systems. Prerequisite: EEE 570 or equivalent.

572 Power System Protection. (3) F '86
Elements of protective systems, relays, relaying schemes, circuit interrupting devices, fault protection of radial feeders, network protective schemes, complex loci in Z and Y Planes, protective system reliability. Prerequisite: EEE 571 or equivalent.

573 Power Systems Control. (3) S '87
Analytical concepts of economic dispatch of electric generation, system frequency control, control center functions, real-time control concepts. Prerequisite: EEE 470 or equivalent; corequisite: EEE 480.

574 Computer Solution of Power Systems. (3) F '85
Algorithms for digital computation for power flow and stability analysis, sparsity programming, optimization. Prerequisite: EEE 471 or equivalent.

575 Power System Stability Modeling. (3) S '86
Mathematical modeling of synchronous machines, excitation systems, governors, power plants, and loads for dynamic analysis. Simulation of small systems. Prerequisites: EEE 480.

576 Power System Reliability. (3) F '86
Reliability functions, distributions, Markov processes, recursive techniques, generation capacity evaluation, spinning capacity, frequency and duration method, transmission reliability, composite systems. Prerequisite: EEE 471 or equivalent.

577 Power System Planning. (3) S '87
Load forecasting methods, energy forecasts, interconnected system reliability, generation cost analysis, transmission planning. Prerequisites: EEE 576.

578 Electric Power Distribution. (3) F '85
Distribution components, load characteristics, voltage calculations, primary and secondary systems, transformers, capacitor applications. Prequisite: EEE 471 or equivalent.

579 Electric Power Transmission. (3) S '87
EHV design characteristics, conductor configurations, corona phenomena and losses, radio noise, insulation coordination, switching surges, lighting phenomenon, dc transmission. Prerequisite: EEE 471 or equivalent.

580 Digital Control Systems. (3) S
Analysis and design of digital and sampled data control systems including: sampling theory, z-transforms, the state transition method, stability, design and synthesis. Prerequisites: EEE 550, 582.

581 Random Processes in Control Systems. (3) N
Statistical filtering, estimation, and control with emphasis on the Kalman filter and its applications and computational problems. Prerequisites: EEE 550, 554, 582.

582 Linear System Theory. (3) F
State variables, controllability and observability, state feedback and observers, multivariable systems. Prerequisite: EEE 480.

583 Real-Time Systems. (3) N
Design of computer systems for real-time applications in signal processing, graphics, control, and simulation. Prerequisite: EEE 423 or equivalent, EEE 433.

586 Nonlinear Control Systems. (3) N
Stability theory including phase-plane, describing function, Liapunov's method and frequency domain criteria for continuous and discrete, nonlinear and time-varying systems. Prerequisite: EEE 582.

587 Optimal Control Systems. (3) N
Application of calculus of variations, Pontryagin's principle, and dynamic programming to control problems. Computational techniques for solving optimal control problems. Prerequisite: EEE 582.

645 Microwave Filter Design. (3) S
Analysis and Design of microwave low-pass, high pass, band-pass and band-stop filters, and microwave diplexers/multiplexers. Prerequisite: EEE 545 or consent of instructor.

731 Small MOS Devices. (3) S
Subthreshold current, threshold voltage modulation, scaling and other small size limitations. Prerequisite: EEE 532.

732 Advanced Bipolar Devices and Circuits. (3) S
Critical examination of new bipolar device and circuit technologies. Performance tradeoffs, scaling effects, and modeling techniques. Prerequisite: EEE 531.

770 Advanced Topics in Power Systems. (3) N
Power system problems of current interest, approached at an advanced technical level, for mature students. Prerequisites: EEE 571, 575, 577 or equivalent and approval of instructor.

Special Courses: EEE 484, 494, 498, 499, 590, 591, 592, 594, 598, 599, 690, 691, 692, 790, 791, 792, 799. (See pages 35-36.)

Engineering Core

ECE 105 Introduction to Languages of Engineering. (3) F, S
Computer programming using FORTRAN-77, freehand drawing, visualization and computer graphics. Prerequisites: Algebra and BASIC programming experience. One lecture. 2 hours recitation. 3 hours laboratory.

106 Introduction to Computer-Aided Engineering. (3) F, S
Computer-aided analysis and design, computer graphics, modeling, optimization, and graphic documentation. Prerequisites: ECE 105; one year high school physics (or corequisite of PHY 112 or 116). One lecture, 2 hours recitation, 3 hours laboratory.

211 Engineering Mechanics I: Statics. (2) F, S, SS
Force systems, resultants, equilibrium, distributed forces, area moments, internal stresses and friction. Prerequisite: PHY 115, 117; corequisite: MAT 274. Lecture and recitation.

301 Electrical Networks I. (3) F, S, SS
Introduction to electrical networks. Component models, transient and steady-state analysis. Prerequisites: MAT 274; PHY 116, 118. Lecture and recitation.

312 Engineering Mechanics II: Dynamics. (3) F, S, SS
Kinematics and kinetics of particles, translating and rotating coordinate systems, rigid body kinematics, dynamics of systems of particles and rigid bodies, energy and momentum principles. Prerequisite: ECE 211. Lecture and recitation.

314 Introduction to Deformable Solids. (2) F, S, SS
Equilibrium, geometric compatibility, force-deformation relations; concepts of stress and strain, transformation equations, measurement of strain, stress-strain-temperature relations. Applications in various engineering disciplines. Prerequisites: ECE 211; MAT 274. Lecture and recitation.

334 Electronic Devices and Instrumentation. (4) F, S, SS
Application of electric network theory to semiconductor discrete and integrated circuits. Electronic device and circuit applications, laboratory circuit design, testing and verification. Prerequisite: ECE 301. Lecture, recitation, laboratory.

340 Thermodynamics. (3) F, S, SS
Work, heat and energy transformations, relationships between properties; laws, concepts and modes of analysis common to all applications of thermodynamics in engineering. Corequisites: ECE 312; MAT 274. Lecture and recitation.

350 Structure and Properties of Materials. (3) F, S, SS
Basic concepts of material structure and its relation to properties. Application to engineering problems. Corequisite: ECE 340. Lecture and recitation.

351 Engineering Materials. (3) F, S
Structure and behavior of civil engineering materials. Laboratory investigations and test criteria. Prerequisite: ECE 314. Two lectures, 3 hours laboratory.

352 Semiconductors and Devices. (3) F, S
Crystalline nature of solids, classical and quantum mechanical description of solids, excess carriers in semiconductors, junctions, transistors and integrated circuits. Prerequisites: ECE 334; MAT 274.

383 Probability and Statistics for Engineers. (2) F, S, SS
Probability, random variables, discrete and continuous distributions, descriptive statistics, and sampling distributions. Prerequisite: MAT 272 or MAT 291.

384 Numerical Analysis for Engineers. (2) F, S
Numerical solution of algebraic and transcendental equations, and systems of linear equations. Numerical integration. Curve fitting. Error bounds and error propagation. Emphasis on use of digital computer. Prerequisites: ECE 105; MAT 272 or MAT 291.

386 Partial Differential Equations for Engineers. (2) F, S
Boundary value problems, separation of variables, Fourier series as applied to initial-boundary value problems. Prerequisite: MAT 274.

400 Engineering Communications. (3) F, S, SS
Planning and preparing engineering publications and oral presentations, based on directed library research related to current engineering topics. Prerequisite: Senior standing in chosen technical field and demonstrated English proficiency.

Industrial and Management Systems Engineering

IEE 300 Economic Analysis for Engineers. (2) F, S
Economic evaluation of alternatives for engineering decisions emphasizing the time value of money.

330 Introduction to Data Base Design. (2) S
Data structures and techniques with special attention to DBTG standards. Design, implementation, control and case studies of data management systems. Prerequisite: ECE 105.

362 Work Analysis and Design. (3) F
Analysis and design of man-machine systems; emphasis on work planning, methods, measurement, job evaluation. Applications in diversified fields. Two lectures, 2 hours laboratory. Corequisite: MAE 351 or approval of instructor.

372 Facilities Analysis and Design. (3) F
Analysis and design of man-machine systems; emphasis on facilities location, facilities design, material handling, automation. Applications in diversified fields. Two lectures, 2 hours laboratory. Prerequisite: IEE 300. Corequisite: MAE 351 or approval of instructor.

374 Quality Control. (3) F
In-depth analysis of control chart techniques. Organization and managerial aspects of quality assurance. Attribute and variable acceptance sampling plans. Prerequisite: ECE 383.

411 Engineering Economy. (3) S
Equipment replacement analysis, treatment of inflation in cash flow studies and consideration of risk and uncertainty. Prerequisite: IEE 300.

422 Information Systems Design. (3) F
Emphasis on the application of system analysis and design to information systems. Microprocessor MIS project required.

431 Engineering Administration. (3) F, SS
Engineering organization and administration; introduction to decision making, quantitative and qualitative approaches to management and engineering administration.

437 Human Resources Engineering. (3) F
Study of people at work; designing for human performance effectiveness and productivity. Considerations of human physiological and psychological factors. Prerequisite: IEE 362. (Also listed as PSY 437).

461 Integrated Production Control. (3) F, S
Production control techniques for the planning, analysis, control and evaluation of operating systems. Time series forecasting, network planning, scheduling and control. Prerequisite: ECE 383.

463 Computer-Aided Manufacturing Processes. (3) F, S
Emphasis on computer control in manufacturing; real time concepts, CIM, NC, group technology and process planning, robotics. Prerequisite: ECE 105.

464 Computer Integrated Design Applications. (3) F, S
Use of computer graphics and CAD for industrial engineering applications: Facility layout and design, human factors engineering, CAM. Upper division credit only. Prerequisite: ECE 105 or equivalent.

473 System Applications of Linear Programming. (3) F
Linear programming in a systems context. Emphasis on linear programming models as design optimization tools, exposure to a variety of industrial applications. Prerequisite: MAT 242.

474 Reliability Assessment Techniques. (3) S
Distributions encountered in reliability assessment. Reliability testing and analysis. Availability and maintainability analysis. Prerequisite: IEE 374.

475 Introduction to Simulation. (3) F
Digital simulation and its use in the analysis and design of discrete systems. Transaction and discrete event orientations are used. Prerequisites: ECE 105; ECE 383.

476 Introduction to Operations Research Models. (3) S
Operations research methodology for probabilistic systems. Development of models and techniques for solving decision problems such as queueing, inventory, and replacement. Prerequisite: ECE 383.

492 Project in Design and Development. (3) F, S, SS
Individual project in creative design and synthesis.

500 Systems Research Methods. (3) N
Methods of engineering and scientific research as applied to master's thesis and doctoral dissertation research.

501 Foundations of Industrial Engineering I. (3) F, S
Techniques for the analysis and design of man-machine systems. Emphasis on work planning, methods, measurements, material handling and facility design. Not available for I.E. graduate credit.

502 Foundations of Industrial Engineering II. (3) F, S
Introduction to quantitative production control techniques: planning, forecasting, inventory control and MRP, scheduling. Influence of CAD/CAM and automation on production control process. Not available for I.E. graduate credit. Prerequisite: ECE 383 or equivalent.

510 Measurement of Productivity. (3) F
The engineering economic audit and its use with applications to break-even analysis, variable budget control cost analysis, and product pricing. Prerequisite: ECE 383.

511 Analysis of Decision Processes. (3) F
Methods of making economic decisions in complex environments, statistical decision theory; effects of risk, uncertainty, and strategy on engineering and managerial decisions. Prerequisite: ECE 383

520 Topics in Human Engineering. (3) S
Human physiological and psychological factors in the design of work environments and in employment of people in man-machine systems. Two lectures, 2 hours laboratory. Prerequisite: IEE 362.

531 Topics in Engineering Administration. (3) S
Consideration given to philosophical, psychological, political and social implications of administrative decisions.

533 Scheduling and Network Analysis Models. (3) F
Application of scheduling and sequencing algorithms, deterministic and stochastic network analysis and flow algorithms. Prerequisite: ECE 383; IEE 475.

560 Data Base Concepts for Industrial Management Systems. (3) S
Application of data base concepts to industrial systems problems. Topics include conceptual modeling, data structures, data base software, and perspectives from expert and knowledge base systems.

561 Production Control Information Systems. (3) S
Development of information system designs for production control. Topics include MRP I, MRP II, scheduling, sequencing, and inventory control. On-line design concepts are covered.

563 Systems Analysis for Distributed Systems. (3) N
Analysis and design of distributed systems for computer integrated manufacturing and information processing. Concepts of host driven microprocessors to collect, store and communicate data.

564 Planning for Computer Integrated Manufacturing. (3) F
Theory and use of IDEF methodology in planning for flexible manufacturing, robotics, and real-time control. Simulation concepts applied to computer integrated manufacturing planning. Prerequisite: IEE 475 or approval of instructor.

565 Computer Integrated Manufacturing Research. (3) N
Determination and evaluation of research areas in computer integrated manufacturing including real-time software, manufacturing information systems, flexible and integrated manufacturing systems, robotics, computer graphics. Prerequisite: IEE 463 or approval of instructor.

566 Simulation in Computer Integrated Manufacturing Planning. (3) S
Use of simulation in the planning of computer integrated manufacturing planning related to robotics, flexible and integrated manufacturing systems. Use of computer graphics combined with simulation analysis for CIM decision support. Prerequisite: IEE 475 or approval of instructor.

567 System Simulation. (3) S
Use of simulation in the analysis and design of systems involving continuous and discrete processes; simulation languages; statistical aspects of simulation. Prerequisite: IEE 475.

569 Nonparametric Statistical Inference. (3) S
Application of statistical inference procedures, based on ranks, to engineering problems. Efficient alternatives to classical statistical inference   used by normality assumptions. Prerequisite: ASE 485.

570 Advanced Quality Control. (3) F
Economic based acceptance sampling, multiattribute acceptance sampling, narrow limit gauging in inspector error and attributes acceptance sampling, principles of quality management, selected topics from current literature. Prerequisite: IEE 374 or approval of instructor.

572 Engineering Statistics. (3) F
Analysis of variance and experimental design. Topics include general design methodology, incomplete blocks, confounding, fractional replication, response surface methodology. Prerequisite: ASE 485.

574 Applied Deterministic Operations Research Models. (3) F
Formulation, solution, analysis and application of deterministic models in operations research, including those of linear programming, integer programming, and non-linear programming. Prerequisite: MAT 242.

575 Applied Stochastic Operations Research Models. (3) S
Application of stochastic models including inventory theory, queueing theory, Markov processes, stochastic programming, and renewal theory. Prerequisite: ECE 383.

576 Applications of Operations Research. (3) F
Case studies of application of linear and non-linear models and general types of search techniques. Prerequisites: IEE 574 or approval of instructor.

577 Information Systems Methodology. (3) F
Systems approach to the analysis, design and implementation of decision support systems. Emphasis is on development of databases, model bases dialogs and systems architecture as well as systems effectiveness.

578 Advanced Decision Theory. (3) S
Advanced decision theory techniques for industrial systems. Topics include conjugate families of distributions, value theory, decisions with multiple objectives and goal programming. Prerequisite: IEE 511.

579 Time Series Analysis and Forecasting. (3) F
Forecasting time series by the Box-Jenkins and exponential smoothing techniques; existing digital computer programs are utilized to augment the theory. Prerequisite: ASE 485.

Special Courses: IEE 484, 494, 498, 499, 590, 591, 592, 598, 599, 784, 790, 792, 799. (See pages 35-36.)

Mechanical and Aerospace Engineering

MAE 317 Dynamic Systems and Control. (4) F, S
Modeling and representations of dynamic physical systems: transfer functions, block diagrams, state equations. Transient response. Principles of feedback control and linear system analysis including root locus and frequency response. Introductory analog computer laboratory. Prerequisites: ECE 301, 312.

333 Internal Combustion Engines. (3) S
Performance characteristics, combustion, carburetion, cooling, and control of internal combustion engines. Prerequisite: MET 381 or MAE 382 or approval of instructor.

336 Air Conditioning and Refrigeration. (3) F
Refrigeration cycles, refrigerant properties, heating, cooling loads; psychrometry, purification; temperature and humidity control. Prerequisite: MET 381 or MAE 382 or approval of instructor.

341 Kinematics and Force Analysis in Machinery. (3) F
Positions, velocities, and accelerations of machine parts; cams, gears, flexible connectors, rolling contact; introduction to synthesis. Prerequisite: ECE 312.

351 Production Processes. (3) F, S
Production techniques and equipment. Casting and molding, pressure forming, material removal, joining and assembly processes, automation and material handling. Prerequisite: ECE 350.

355 Introduction to Metallurgy. (3) S
Elements of the structure of metals and alloys, measurement of mechanical properties, and optical metallography. Field trips. Lecture and laboratory. Prerequisite: CHM 114 or 116.

371 Fluid Mechanics. (3) F, S
Introductory concepts of fluid motions; fluid statics; control volume forms of basic principles; introduction to local principles. Prerequisites: ECE 312, 340.

372 Fluid Mechanics. (4) F, S
Application of basic principles of fluid mechanics to problems in viscous and compressible flow. Laboratory experimentation and demonstrations. Prerequisites: ECE 384, 386; MAE 371; MAT 242.

382 Thermodynamics. (3) F, S
Applied thermodynamics; gas mixtures, power cycles and reactive systems. Laboratory experimentation and demonstrations. Prerequisite: ECE 340.

402 Introduction to Continuum Mechanics. (3) S
Application of the principles of continuum mechanics to such fields as flow in porous media, biomechanics, electromagnetic continua, magneto-fluid mechanics. Prerequisites: ECE 314, 384; MAE 371; MAT 242.

403 CAD/CAM. (3) F
Develop new software/ use existing software to aid in the design and manufacturing of machine parts, PC boards, etc. Prerequisites: Junior standing in engineering.

404 Finite Elements in Engineering. (3) S
Introduction to ideas and methodology of finite element analysis. Applications to solid mechanics, heat transfer, fluid mechanics, vibrations. Prerequisites: MAT 242; ECE 314, 384.

405 Microcomputer-Aided Processes for Mechanical Engineers. (3) F, S
Microcomputer and microprocessor fundamentals. Overview of programming languages, input/output, interfacing and analog/digital conversion, data acquisition, control, applications. Prerequisite: ECE 106 or CSC 100.

410 Acoustics and Noise Control. (2) S
Acoustic analysis and design. Acoustic fatigue of aerospace structures. Aircraft, traffic and industrial noise control. Environmental noise standards. Architectural acoustics. Prerequisite: PHY 116.

413 Intermediate Dynamics. (3) S
Rotating reference frames, Lagrange's and Euler's equations, gyroscopic motion, aerospace vehicle flight mechanics. Prerequisite: ECE 312.

415 Vibration Analysis. (4) F, S
Free vibration and forced response of single and multiple degree of freedom systems, normal modes, random vibrations. Lecture and laboratory. Prerequisite: ECE 314, 384; MAT 242.

416 Vibrations Laboratory. (2) N
Lecture and laboratory related to mechanical systems. Time series analysis, modal modeling, and identification. Lecture and laboratory. Prerequisite: MAE 415.

417 Control System Design. (3) S
Tools and methods of control system design and compensation: simulation, response optimization, frequency domain techniques, state variable feedback, sensitivity analysis. Introduction to nonlinear and discrete time systems. Prerequisite: MAE 317.

418 System Identification. (3) N
Transform methods for generalized system response: impulse convolution integral, frequency response, random signal response. Experimental methods: frequency response, pulse testing, random signals, para-

meter tracking, multiple regression and least-squares. Prerequisite: MAE 317.

422 Mechanics of Materials.(4) F, S
Failure theories, energy methods, finite element methods, plates, torsion of non-circular members, unsymmetrical bending, shear center, beam column. Lecture, recitation, and laboratory. Prerequisite: ECE 314, 384; MAT 242.

426 Aerospace Structures. (3) S
Loads; analysis of stringer-skin members, pressure vessels, rings, ribs and frames; ultimate analysis, buckling, tension field beams, matrix methods. Prerequisite: MAE 422.

430 Introduction to Nuclear Engineering. (3) F
Neutron interactions with matter. Principles of neutron chain reacting systems. Neutron diffusion and moderation. Heat removal from nuclear reactors. Point reactor kinetics. Prerequisite: PHY 361. (Also listed as EEE 460).

431 Nuclear Reactor Theory I. (3) N
Neutron transport theory, diffusion theory, applications. Reactor kinetics, applications. Reactivity, interdependence between neutronics and thermal-hydraulics. Prerequisite: MAE 430.

433 Nuclear Plant Systems Design. (3) F
Relevant thermodynamic cycles. Conceptual design of commercial fission-reactor systems (light water reactors, gas-cooled reactors, fast breeder reactors) and fusion-reactor systems. Emphasis on thermal-hydraulic aspects. Prerequisites: ECE 340; MAE 430.

435 Turbomachinery. (3) S
Design and performance of turbomachines including steam, gas and hydraulic turbines, centrifugal pumps, compressors, fans and blowers. Corequisites: MAE 372, 382.

436 Combustion. (3) N
Thermodynamics and chemical kinetics of combustion. Structure, propagation, and stability of flames. Ignition theories; droplet and solid particle combustion. Pollutant formation. Prerequisite: MAE 382.

437 Direct Energy Conversion. (3) F
Unconventional methods of energy conversion; fuel cells, thermoelectrics, thermionics, photovoltaics, and magnetohydrodynamics. Prerequisites: ECE 340, 350.

438 Solar Energy. (3) S
Solar radiation and instrumentation, design and testing of collectors, performance analyses of systems, thermal storage, photovoltaics, materials and economic analysis. Prerequisites: MAE 382, 488.

441 Principles of Design I. (3) F, S
Introduction to the design process; use of fundamentals in modeling and analysis of design problems; material failure modes; application of constraints and selection criteria; manufacturing processes; *computer tools* in design. Prerequisites: ECE 350; MAE 422.

442 Principles of Design II. (3) S
Continuation of MAE 441. Application of engineering principles and techniques to the design of mechanical systems and components. Modeling and design with mechanical, electrical, hydraulic and pneumatic components. Prerequisite: MAE 441.

443 Engineering Design. (3) F, S
Group projects to design engineering components and systems. Problem definition ideation, modeling and analysis, decision making and communication activities emphasized. Six hours laboratory. Prerequisites: ECE 384; MAE 441; three of MAE 415, 422, 382, 317, 372, 488.

446 Thermal System Design. (3) S
Application of thermodynamics, fluid mechanics and heat transfer to the design of heat exchangers, cooling towers, power plants, and turbine engines. Steady state system simulation techniques studied. Prerequisites: MAE 382, 488.

447 Robotics and Its Influence on Design. (3) N
Robot applications, configurations, singular positions, and work space; modes of control; vision; programming exercises; design of parts for assembly. Prerequisite: MAE 317.

450 Mechanical Properties of Solids. (3) S
Effects of environmental and microstructural variables on mechanical properties; plastic deformation, fatigue, creep, brittle fracture, internal friction. Prerequisite: ECE 350.

451 X-Ray and Electron Diffraction. (3) F
Fundamentals of X-ray diffraction, transmission electron microscopy and scanning electron microscopy. Techniques for studying surfaces, internal microstructures, and fluorescence. Lecture and demonstrations. Prerequisite: ECE 350.

452 Manufacturing Engineering. (3) F
Analysis and optimization of manufacturing processes. Prerequisite: MAE 351.

453 Corrosion and Corrosion Control. (3) S
Introduction to corrosion mechanisms and methods of preventing corrosion. Topics: electrochemistry, polarization, corrosion rates, oxidation, coatings, cathodic protection. Prerequisite: ECE 350.

455 Physical Metallurgy. (4) F
Crystal structure and defects. Phase diagrams, metallography, solidification and casting, deformation and annealing. Three lectures, 3 hour laboratory. Prerequisite: ECE 350.

460 Gas Dynamics. (3) N
Compressible flow at subsonic and supersonic speeds; duct flow; normal and oblique shocks, perturbation theory. Prerequisite: MAE 371.

461 Aerodynamics. (3) F
Aerodynamic characteristics of airfoils; airfoils and wing-body combinations in compressible flows; linearized theory of subsonic and supersonic flows; numerical techniques. Prerequisites: ECE 384; MAE 371; MAT 242; *corequisite* MAE 460.

462 Aerospace Vehicle Dynamics. (3) F
Aircraft dynamic stability and response, orbital mechanics, spacecraft attitude dynamics. Prerequisite: MAE 413.

463 Propulsion. (3) F
Performance analysis of propulsion systems including turbojet, fanjet and turboprop engines, solid and liquid-fueled rockets, and ion-propulsion devices. Prerequisite: MAE 460.

464 Aerodynamics Laboratory. (2)
Measurements of aerodynamic parameters in both subsonic and supersonic flows; flow over airfoils, wedges, and cones. Prerequisite: MAE 460; corequisite: MAE 461. Six hours laboratory.

468 Aerospace Systems Design. (3) S
Preliminary design. Trade-off studies. Prerequisites: MAE 413, 426, 461, 463.

471 Numerical Fluid Mechanics. (3) F
Numerical solutions for selected problems in fluid mechanics. Prerequisite: MAE 372.

488 Heat Transfer. (3) F, S
Steady and unsteady heat conduction including numerical solutions; thermal boundary layer concepts and applications to free and forced convection. Thermal

radiation concepts. Laboratory experimentation and demonstrations. Prerequisite: MAE 371.

489 Thermodynamics of Materials. (3) N
Principles of statistical mechanics, statistical thermodynamics of single crystals, solutions, phase equilibrium, free energy of reactions, free electron theory, thermodynamics of defects. Prerequisite: ECE 340.

491 Experimental Mechanical Engineering. (3) F, S
Experimental and analytical studies of phenomena and performance of fluid flow, heat transfer, thermodynamics, refrigeration and mechanical power systems. Prerequisites: MAE 382, ECE 334; corequisite: MAE 488. One hour lecture/three hours laboratory.

492 Projects. (2) F, S
Small group projects in fundamental or applied aspects of engineering; emphasis on experimental solutions to complex problems. Prerequisites: MAE 488; either MAE 491 or MAE 455. Six hours laboratory.

498 Pro-Seminar. (1-3) N
Special topics for advanced students. Application of the engineering disciplines to design and analysis of modern technical devices and systems. Prerequisite: approval of instructor.

502 Computation Methods in Engineering Science. (3) F
Utilization of documented computer programs. Application in analysis, design and computer graphics.

503 Engineering Structures and Systems. (3) F
Principles of dimensional analysis and similitude with application to a wide variety of problems from several fields of engineering.

504 Laser Diagnostics for the Thermal Sciences. (3) S
Fundamentals of lasers and light scattering, laser velocimetry, particle and droplet sizing.

505 Perturbation Methods in Mechanics. (3) N
Nonlinear oscillations, strained coordinates, renormalization, multiple scales, boundary layers, matched asymptotic expansions, turning point problems, WKBJ method.

506 Advanced System Modeling, Dynamics, and Control. (3) F
Lumped-parameter modeling of physical systems with examples. State variable representations and dynamic response. Introduction to modern control. Prerequisite: MAE 317 or approval of instructor.

507 Modern Control Theory and Applications. (3) S
Advanced techniques for the control of physical systems and processes. Optimal control: Pontryagin formulation, numerical methods, linear regulator. Accommodation of disturbances; deterministic observers. Introduction to stochastic estimation and control: Kalman filtering. Prerequisite: MAE 506.

508 Digital Control. (3) S
Introduction to discrete-time systems difference equations, Z-transforms, and digital filters. Hybrid analog/digital systems modeling. Control design methods. Lectures, demonstrations, and laboratory. Prerequisite: MAE 317.

511 Acoustics. (3) F
Principles underlying the generation, transmission and reception of acoustic waves. Applications to noise control, architectural acoustics, random vibrations, acoustic fatigue.

512 Random Vibrations and Acoustic Fatigue. (3) F
Random processes and stochastic response. Acoustic fields. Design and acoustic fatigue.

513 Advanced Dynamics. (3) F
Dynamics of mechanical systems, variational principles, Lagrange's and Hamilton's equations, applications to

vehicle motion, gyroscopes, and space mechanics. Nonlinear systems.

515 Vibrations: Discrete Systems. (3) S
Free vibration and forced response of discrete elastic systems. Finite elements. Analytical and computer methods of solution. Random vibrations. Prerequisite: MAE 415.

516 Vibrations: Continuous Systems. (3) F
Free vibration and forced response of continuous elastic systems. Variational methods. Exact and approximate methods of solution. Wave propagation. Prerequisite: MAE 415.

518 Dynamics of Rotor-Bearing Systems. (3) S
Critical speed and response analysis of rigid and flexible rotor systems. Bearing influence and representation. Stability analysis. Methods of balancing.

520 Continuum Mechanics. (3) F
Methods of continuum mechanics with applications to current research. Prerequisite: ASE 582.

522 Variational Principles of Mechanics. (3) S
Virtual work, stationary and complementary potential energies. Hamilton's principle. Application of these and direct methods to vibrations, elasticity and stability.

523 Theory of Plates and Shells. (3) S
Large deflection and bending of plates. Membrane theory of shells. Bending theory of cylindrical shells. Shells of revolution. Approximate methods. Prerequisite: ECE 386 or MAT 462.

524 Theory of Elasticity. (3) F
Analysis of stress and strain in three dimensions. General theorems. Plane elastostatic problems. Bending and torsion, thermoelasticity, axi-symmetrical problems. Applications. Prerequisite: ECE 386 or MAT 462.

526 Biomechanics. (3) S
Mechanics of the human body. Mechanical and physical properties of tissues. Application to fields of interest including joint replacement, sports medicine.

527 Finite Element Methods in Engineering Science. (3) F
Discretization, interpolation, elemental matrices, assembly, computer implementation. Application to solid and fluid mechanics, heat transfer, time dependent problems. Prerequisite: ASE 582.

529 Theory of Elastic Stability. (3) S
General concepts; stability of discrete and continuous systems. Torsional and lateral buckling of thin plates. Dynamic justability. Prerequisite: ECE 386 or MAT 462.

534 Reactor Design. (3) N
Heterogeneous reactor systems, perturbation theory, fuel burn-up. Introduction to transport theory. Kinetics, controls and feedback methodology. Prerequiste: MAE 532.

536 Combustion. (3) N
Kinetic theory, chemical kinetics and reaction rate theories. Ignition theories; droplet, coal and fluidized bed combustion. Laser diagnostics in combustion. Prerequisite: MAE 436 or approval of instructor.

544 Mechanical Design and Failure Prevention. (3) F
Modes of mechanical failure; application of principles of elasticity and plasticity in multiaxial state of stress to design synthesis; failure theories; fatigue; creep; impact. Prerequisite: MAE 443.

547 Mechanical Design and Control of Robots. (3) N
Homogeneous transformations, three-dimensional kinematics, geometry of motion, solving kinematic equations, differential relationships, motion trajectories, dynamics, control, static forces.

548 Mechanism Synthesis and Analysis. (3) S
Algebraic and graphical methods for exact and approximate synthesis of cam, gear, and linkage mechanisms; design optimization; methods of planar motion analysis; characteristics of plane motion; spatial kinematics.

550 Theory of Crystalline Solids. (3) F
Anisotropic properties of crystals; tensor treatment of elastic, magnetic, electric, and thermal properties, crystallography of Martensitic transformations.

551 Effects of Radiation and Particles on Materials. (3) S
Includes defect production and annealing. Generalized treatment including ion implantation, neutron irradiation damage, and the interaction of other incident beams. Prerequisite: MAE 450.

552 Strengthening Mechanisms. (3) S
Deformation of crystalline materials. Properties of dislocations. Theories of strain hardening, solid solution, precipitation, and transformation strengthening. Prerequisite: ECE 350 or equivalent.

553 Advanced Materials Characterization. (3) S
Analytical instrumentation for characterization of materials: SEM, SIMS, Auger, Analytical TEM and other advanced research techniques.

554 Metallurgical Thermodynamics and Kinetics. (3) S
Thermodynamics of alloy systems, diffusion in solids, kinetics of precipitation and phase transformations in solids. Prerequisites: ECE 340, 350.

555 Analysis of Material Failures. (3) S
Identification of types of failures. Analytical techniques. Fractography, SEM, nondestructive inspection, metallography. Mechanical and electronic components. Prerequisite: ECE 350.

556 Fracture, Fatigue, and Creep. (3) F
Relationship between microstructure and fracture; fatigue and creep properties of materials. Environmental effects, recent developments. Current theories and experimental results. Prerequisite: MAE 450 or equivalent.

557 Mechanics of Composite Materials. (3) S
Analysis of composite materials with applications. Micromechanical and macromechanical behavior. Classical lamination theory developed with investigation of bending-extension coupling.

558 Polymer Structure and Properties. (3) F
Relationships between structure and properties of synthetic polymers: glass transition, molecular relaxations, crystalline state, viscoelasticity, morphological characterization, processing.

559 Electron Microscopy: Physics and Materials Analysis. (3) S
Microanalysis of the structure and composition of metals, semiconductors and ceramics using images, diffraction, and X-ray and energy loss spectroscopy.

560 Propulsion Systems. (3) N
Principles of gas dynamics with application to propulsion-system components. Air-breathing and chemical rocket engines.

561 Computational Aerodynamics. (3) S
Finite-difference and finite-volume techniques for solving the subsonic, transonic, and supersonic flow equations. The method of characteristics. Numerical grid generation techniques. Prerequisite: MAE 571 or approval of instructor.

565 Turbomachinery. (3) N
Design and performance of turbomachines including turbines, compressors, pumps, fans and blowers.

571 Fluid Mechanics. (3) F
Basic kinematic, dynamic and thermodynamic equations of the fluid continuum and their application to basic fluid models.

572 Inviscid Fluid Flow. (3) S
Mechanics of fluids for flows in which the effects of viscosity may be ignored. Potential flow theory, waves, inviscid compressible flows. Prerequisite: MAE 571.

573 Viscous Fluid Flow. (3) F
Mechanics of fluids for flows in which the effects of viscosity are significant. Exact and approximate solutions of the Navier-Stokes system, laminar flow at low and high Reynolds number. Prerequisite: MAE 571.

574 Viscous, Compressible Fluid Flow. (3) N
Mechanics of fluids for flows in which the effects of compressibility and viscosity are significant. Compressible boundary layers, free shear layers, shock waves, internal flows. Prerequisite: MAE 572.

575 Turbulent Shear Flows. (3) F
Homogeneous and isotropic turbulence, wall turbulence. Experimental results. Introduction to turbulent-flow calculations. Prerequisite: MAE 571.

577 Turbulent Flow Modeling. (3) S
Reynolds equations and their closure. Modeling of simple and complex turbulent flows, calculations of internal and external flows and application to engineering problems. Prerequisite: MAE 571.

581 Thermodynamics. (3) F
Basic concepts and laws of classical equilibrium thermodynamics. Introduction to statistical thermodynamics. Applications to engineering systems.

582 Thermodynamics. (3) N
Continuation of MAE 581, including statistical and irreversible thermodynamics. Prerequisite: MAE 581.

583 Direct Energy Conversion. (3) N
Advanced selected topics in direct energy conversion, theory, design and applications. Prerequisite: MAE 581.

585 Conduction Heat Transfer. (3) F
Basic equations and concepts of conduction heat transfer. Mathematical formulation and solution (analytical and numerical) of steady and unsteady, one and multi-dimensional heat conduction problems. Prerequisite: MAE 488 and ECE 386.

586 Convection Heat Transfer. (3) S
Basic concepts and governing equations. Analysis of laminar and turbulent heat transfer for internal and external flows. Natural and mixed convection. Prerequisite: MAE 488.

587 Radiation Heat Transfer. (3) F
Advanced concepts and solution methodologies for radiation heat transfer, including exchange of thermal radiation between surfaces, radiation in absorbing, emitting and scattering media, and radiation combined with conduction and convection. Prerequisite: MAE 488.

594 Graduate Research Conference. (1) F, S
Topics in contemporary research. Required every semester of all departmental graduate students registered for 9 or more semester hours. Not for degree credit.

598 Special Topics. (1-3) F, S
Special topics courses, including the following which are regularly offered, are open to qualified students.

(a) Dynamics and Control
(b) Two-Phase Flow.
(c) Hydrodynamic Stability.
(d) Combustion Diagnostics.
(e) Aerodynamics
(f) Aeroelasticity

Special Courses: MAE 484, 494, 499, 500, 590, 591, 592, 598, 599, 792, 799. (See pages 35-36.)

Society, Values, and Technology

STE 201 Technology and Social Change. (2) F, S
Technology as related to social change, contemporary impact of technology on society. (Also listed as HPS 201).

303 Energy, Technical and Societal Aspects. (2) S
The role of energy in modern technical society. Transformation of energy from natural forms into forms useful to man; physical laws and material behaviors governing transformation; emphasis on methodology used to solve engineering problems. (Not for engineering degree credit.) Prerequisite: algebra.

310 Man and Machine. (3) F
Relation of man to machine examined in historical, political, and social terms. Comparisons with a look at artificial intelligence studies. (Also listed as HPS 321.)

311, 312 Science and Technology in History. (3, 3) F, S
Development and application of scientific thinking from ancient times to present. First semester through 17th century. Second semester: 18th to present. (Also listed as HPS 322, 323.)

402 Technology, Society and Human Values. (3) F, S, SS
Values which motivate mankind to create technology. Areas of conflict and resolution between basic human values and technology. Reading and discussion with visiting lecturers. (Also listed as HPS 402.) Prerequisite: junior standing or above.

411 Social Effects of Invention. (3) S
The role of science and invention, the private and public sector, in the development and application of technology. The issue of the personal and public responsibility of scientists and engineers is examined. (Also listed as HPS 411).

Special Courses: STE 394, 484, 494, 498, 499, 591.

Division of Technology

Ernest T. Hirata, Ed.D., Director

Purpose

The Division of Technology provides the opportunity to earn a degree in a technological field which stresses theory reinforced by laboratory application, in other words, a more "hands-on" approach than engineering students experience. The engineering technology and industrial technology programs offer challenging career opportunities in industry and government for the forward looking student. The programs in industrial vocational education prepare students for instructional and administrative positions in secondary and post-secondary educational institutions as well as industry.

The technology graduate in industry becomes a member of the total engineering effort, contributing applications-oriented skills along with the engineer's more theoretical concepts. A student will be educated to render practical decisions with safety and economy in mind; to install and operate technical systems; develop or improve a product; to service machines and revise systems; and to provide customer support when needed.

The degree programs offered by the Division will provide not only technical competence but a realization of the problems facing humanity today as well as an appreciation of the cultural accomplishments of the past.

Organization

There are four departments within the Division of Technology: Aeronautical, Electronics and Computer, Industrial, and Manufacturing. The organization of the departments is listed below. Refer to department sections which follow for more specific information.

Department of Aeronautical Technology

Aeronautical Engineering Technology
Aeronautical Industrial Technology

Department of Electronics and Computer Technology

Electronic Engineering Technology
Computer Engineering Technology
Microelectronics Engineering Technology

Department of Industrial Technology

Graphic Communications Engineering Technology
Graphic Communications Industrial Technology
Industrial Supervision
Technical Teacher Education
Vocational Teacher Education

Department of Manufacturing Technology

Manufacturing Engineering Technology
Mechanical Engineering Technology
Welding Engineering Technology

Degrees

Bachelor of Science (B.S.) degrees are offered in: Engineering Technology, Industrial Technology, Computer Engineering Technology, Microelectronic Engineering Technology and Industrial Vocational Education. The degree is composed of three

parts: General Studies, Technology Core Classes, and the concentration requirements.

General Studies courses satisfy a University requirement but the requirements are established by the College of Engineering and Applied Sciences. Consult pages 212-213 for full details and recommended list of courses to fulfill the Humanities and Fine Arts and the Behavioral and Social Sciences requirement.

The Core Classes combine the essential elements of mathematics, science, graphics, communications, and technical sciences appropriate to the particular concentration. Consult the following pages under each department for details on the core classes required for each concentration/major.

Students should always work out the details of classes required for their program with an academic advisor.

Master of Technology (M.Tech.) degree is offered in accordance with the details given on page 209.

General Information
See pages 19-23 and 38-39 for complete information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, students who are initiating their college work in the Division of Technology should present secondary school units in accordance with minimum University requirements. Students who have omissions or deficiencies in secondary school subject matter may be required to complete additional university course work which will not be applied toward their degree.

The requirement for admission of transfer students is a 2.25 GPA. The freshman and sophomore programs of study are designed to facilitate transfer of junior and community college students or Associate Degree graduates.

International students are required to have a TOEFL score of 500.

Graduation Requirements
In order to qualify for graduation from the Division of Technology, a student must have a grade point average of at least 2.00 for the required courses in the major field.

Cooperative Education
The co-op program includes one or more periods of employment within the degree curriculum, the employment necessarily re-

lating to student's major. A student who chooses this program will graduate with both the academic background and practical experience gained from working with professionals in his or her chosen field.

A student is eligible upon completion of 60 or more hours of classes in a technology program. Certain positions may require completion of specific courses of study. Transfer students are required to complete at least one semester at ASU before beginning work. All applicants must have a minimum grade point average of 2.5 and the approval of the co-op advisor. Part-time internships are also available.

Interested students should contact the Coordinator of Cooperative Education by inquiring in the Division Office. Registration is required to earn academic credit, and the amount of credit possible varies with the different programs.

Department of Aeronautical Technology

ASSOCIATE PROFESSORS:
_____ (TC 203), REED, ROPER
ASSISTANT PROFESSORS:
CARLSEN, GESELL, PEARCE, ROGERS,
SALMIRS, SCHOEN
LECTURER
NELSON

The Department of Aeronautical Technology offers two concentrations leading to a Bachelor of Science degree. There are five options within these two concentrations, as follows:

Aeronatical Engineering Technology
  Aeronautical Engineering Technology

Aeronautical Industrial Technology
  Air Transportation Flight Technology
  Aircraft Systems Management (FAA Approved)
  Air Transportation Management Technology
  Airway Science Management (FAA Approved)

Graduates are prepared for entry into the aerospace industry in productive, professional employment or, alternatively, for graduate study. The curricula emphasize the recognized principles underlying the appli-

cation of technical knowledge as well as current technology, preparing the graduate to accommodate to the rapid and continual changes in aerospace technology.

The two concentrations in Aeronautical Technology build upon a core of courses which are common to all options.

Aeronautical Technology Core

			Semester Hours
MAT	115	College Algebra and Trigonometry	4
MAT	260	Technical Calculus I	3
CSC	183	Programming in Fortran	3
PHY	111	and 113 General Physics	4
PHY	112	and 114 General Physics	4
CHM	114	General Chemistry for Engineers or CHM 113 General Chemistry	4
ECN	111	Macroeconomic Principles	3
MET	101	Manufacturing Processes and Materials	3
CET	121	Structured Problem Solving	3
ICG	111	Graphic Language	2
ELT	200	Applied Electricity/ Electronics	3
GRC	420	Technical Communications	3
AET	180	Aerospace Structures and Materials	3
AET	181	Aerospace Systems	3
AET	287	Aircraft and Aerospace Powerplants	3
AET	288	Gas Turbines and Turbomachinery	3
AET	300	Aircraft Design I	3
AET	306	Aerospace Electrical and Electronic Systems	3
AET	390	Aerospace System Analysis I	3
AET	487	Aircraft Design II	3
		Total	63

Satisfactory completion of all Department core courses, or their equivalents, plus the courses listed below for each option, is necessary to qualify for graduation. Students planning to begin course work at another institution should consult an Aeronautical Technology academic advisor for assistance in planning a transferable program.

A Master of Technology program is available for qualified persons. (See Division of Technology Graduate Degrees and the *Graduate College Catalog*.)

Aeronautical Engineering Technology

(Accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.)

The Aeronautical Engineering Technology curriculum is designed to prepare the technologist for technical support of engineering activities throughout the aerospace field. Areas of responsibility include the application of applied engineering practice related to: aircraft and aerospace vehicle design, internal combustion engines, combustion processes, turbomachinery, systems analysis, and environmental control. A minimum of 130 semester hours of satisfactory credits are required to complete this program.

The following courses are required in addition to the Department core courses, three hours of technical electives as approved by the student's academic advisor, and the General Studies requirements:

Required courses: ELT 201, MAT 261, 262; MET 116, 310, 311, 360, 380, 381, 407; AET 301, 309, 310, 414, 415, 417, 490.

The suggested freshman pattern presented below may be useful as a general guide for new Aeronautical Engineering Technology students. Each individual student's program is subject to final approval of the academic advisor.

Suggested Course Pattern for Freshmen

Fall Semester

			Semester Hours
ENG	101	Freshman Composition	3
AET	180	Aerospace Structures and Materials	3
MET	116	Aeronautical Welding	2
MAT	115	College Algebra and Trigonometry	4
MET	101	Manufacturing Processes and Materials	3
		Total Credit Hours	15

Spring Semester

ENG	102	Freshman Composition	3
AET	181	Aerospace Systems	3
PHY	111/ 113 General Physics		4
CET	121	Structured Problem Solving	3
MAT	260	Technical Calculus I	3
		Total Credit Hours	16

Aeronautical Industrial Technology

Instruction combines thorough technical training with a general university education. The curricula are designed to prepare aeronautical industrial technologists with

theoretical and practical backgrounds in the area of structures, internal combustion, turbomachinery, design, management, general and commercial aviation, systems analysis, and environmental control. Employment is possible in certain positions within the FAA, if the Airway Science curriculum is completed.

Four options are available in this concentration: Air Transportation Flight Technology, Aircraft Systems Management (FAA Approved), Air Transportation Management Technology, and Airway Science Management (FAA Approved). Each requires a minimum of 127 semester hours of satisfactory credits for completion. The four options are described separately below.

Air Transportation Flight Technology

(Flight training is certified by the Federal Aviation Administration.)
Air Transportation Flight Technology combines academic studies and flight training to prepare graduates for a variety of positions within the air transportation industry, primarily in the area of flight operations. Ground school and flight training are available, allowing the student to obtain the private pilot, commercial pilot and flight instructor certificates, and also the instrument pilot, instrument instructor, and multiengine pilot ratings.

While enrolled at Arizona State University, students will not receive college credit for flight instruction received at flight schools other than schools with which the University has currently contracted for such instruction. Consideration for credit will be given for flight experience and certificates received prior to enrollment at the University.

Flight instruction costs are not included in University tuition.
The following courses are required, in addition to the Department core courses, two hours of technical electives as approved by the student's academic advisor, and the General Studies requirements:

Required Courses: AET 182, 183, 202, 303, 308, 314, 380, 382, 383, 384, 385, 386, 391, 394, 408, 410, 411, 488, 489, *either* AET 387 *and* 389 *or* AET 392 *and* 393; GPH 212; MET 310; MGT 301, 311, 352.

The suggested freshman pattern presented below may be useful as a general guide for new Air Transportation Flight Technology students. Each individual student's program

is subject to final approval of the academic advisor.

Suggested Course Pattern for Freshmen

Fall Semester

			Semester Hours
ENG	101	Freshman Composition	3
AET	180	Aerospace Structures and Materials	3
AET	182	Private Pilot Ground School	4
MAT	115	College Algebra and Trigonometry	4
PGS	100	Introduction to Psychology	3
Total Credit Hours			17

Spring Semester

ENG	102	Freshman Composition	3
AET	181	Aerospace Systems	3
AET	183	Private Pilot Certificate	1
MAT	260	Technical Calculus I	3
CET	121	Structured Problem Solving	3
PHY	111/ 113	General Physics	4
Total Credit Hours			17

Aircraft Systems Management FAA Approved

The Aircraft Systems Management option concentrates on flying and the technical, management, and computer-related applications of an inter-disciplinary course of studies. It is a comprehensive educational program emphasizing critical thinking, cognitive and analytical skills, and communications skills. This career option leads to development, administration, and enforcement of safety regulations including airworthiness and operational standards in civil aviation. The courses listed above under the Air Transportation Flight Technology option, and the suggested course pattern for freshmen, are applicable to this option.

Air Transportation Management Technology

The management option is designed to prepare graduates for managerial and supervisory positions within the air transportation industry. It encompasses areas leading to jobs with manufacturers, fixed-base operators, airports, airlines, and government agencies. A depth of technical training is included along with a broad exposure to business management curricula.

The following courses are required in addition to the Department core courses, three hours of technical electives as approved by the student's academic advisor, and the General Studies requirements:

Required Courses: AET 101, 201, 303, 308, 384, 391, 408, 410, 411, 488, 489, 490; ACC 211, 212; ADS 101, 233, 305; COM 110, 207; ECN 112; FIN 300; MGT 301, 311, 352, 423; SOC 301.

The suggested pattern presented below may be useful as a general guide for new Air Transportation Management Technology students. Each individual student's program is subject to final approval of the academic advisor.

Suggested Course Pattern for Freshmen

Fall Semester

			Semester Hours
ENG	101	Freshman Composition	3
AET	180	Aerospace Structures and Materials	3
MAT	115	College Algebra and Trigonometry	4
AET	101	Introduction to Aeronautics	3
PGS	100	Introduction to Psychology	3
Total Credit Hours			16

Spring Semester

ENG	102	Freshman Composition	3
AET	181	Aerospace Systems	3
CET	121	Structured Problem Solving	3
PHY	111/	113 General Physics	4
MAT	260	Technical Calculus I	3
Total Credit Hours			16

Airway Science Management
FAA Approved

The Airway Science Management option is a series of courses, inter-disciplinary in nature, which will prepare the aeronautical career-oriented student for a variety of administrative and management positions. It includes a background in science, mathematics, business and technical information applicable to several career options including air traffic control specialist, air carrier manager, airport manager, and general aviation operations manager. The courses listed above under the Air Transportation Management Technology option are required and the suggested course pattern for freshmen is applicable to this option.

Department of Electronics and Computer Technology

PROFESSORS:
KANNEMAN (TC 301A)
ASSOCIATE PROFESSORS:
McCURDY, McHENRY, STRAWN, WOOD
ASSISTANT PROFESSORS:
BAXTER, EDWARDS, PETERSON, SADDLER (Visiting), YOUNG

Electronics and computers permeate every facet of our lives as technology continues to serve mankind. These fields provide challenging career opportunities for the forward looking student. Engineering Technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities. It lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer. The engineering technologist is a member of the engineering team, consisting of the engineer, engineering technologist, and engineering technician.

The engineering technologist must be applications oriented, building upon a background of applied mathematics including the concepts and applications of calculus. Utilizing applied science and technology, the technologist must be able to: produce practical, workable and safe results quickly and economically, install and operate technical systems, configure hardware from proven concepts, develop and produce products, service machines and systems, manage construction and production processes, and provide customer support to technical products and systems.

The Department of Electronics and Computer Technology offers three majors: Computer Engineering Technology, Microelectronics Engineering Technology and Engineering Technology with a concentration in Electronic Engineering Technology.

The Electronic Engineering Technology concentration emphasizes applied electrical science and electronics with emphasis areas in communication systems, digital systems, and systems control and instrumentation.

The Computer Engineering Technology major combines applied electronics and

computer hardware-software concepts and applications.

The Microelectronics Engineering Technology major combines applied electronics, monolithic and hybrid integrated circuit processing and applications, and device and component fabrication and manufacturing.

All three are directed to technical careers in industry, education or government, in support of engineering functions.

Several cooperative education and internship programs are available. These programs consist of formal agreements between the Department of Electronics and Computer Technology and electronics industries. Cooperative programs usually involve students at the junior or senior level in electronics/computers, with full-time academic work rotated with full-time employment using the fall, spring, and summer sessions as school/work periods. Intern programs usually involve continuous concurrent part-time enrollment at ASU and part-time employment at a participating company. Graduation is usually extended by one or more semesters for either type of program. The department offers a rotational selection of late afternoon and evening courses to serve the part-time student.

A Master of Technology degree program, with a concentration in Electronics Engineering Technology is available for qualified B.S. graduates.

Courses offered by the Department of Electronics and Computer Technology are listed in the course section of the catalog, and are organized under the following course prefixes:

ELT: Electronic Technology

EET: Electronic Engineering Technology

CET: Computer Engineering Technology

UET: Microelectronics Engineering Technology

To aid freshmen and transfer students in planning their program, a suggested two-year pattern of courses applicable to all programs in the department is shown below. Complete curriculum and four-year course patterns for each B.S. degree program offered by the department are available from the department. Direct entry to any of the programs as a freshman student assumes three (3) years of high school math (algebra I, II and geometry). One year each of high school chemistry and physics is recommended. One semester of typing or equivalent proficiency is required for the Comput-

er Engineering Technology program. Students without the required math background must take appropriate deficiency courses prior to entry, or immediately upon enrollment at ASU. Associate degree transfer students are expected to have completed college algebra and trigonometry (MAT 115 or equivalent).

Suggested Course Pattern for First Two Years: (66 credit hours total)

Freshman Year

First Semester

ENG	101	Freshman Composition	3
MAT	115	Coll. Alg. & Trig.	4
XXX	XX1	(Variable course)*	3
ICG	111	Graphic Language	2
CET	121	Structured Problem solving	3
		Total	15

Second Semester

ENG	102	Freshman Composition	3
PHY	111	Gen. Physics I	3
PHY	113	Gen. Physics Lab I	1
MAT	260	Tech. Calc. I	3
CSC	183	Programming in FORTRAN	3
ELT	202	App. Elec. Sci.	3
ELT	203	App. Elec. Sci. Lab	1
		Total	17

Sophomore Year

First Semester

PHY	112	Gen. Physics II	3
PHY	114	Gen. Physics Lab II	1
ELT	210	Active Devices	3
ELT	211	Elect. Cir. Lab I	1
ELT	208	Elec. Circuits	3
XXX	XX2	(Variable Course)*	3
MAT	261	Tech. Calc. II	3
		Total	17

Second Semester

UET	215	Elect. Fab. Prin. I	2
ELT	220	Elect. Circuits Sys	3
ELT	221	Elect. Syst. Lab	1
CET	250	Dig. Sys. & Microproc.	3
CET	251	Dig. Sys. & Micro. Lab	1
XXX	XX3	(Variable course)*	3
CHM	113	General Chemistry	4
		Total	17

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*The variable courses by program are as follows: The Electronic and Microelectronics Engineering Technology programs require:

XX1: MET 101 Manufacturing Processes & Materials (3)
XX2: COM 100 Intro to Human Communication (3) or COM 230 Small Group Communication (3)
XX3: ECN 111 Macroeconomic Principles (3)

The Computer Engineering Technology program requires:
XX1: COM 100 or 230 (3) (See XX2 above)
XX2: CSC 100 Intro. Computer Science I (3)
XX3: CSC 101 Intro. Computer Science II (3)

All departmental curricula are organized into specialty areas and general studies courses for a total of 132 semester hours minimum. A minimum of 50 upper division hours are required, including at least 24 semester hours of ELT, EET, CET, or UET upper division hours to be taken at ASU. Complete program of study guides with typical four year patterns are available from the department for each program.

The specialty area consists of 78-82 semester hours, which for all programs requires the following 38-hour common departmental core:

Common Department Core (38 semester hours)

ITC	111	Graphic Language	2
CET	121	Structured Problem Solving	3
CET	250	Digital Systems & Microprocessors	1
CET	251	Digital Systems & Microprocessors Lab	1
CET	350	Digital Logic Principles	3
CET	351	Digital Electronics Lab	1
CET	454	Microcomputer Systems Principles	3
CET	455	Microcomputer Applications Lab	1
ELT	202	Applied Electrical Science	3
ELT	203	Applied Electrical Science Lab.	1
ELT	208	Electric Circuits	3
ELT	210	Active Devices	3
ELT	211	Electronic Circuits Lab I	1
ELT	220	Electronic Circuits & Systems	3
ELT	221	Electronic Circuits & Systems Lab	1
ELT	496	Professional Orientation*	1
GRC	420	Technical Communications	3
UET	215	Electronics Fabrication Principles I	2
		Total	38

*Students must register for ELT 496 in the semester in which their 87th hour (ASU plus transfer hours) is earned. If this occurs in Summer session, student should register for ELT 496 in prior Spring semester.

The remaining 40-44 semester hours in the specialty area are special requirements of each major/concentration and are listed under the individual program descriptions.

The courses required in the general studies area common to all departmental programs are listed below.

General Studies (47-54 semester hours; 47 hours minimum)

ENG	101	Freshman Composition	3
ENG	102	Freshman Composition	3
		or ENG 105 Advanced Freshman Composition (3)	
Humanities and Fine Arts Electives*			6-10
Social and Behavioral Sciences Electives*.			10-6

Required:
ECN 111 Macroeconomic Principles (3)
COM 100 Introduction to Human Communication (3) or COM 230 Small Group Communication (3)

MAT	115	College Algebra and Trigonometry	4
MAT	260	Technical Calculus I	3
MAT	261	Technical Calculus II	3
MAT	262	Technical Calculus III	3
		(or STP 420 Intro. Applied Statistics (3)**	
PHY	111	General Physics I	3
PHY	113	General Physics Lab I	1
PHY	112	General Physics II	3
PHY	114	General Physics Lab II	1
CSC	183	Programming in FORTRAN	3
CHM	113	General Chemistry	4
		(or CHM 116 General Chemistry**)..	4
		Total	50-54

*See page 213 for specific requirements and approved list.
**CHM 116 is required only for the Microelectronics Engineering Technology program. This program also requires STP 420 in place of MAT 262. The other programs require MAT 262.

Electronic Engineering Technology

(An engineering technology bachelor's degree program accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET).)
The Electronic Engineering Technology concentration is available to students inter-

ested in applied electronics with emphasis on established electronic engineering design principles and application. This program is designed primarily to prepare students for employment in technical positions in industry, government or education in engineering-related activities. The program is also designed to interface with TAC/ABET accredited associate degree graduates in electrical/electronic technology.

The graduate typically finds employment in most major industries at various levels of responsibility including research and development support, design support, product support, process control, fabrication, production, testing and evaluation, technical writing, test equipment and field engineering.

The program elements are categorized below.

1. General Studies 50
2. Common Departmental Core 38
3. Program (E/ET) Core 21
4. Emphasis Area 23

      Total 132

Categories 1 and 2 are detailed in the introductory material for the department. The required courses in the core (category 3) are:

EET	301	Electric Networks I	3
EET	310	Electronic Circuits	3
EET	311	Electronic Circuits Lab II	1
EET	400	Electric Networks II...................	3
EET	472	Communication Systems...........	3
UET	414	Applied Material Science for Electronics.............................	3
UET	415	Electronics Fabrication Principles II	2
MET	101	Manufacturing Processes and Materials	3
		(or approved MET substitute)	
		Total	21

Area of Emphasis (Category 4): The student must select an area of emphasis according to career interests within the field of electrical/electronics. Each area of emphasis consists of 23 hours in an approved pattern which must include the equivalent of 6 hours of approved upper-division design-laboratory units in addition to laboratories required in categories 2 and 3. Required courses comprising the approved areas of emphasis are listed below:

Communication Systems Emphasis:
Required Courses: EET 404, 470, 471; CET 473, 475; plus an additional 12 hours of approved upper division technical electives.

Digital Systems Emphasis:
Required Courses: CET 452, 453, 456; EET 422, 423; plus an additional 12 hours of approved upper division technical electives.

Systems Control and Instrumentation Emphasis:
Required Courses: EET 340, 341, 406, 407, 430, 431; plus an additional 11 hours of approved upper division technical electives.

The Junior year course pattern for the Electronic Engineering Technology program is as follows: (Total: 34 credits)
First Semester: CET 350, 351; EET 301, 310, 311; MAT 262; Humanities/Fine Arts approved elective (3). Total credit hours: 17. Second Semester: ELT 496; CET 454, 455; EET 400, 472; UET 414; Social/Behavioral Sciences aproved elective (3). Total credit hours: 17. (Note: UET 414 is offered only in Spring semester.)

The Senior year course pattern for each of the emphasis area patterns within the Electronic Engineering Technology program is as follows: (Total: 32 credits)

Communication Systems Emphasis:
First Semester: GRC 420; UET 415; CET 473, 475 (Fall only courses); approved technical elective (3); approved Humanities/-Fine Arts electives (4). Total credit hours: 16.
Second Semester: EET 404, 470, 471 (Spring only courses); approved technical electives (9). Total credit hours: 16.

Digital Systems Emphasis:
First Semester: GRC 420; UET 415; CET 456; approved technical electives (9); approved Humanities/Fine Arts electives (4). Total credit hours: 16.
Second Semester: EET 422, 423 (Spring only courses); CET 452, 453 (Spring only courses); approved technical electives (8). Total credit hours: 16.

Systems Control and Instrumentation Emphasis:
First Semester: EET 340, 341 (Fall only courses); aproved technical electives (8). Total credit hours 16.

Second Semester: EET 406. 407, 430, 431 (Spring only courses); approved technical electives (8). Total credit hours: 16.

Computer Engineering Technology

The Computer Engineering Technology major is available to students interested in the applications and operations aspects of computer hardware and software. To support this combined hardware/software emphasis, the program curriculum includes a basic electronics component, a hardware/software oriented component, a software/programming component and a supporting area of emphasis component which may be used to strengthen one or more of the preceding curriculum components or related areas. The major is designed to meet TAC/ ABET criteria for accredited programs in engineering technology and IEEE curriculum guidelines for computer engineering technology programs.

The graduates of this program will typically find employment in industry, government and education in the many areas where a combination of hardware and software background is important. The graduate is intended to work as a member of the computer science and engineering team consisting of computer scientists, computer engineers, computer engineering technologists, computer technicians, and other professionals who serve the diverse and rapidly expanding computer and computer related fields. The program is also designed to interface with TAC/ABET accredited two year associate degree graduates in computer technology as well as with TAC/ABET accredited two year associate degree graduates in electronic/electrical technology.

The program elements are summarized below:

1. General Studies 50
2. Common Departmental Core 38
3. Computer Engineering Technology Core .. 32
4. Emphasis Area 12

     Total 132

Categories 1 and 2 are detailed in the introductory material for the department. The required courses in the Computer Engineering Technology Core (category 3) are:

CSC	100	Intro to Computer Science I	3
CSC	101	Intro to Computer Science II	3
CSC	310	Data Structures	3
CSC	383	Applied FORTRAN Programming	3

MAT	466	Applied Computation Methods	3
EET	472	Communication Systems	3
CET	452	Digital Systems Logic and Applications	3
CET	453	Digital Systems Logic Lab	1
CET	456	Minicomputer Systems and Programming	3
CET	473	Digital/Data Communication Systems	3
CET	475	Communication Systems Lab	1
CET	457	Microcomputer Systems and Applications	3
		Total	32

Area of Emphasis: The student must configure an approved area of emphasis consisting of 12 semester credit hours of approved electives which support particular career goals. Suggested approved electives are: CSC 340; STP 326 or 420; MAT 243; IEE 463; CET 408, 485, 486; UET 415. Other approved courses which may be selected will depend on prerequisite background and hence the department or faculty offering the course should be consulted.

It is recommended that computer engineering technology majors take the programming sequence: CET 121; CSC 183, 100, 101, 310 in that order.

The typical course pattern for the Junior and Senior years are as follows:
Junior Year:
First Semester: CET 350, 351; MAT 262; CSC 310; ECN 111; approved Humanities/-Fine Arts electives (4). Total credit hours: 17.
Second Semester: ELT 496; CET 454, 455; MAT 466; CSC 383; EET 472; approved Humanities/Fine Arts elective (3). Total credit hours: 17.
Senior Year:
First Semester: GRC 420; CET 456; CET 473, 475 (Fall only courses); approved technical electives (6). Total credit hours: 16.
Second Semester: CET 452, 453, 457 (Spring only courses); approved technical electives (6), approved Social/Behavioral Science elective (3). Total credit hours: 16.

Microelectronic Engineering Technology

The Microelectronics Engineering Technology major is available to students interested in the design, fabrication and manufacture of imprinted circuitry, monolithic integrated circuits (bipolar and MOS), and hybrid thick film and thin film circuitry, components and systems. The major combines elements of electronics, microelectronics

and manufacturing technology. The program is designed to meet TAC/ABET criteria for accredited programs in engineering technology.

Graduates of this program have various career opportunities in industry, particularly in semiconductor processing, fabrication, manufacturing and device product application areas. The continuing explosion in semi-conductor and related technologies and their applications to electronic and computer related products offers unique and challenging opportunities. Graduates of this program will tend to function in processing, manufacturing, operations and applications areas in industry as members of the diverse scientific engineering team consisting of engineers and scientists of various disciplines, technologists, electronic and manufacturing technicians and other professionals. The program is also designed to interface with TAC/ABET accredited two year associate degree programs in microelectronics as well as with TAC/ABET accredited two year associate degree graduates in electronic/electrical technology.

The program elements are categorized below:

1. General Studies	54
2. Common Departmental Core	38
3. Microelectronics Core	17
4. Manufacturing Technology Emphasis	23
Total	132

Categories 1 and 2 are detailed in the introductory material for the department. The required courses in the Microelectronics Technology Core (category 3) are:

EET	310	Electronic Circuits	3
EET	311	Electronic Circuits Lab II	1
UET	414	Applied Materials Science for Electronics	3
UET	415	Electronics Fabrication Principles II	2
UET	416	Monolithic Integrated Circuit Technology	3
UET	417	Solid State Device Processes Lab I	1
UET	418	Hybrid Integrated Circuit Technology	3
UET	419	Solid State Device Processes Lab II	1
		Total	17

For the Manufacturing Technology Emphasis (category 4) an approved pattern of 23 hours is required, as given below:

MET	101	Manufacturing Processes and Materials	3
MET	303	Machine Control Systems	3
MET	401	Quality Control	3
MGT	301	Principles of Management (3) (or IEE 431 Engineering Administration (3)	3
IEE	300	Economic Analysis for Engineers	2
IEE	463	Computer-Aided Processes (or approved elective in CAD/CAM)	3
Approved Technical Electives			6
		Total	23

The 6 hours of approved electives may be selected from EET, CET, UET, MET, CSC, IEE, EEE, CHE, CHM or PHY. Since courses selected will depend on prerequisite background, the department or faculty offering the course should be consulted.

The typical course patterns for the Junior and Senior years are as follows:
Junior Year:
First Semester: CET 350, 351; EET 310,311; CHM 116; IEE 300; approved Humanities/Fine arts elective (3). Total credit hours: 17.
Second Semester: ELT 496; CET 454, 455; UET 414 (Spring only course); STP 420; UET 415; approved Social/Behavioral Science elective (3). Total Credit hours: 16.
Senior Year:
First Semester: GRC 420; UET 416, 417, (Fall only courses); IEE 463 (Fall only); MET 303 (Fall only); approved technical elective (3). Total credit hours: 16.
Second Semester: UET 418, 419 (Spring only courses); MET 401 (Spring only); MGT 301; approved technical elective (3); approved Humanities/Fine Arts electives (4). Total credit hours: 17.

Department of Industrial Technology

PROFESSORS
PRUST (TC 201H), BROWN, KIGIN

ASSOCIATE PROFESSORS
AUTORE, HIRATA, LAWLER, PARDINI, ROE, RYAN, WILLIAMS

ASSISTANT PROFESSORS
ANDREWS, BOWERS, MATSON, SCHILDGEN

The Department of Industrial Technology includes the following majors: Engineering Technology, Industrial Technology and In-

dustrial Vocational Education; and concentrations in: Graphic Communications Engineering Technology, Graphic Communications Industrial Technology, Industrial Supervision, Technical Teacher Education and Vocational Teacher Education. Even though the direction varies considerably, the applied aspects of industrial processes are predominant in all specializations.

Each offering has specific core courses required, in addition to the University General Studies. There are also variations in the courses taken as an area of emphasis.

Suggested freshman patterns are presented in each offering, which should be used as a guide, but the final course selection is made with and approved by a faculty advisor.

Graphic Communications Engineering Technology

This concentration is designed to prepare the graduate for employment in technical positions which require engineering-related activities. These students receive educational experience in graphic communications, manufacturing, electronics and computer applications. Emphasis is placed upon the theory, design, and mathematical solutions to technical problems in all phases of production of printed material and media applications. Each student is also required to take the Engineering Technology Core as well as the General Studies courses.

A minimum of 130 semester hours of satisfactory credits are required to complete this program.

Required Core Courses

			Semester Hours
CET	121	Structured Problem Solving	3
CHM	114	General Chemistry for Engineers	4
Computer Science Course			3
ECN	111	Macroeconomic Principles	3
ELT	200	Applied Electricity/Electronics	3
GRC	420	Technical Communications	3
ICG	111	Graphic Language	2
MAT	115	College Algebra and Trigonometry	4
MAT	260	Technical Calculus I	3
MAT	261	Technical Calculus II	3
MET	101	Manufacturing Processes and Materials	3

PHY	111 & 113	General Physics	4

The sequence in which courses are taken is very important, although slight variations are permitted. The following course selection pattern is recommended for the freshman year:

			Semester Hours
First Semester			
ENG	101	Freshman Composition	3
ICG	111	Graphic Language	2
MAT	115	College Algebra and Trigonometry	4
MET	101	Manufacturing Processes and Materials	3
Technical Courses			6
		Total Credit Hours	18
Second Semester			
ELT	200	Applied Electricity/Electronics	3
ENG	102	Freshman Composition	3
CET	121	Structured Problem Solving	3
PHY	111 & 113	General Physics	4
Technical Courses			6
		Total Credit Hours	19

The student is advised to seek assistance in planning transferable courses.

The following courses are required and should be selected with the assistance of an advisor: GRC 135, 136, 238, 331, 332, 333, 334, 336, 337, 436, 437, 439; MET 200, 304, 305, 306; ELT 201; CET 250, 251, 350, 351 IVE 443; IEE 330; COM 230; MGT 301.

Graphic Communications Industrial Technology

The Graphic Communications Industrial Technology concentration provides a diversified approach for individuals interested in graphic communications techniques. The various processes of producing written and printed materials, such as newspapers, magazines, manuals, books, greeting cards, package printing and other visual materials are of major interest to students in the program as is the impact of these materials on our society.

The Graphic Communications Industrial Technology concentration has two areas of emphasis. The first is the Commercial Printing aspect of the industry. These students would seek employment in firms whose specific product is printed by a graphic communications process. It is a broad based professional education which is intended to prepare students for a wide range of careers in the industry. Among these are

positions in general management, production, quality control, sales, customer service, estimating and design.

The second area of emphasis is In-Plant Printing Management. The main thrust of the emphasis is the preparation of individuals for employment in in-plant facilities.

The goals of each student are reviewed and courses are suggested beyond the required courses. The selection of support courses is based on the anticipated needs of the student.

Commercial Printing Area of Emphasis

The students in Commercial Printing will be involved in educational experiences which are technically oriented with management skills a prime objective. Electives may be taken in many areas such as computer applications, design, marketing, etc.

Commercial Printing Core

			Semester Hours
CET	121	Structured Problem Solving	3
CHM	101	Intro. to Chemistry	4
		Computer Science Course	3
ECN	111	Macroeconomic Principles	3
ELT	200	Applied Electricity/Electronics	3
GRC	420	Technical Communications	3
ICG	111	Graphic Language	2
MAT	115	College Algebra and Trigonometry	4
MAT	260	Technical Calculus I	3
MET	101	Manufacturing Processes and Materials	3
MGT	301	Principles of Management	3
PHY	101	Intro. to Physics	4

The suggested freshman pattern:

First Semester

ENG	101	Freshman Composition	3
ICG	111	Graphic Language	2
MAT	115	College Algebra and Trigonometry	4
MET	101	Manufacturing Processes and Materials	3
		Technical Courses	6
		Total Credit Hours	18

Second Semester

CHM	101	Intro. to Chemistry	4
ENG	102	Freshman Composition	3
CET	121	Structured Problem Solving	3
		Technical Courses	6
		Total Credit Hours	16

The following courses are required and should be selected with the assistance of an advisor: GRC 135, 136, 236, 237, 238, 331, 332, 333, 334, 335, 336, 337, 339, 433, 435, 436, 437, 438, 439; ACC 300; MGT 311; IVE 443.

In-Plant Printing Management Area of Emphasis

The pattern of study is very similar to the Commercial Printing emphasis but additional courses in analysis and computer applications are required of all majors in the In-Plant Printing Management emphasis.

In-Plant Printing Management Core

			Semester Hours
CET	121	Structured Problem Solving	3
CHM	101	Intro. to Chemistry	4
		Computer Science Course	3
ECN	111	Macroeconomic Principles	3
ELT	200	Applied Electricity/Electronics	3
GRC	420	Technical Communications	3
ICG	111	Graphic Language	2
MAT	115	College Algebra/Trigonometry	4
MAT	260	Technical Calculus I	3
MET	101	Manufacturing Processes and Materials	3
MGT	301	Principles of Management	3
PHY	101	Intro. to Physics	4

The suggested freshman pattern is as follows:

First Semester

			Semester Hours
ENG	101	Freshman Composition	3
ICG	111	Graphic Language	2
MAT	115	College Algebra/Trigonometry	4
MET	101	Manufacturing Processes and Materials	3
		Technical Courses	6
		Total Credit Hours	18

Second Semester

CHM	101	Intro. to Chemistry	4
ENG	101	Freshman Composition	3
CET	121	Structured Problem Solving	3
		Technical Courses	6
		Total Credit Hours	16

The following courses are required and should be selected with the assistance of an advisor: GRC 135, 136, 237, 238, 332, 333, 334, 335, 336, 337, 339, 433, 435, 438; ACC 300; MGT 301, 311; IVE 443. Selected sta-

tistical analysis and computer applications courses will be required as recommended by the Graphic Comunications Advisory Board.

Industrial Supervision

The purpose of the Industrial Supervision program is to prepare supervisors and higher level personnel for management functions in manufacturing and public service organizations. It requires a technical background and supervisory functions of planning, organizing, communicating, motivating and evaluating.

The Industrial Supervision program is articulated with selected community colleges. Contacting an advisor is suggested to coordinate the course selection for transfer to the Industrial Supervision concentration.

A minimum of 18 semester hours of credit, approved by the advisor, is required in supervision and 40 semester hours of credit in a technical support pattern, such as aeronautics, interactive computer graphics, electronics, graphic communications or manufacturing as well as courses in safety, fire science and health. Among the options, one which should be strongly considered is the emerging field of interactive computer graphics.

Internship and prior industrial experience (IVE 445 and 455) can be used as part of the technical concentration. Prior to the completion of the degree, the student must show evidence of adequate and appropriate occupational experience.

Industrial Supervision Core

The following courses are required of all Industrial Supervision majors:

			Semester Hours
CHM	101	Intro. to Chemistry	4
Computer Science Course			3
COM	230	Group Communication	3
ECN	112	Microeconomic Principles	3
ELT	200	Applied Electricity/Electronics	3
GRC	420	Technical Communications	3
ICG	111	Graphic Language	2
IVE	443	Industrial Safety	3
IVE	444	Industrial Organization	3
IVE	450	Industrial Training	3
IVE	452	Industrial Supervision	3
MAT	115	College Algebra and Trig	4
PGS	100	Intro. to Psychology	3

PHY	111	General Physics	3
PHY	113	General Physics Lab	1

The suggested freshman pattern follows:

First Semester

ENG	101	Freshman Composition	3
ICG	111	Graphic Language	2
MAT	115	College Algebra/Trigonometry	4
PGS	100	Intro. to Psychology	3
Electives or Technical Courses			6
		Total Credit Hours	15-18

Second Semester

ECN	111	Macroeconomic Principles	3
ELT	200	Applied Electricity/Electronics	3
ENG	102	Freshman Composition	3
PHY	111	General Physics	3
PHY	113	General Physics Lab	1
Electives or Technical Courses			3
		Total Credit Hours	16

The following courses are also required: MGT 301, 351; PGS 430.

Industrial Vocational Education

The Industrial Vocational Education programs consist of three concentrations: Industrial Arts Education, Technical Teacher Education, and Vocational Teacher Education.

Students in each of these concentrations combine technology courses, professional education, and General Studies to prepare for educational careers. Concentration in a variety of technical fields is available.

Industrial Arts Education

The Industrial Arts Education student is being prepared to teach technical subjects at the elementary and secondary school levels. Each person will choose two technical areas, such as automotives, interactive computer graphics, electronics, graphic communications, metals and woods. A minimum of 60 semester credit hours, approved by an advisor, is required in technical and IVE professional courses to meet degree requirements leading to a teaching certificate. A 30 semester hour minor is available in Industrial Arts Education. Automotive courses should be selected at a community college in consultation with an advisor.

Industrial Arts Education Core

The following courses are required of all Industrial Arts Education Students:

Semester Hours

ELT	200	Applied Electricity/Electronics..	3
GRC	135	Graphic Communications	3
ICG	111	Graphic Language	2
IVE	120	Production Woods	3
IVE	160	General Metals	3
IVE	202	Design for Industry	3
IVE	300	American Industry Enterprise	3
IVE	402	Occupational Analysis and Course Development	3
IVE	442	Facility Planning and Management	3
IVE	443, 446 or 491		3
MAT	115	College Algebra and Trig	4
Physics, Chemistry			6

While there are variations in the sequence in which courses are taken in industrial arts education, the suggested freshman pattern may be useful as a general guide, subject to the approval of a faculty advisor.

First Semester

ENG	101	Freshman Composition	3
ICG	111	Graphic Language	2
IVE	120	Production Woods	3
IVE	160	General Metals	3
MAT	115	College Algebra and Trigonometry	4
		Total Credit Hours	15

Second Semester

ENG	102	Freshman Composition	3
GRC	135	Graphic Communications	3
HIS	103	U.S. History	3
IVE	202	Design for Industry	2
PGS	101	General Psychology	3
Technical Course			3
		Total Credit Hours	17

The following courses are required and should be selected with the assistance of an advisor: (EDF 300; SED 343, 373, 403, 433) or (SED 400, 401, 433, 434), IVE 480; RDG 467, 480; COM 100/230.

Industrial Arts Education students transfer to the Department of Secondary Education in the College of Education when they are classified as juniors. The student must meet the College of Education requirements.

Technical Teacher Education

The objective of Technical Teacher Education is the preparation of technical educators for the post-secondary level. A technical area of emphasis is required. Internship and prior industrial experience, approved by the advisor, is considered a means of gaining technical expertise in an industrial situation.

Prior to the completion of the degree, the student must show evidence of adequate and appropriate occupational experience.

Technical Teacher Education Core

The following courses are required of all Technical Teacher Education students:

Semester Hours

ELT	200	Applied Electricity/Electronics..	3
GRC	420	Technical Communications	3
IVE	202	Design for Industry	2
IVE	402	Occupational Analysis and Course Development	3
IVE	442	Facility Planning and Management	3
IVE	443	Industrial Safety	3
IVE	444	Industrial Organization	3
IVE	446	Instructional Aids and Materials	3
IVE	480	Teaching Industrial and Vocational	3
IVE	485	Teaching Internship	4
IVE	491	Organization and Management of Co-op Programs	3
MAT	115	College Algebra and Trigonometry	4
Physics and Chemistry			6
Computer Programming			3

The following suggested freshman course pattern is to be used as a guide but final selection is to be made with the faculty advisors approval.

Semester Hours

First Semester

COM	100	Intro. Human Communication.	3
ENG	101	Freshman Composition	3
MAT	115	College Algebra/Trigonometry..	4
Technical Courses			6
		Total Credit Hours	16

Second Semester

ENG	102	Freshman Composition	3
Physics			3
Social and Behavioral Sciences			3
Technical Courses			6
		Total Credit Hours	15

The following courses are required and should be selected with the assistance of an advisor: ECN 111; COM 100 or 230.

Vocational Teacher Education

The purpose of Vocational Teacher Education is to provide courses that will meet the needs of vocational teachers and prospective vocational teachers for meeting Arizona vocational certification requirements.

The selection of courses is under direct supervision of a faculty advisor.

Pre-Vocational Industrial Education

This is a broad base curriculum with emphases in industrial areas which will meet requirements for pre-vocational industrial education. There are five emphases available: construction, manufacturing, transportation, visual communications, and electronic communications. Each of these represents a career cluster for which occupational preparation is found in Arizona schools.

Pre-Vocational Industrial Education Core

The following courses are required of all Pre-Vocational Industrial Education majors:

IVE	202	Design for Industry	2
IVE	300	Industry Enterprise	3
IVE	402	Occupational Analysis and Course Development	3
IVE	422	Facility Planning and Management	3
IVE	480	Teaching Industrial Vocational Subjects	3
STE	402	Technology, Society and Human Values	3
PGS	100	Introduction to Psychology	3
MAT	115	College Algebra and Trigonometry	4
Physics, Chemistry			6
Computer Programming			3

The suggested freshman pattern is as follows:

Semester Hours

First Semester

ENG	101	Freshman Composition	3
MAT	115	College Algebra/Trigonometry	4
PGS	100	Intro. to Psychology	3
Technical Courses			6
		Total Credit Hours	16

Second Semester

ENG	102	Freshman Composition	3
HIS	103	The United States	3
Chemistry			4

Technical Courses		6
	Total Credit Hours	16

Pre-Vocational Industrial Education students receive a Bachelor of Science degree and meet the State of Arizona requirements for teaching certification. Requirements established by the Arizona Department of Education include professional education courses and directed teaching.

In addition to the core, each Pre-Vocational Industrial Education student must select two areas of emphasis according to career interests (19 hours each). Industrial internships may be applied.

Construction:
Required: IVE 120, 222, 321, 424, plus an additional 7 hours of approved emphasis electives.

Manufacturing:
Required: IVE 120, 160, MET 200, plus an additional 10 hours of approved emphasis electives.

Transportation:
Required: IVE 377, 471, 478, plus an additional 10 hours approved emphasis electives.

Visual Communications:
Required: ICG 111, 403; GRC 135, plus an additional 11 hours of approved emphasis electives.

Electronic Communications:
Required: ELT 200; EET 341, plus an additional 13 hours of approved emphasis electives.
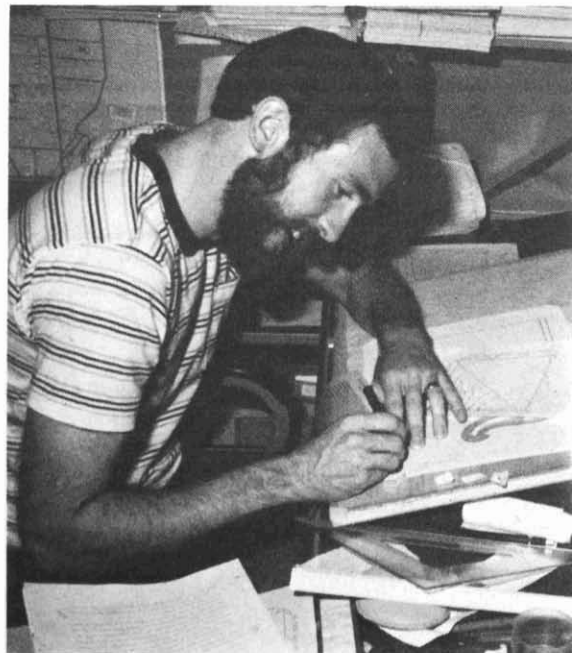
Department of Manufacturing Technology

ASSOCIATE PROFESSORS:
SCHMIDT (MOC 120A), GRAHAM, KISIELEWSKI

ASSISTANT PROFESSORS:
KELLEY, PALMGREN

The Manufacturing Engineering Technology, the Mechanical Engineering Technology, and the Welding Engineering Technology concentrations of the Department of Manufacturing Technology are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology.

Increased technological complexity and sophistication have created great industrial demand for the services of those individuals who possess working knowledge of the technical phases of planning, testing, production and fabrication of consumer and industrial products and equipment. To meet these needs, three concentrations are available in the manufacturing programs: (1) Manufacturing Engineering Technology, (2) Mechanical Engineering Technology and (3) Welding Engineering Technology. Each of these concentrations requires a minimum of 130 semester hours of satisfactory credits for completion.

Each of these concentrations requires a common manufacturing technology core in addition to the University 47 semester hour General Studies requirement.

The three concentrations in the Department of Manufacturing Technology require the core courses listed below:

Manufacturing Technology Core

			Semester Hours
MET	101	Manufacturing Processes and Materials	3
CET	121	Structured Prob. Solving	3
ICG	111	Graphic Language	2
MET	200	Manufacturing Process	3
ELT	200	Applied Electricity/Electronics	3
ELT	201	Applied Electricity/Electronics Laboratory	1
MET	301	Manufacturing Analysis	3
MET	310	Applied Mechanics Statics	3
MET	311	Applied Mechanics-Materials	3
ICG	314	Manufacturing Graphics	3

MET	320	Welding Survey	4
MET	401	Quality Control	3
MET	300	Applied Metallurgy	3
GRC	420	Technical Communications	3
CSC	183	Programming in FORTRAN	3
		Total	43

A suggested freshman year course pattern for all students in the Department of Manufacturing Technology is shown below. Complete curriculum and four-year course patterns for the three concentrations in Manufacturing Technology are available from the Department.

Suggested Course Pattern for Freshmen

Semester Hours

First Semester

ENG	101	Freshman Composition	3
MAT	115	College Algebra and Trig	4
MET	101	Manufacturing Processes and Materials	3
ICG	111	Graphic Language	2
COM	100	Intro. to Human Communication	3
		Total	15

Second Semester

ENG	102	Freshman Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics I	3
PHY	113	General Physics Lab I	1
CET	121	Structured Prob Solving	3
Social/Behavioral Science Elective			3
		Total	16

Manufacturing Engineering Technology. This concentration is designed to prepare technologists with both conceptual and practical applications of processes, materials, and products related to metalworking industries. Accordingly, this concentration is intended to prepare students to meet the responsibilities in planning the processes of production, developing the tools and machines, and integrating the facilities of production or manufacturing.

Required courses: MET 303, 304, 305, 306, 402, 403, 405, 406, 408; AET 309; PHY 111, 112, 113, 114; CHM 114; MAT 115, 260, 261, 262; plus approved technical electives.

Mechanical Engineering Technology. This concentration is designed to prepare the individual for technical positions involved with a broad range of activities such as de-

sign, development and the evaluation of machines, power generation and transmission, instrumentation and testing. Typically, the technologist may be required to lay out, develop details and supervise the development of a machine or process, along with testing, evaluating the performance and recommending such alternatives as to make the machine or process operable and competitive.

Required courses: AET 310; EET 340; MAE 333, 336; MET 303, 360, 380, 381, 418, 419, 440; PHY 111, 112, 113, 114; CHM 114; MAT 115, 260, 261, 262; COM 100 or 230, plus approved technical electives.

Welding Engineering Technology. This concentration is designed primarily to prepare individuals for technical positions in industries utilizing welding and related processes. The focus is on the application of welding technology as applied to current and near future industrial needs. The program is structured to provide the individual with a balance of theory, application and hands-on experiences. The general areas covered by the courses are: welding processes, materials, which includes non-destructive testing, and weldment design.

Required courses: MET 306, 321, 322, 325, 410, 411, 412, 415; AET 309; PHY 111, 112, 113, 114; CHM 114; MAT 115, 260, 261, 262; plus approved technical electives.

Students planning to complete one to two years at a community college or college-accredited private technical institute prior to entering this program should consult an Arizona State University Manufacturing Technology Department advisor for assistance in planning a transferable program.

Technology

AERONAUTICAL TECHNOLOGY

(Flight instruction costs are not included in University tuition)

AET 101 Introduction to Aeronautics. (3) F
Evolution of aviation. Aircraft types and uses. Principles of flight. Technical development of equipment/systems. Airspace use.

180 Aerospace Structures and Materials. (3) F, SS
Basic aerodynamics, aerospace vehicle structural design and materials. Manufacturing processes, assembly and repair techniques, and hardware selection. Two lectures, 4 hours laboratory.

181 Aerospace Systems. (3) S, SS
Aircraft and aerospace vehicle systems (hydraulics, pneumatics, auxiliary, control, instrument, etc.), weight and balance, inspection requirements and methods. Two lectures, 4 hours laboratory.

182 Private Pilot Ground School. (4) F, S, SS
Ground school leading to FAA Private Pilot Certification. Student may begin flight training with approval of instructor. Three lectures, 3 hours recitation.

183 Private Pilot Certificate. (1) F, S, SS
Flight training for the FAA Private Pilot Certificate. Satisfactory completion of FAA tests is required. Prerequisite or corequisite: AET 182.

200 Interim Flight Course. (0) F, S, SS
Allows students to accrue flight time in preparation for the Instrument Pilot Rating and the Commercial Pilot Certificate. Prerequisite: Private Pilot Certificate, 150 hours flying time maximum.

201 Air Traffic Control. (3) S
Ground and air operations. Weather services communications and routing. Flight plans and IFR operations. Departures and arrivals. Airport conditions and emergencies.

202 Aviation Meteorology. (3) F, S
Evaluation, analysis, interpretation of atmospheric phenomena. Low and high altitude weather from the pilot's viewpoint. Nephology. Prerequisite: PHY 111.

287 Aircraft and Aerospace Powerplants. (3) F, S, SS
Theory of internal combustion engines, components, performance analysis, engine accessories, systems and environmental control. Prerequisites: PHY 111, 112, or instructor approval. Two lectures, 4 hours laboratory.

288 Gas Turbine and Turbomachinery. (3) F, S, SS
Development and theory of gas turbine engines. Thrust and performance analysis. Engine components, systems, aerodynamic problem applications and environmental control. Prerequisites: PHY 111, 112, or instructor approval. Two lectures, 4 hours laboratory.

300 Aircraft Design I. (3) F, S, SS
Basic applied aerodynamics, propeller performance and airplane performance analysis. Prerequisites: AET 180, 287, 288; CSC 183; MAT 260; PHY 111, 112.

301 Applied Aerodynamics. (3) S
Wind tunnel and flight test theory, measurements and analysis. Aircraft stability and control. Prerequisites: ELT 200; MAT 261; AET 300. Two lectures, 2 hours laboratory.

303 Aviation Law and Regulations. (2) F, S
Basic source of regulatory powers. Statutes, regulations, advisory circulars. State and international rules. Prerequisite: Junior standing or approval of instructor.

305 Vector and Structure Analysis. (2) F
Vector analysis and topics in structural analysis. Prerequisites: MAT 115 or equivalent and PHY 111. Junior standing or approval of instructor required.

306 Aerospace Electrical and Electronic Systems. (3) F, S
Theory, operation and design of aircraft and aerospace vehicle electrical and electronic systems. Prerequisites: ELT 200, MAT 115, PHY 112.

308 National Airspace System I. (3) F
Regional and local organization. Aircraft certification, manufacturing and inspection. General aviation, flight standards and air carrier operations. Aviation medicine.

309 Nondestructive Testing and Quality Assurance. (3) F, S, SS
Purpose of industrial inspection and quality assurance. Theory and application of nondestructive inspection methods. Classification of material defects. Application

of pertinent standards. specifications, and codes. Prerequisite: Junior standing in Technology or instructor approval. Two lectures, 4 hours laboratory.

310 Instrumentation. (2) F
Measurement system responses and the characteristics of experimental data. Methods of collecting and analyzing data. Prerequisites: ELT 200; MAT 261.

314 Commercial Pilot Ground School. (3) F, S
Ground school leading to Commercial Pilot certification. Ten hours simulator required. Prerequisites: Private Pilot Certificate, AET 202.

380 Instrument Pilot Ground School. (3) S
Ground school leading to the FAA Instrument Pilot Rating. Ten hours simulator required. Prerequisite: Private Pilot Certificate; AET 202.

381 Instrument Pilot Rating. (1) F, S, SS
Flight training for the FAA Instrument Pilot Rating. Satisfactory completion of FAA Instrument Rating required. Prerequisite: AET 380; previous flying time 150 hours minimum. Not for AET majors.

382 Air Navigation. (2) F '85, S '86
Dead reckoning, advanced navigation methods, underlying principles. Corequisite: AET 380 or instructor approval.

383 Commercial Pilot Certificate and Instrument Rating. (2) F, S. SS
Flight training for the FAA Unrestricted Commercial Pilot Certificate. Satisfactory completion of FAA Certificate/Rating required. Prerequisites: AET 314, 380; flying time, 150 hours minimum.

384 Airport Planning. (3) F
Community and airport planning, site selection, navigation aids, lighting, design of landing area, terminal buildings and support facilities. Prerequisite: junior standing.

385 Flight Instructor Ground School. (3) F
Ground school in preparation for the FAA Flight Instructor Certificate. Prerequisite: AET 383.

386 Flight Instructor Rating. (1) F, S, SS
Flight training for FAA Flight Instructor Certificate. Certificate required for course completion. Prerequisite: AET 385.

387 Multi-Engine Ground School. (1) F
Ground school preparation for the FAA Multi-Engine Rating. Prerequisites: AET 288, 306, 383 and current Second Class Medical Certificate.

389 Multi-Engine Rating. (1) F, S, SS
Flight training for the FAA Multi-Engine Rating. FAA rating required for course completion. Corequisite: AET 387.

390 Aerospace Systems Analysis I. (3) F, S
A systems concept of quantitative methods applied to planning and control for aerospace applications. Prerequisites: CSC 183; MAT 260.

391 Airport Operation. (2) F
Airline and general aviation operations, terminal building utilizations, support facilities, disaster plans, community relationships, airport financing, and legislation. Prerequisite: AET 384.

392 Flight Instructor Instrument Ground School. (2) S
Ground school preparation for FAA Instrument Flight Instructor Rating. Prerequisite: AET 386 or approval of instructor.

393 Flight Instructor Instrument Rating. (1) F, S, SS
Flight training for the FAA CFII. CFII certificate required for course completion. Prerequisite: AET 386. Corequisite: AET 392.

394 Multi-Engine Land, Airplane Flight Instructor Rating. (1) F, S, SS
Normal and emergency flight operations. Instruction techniques and procedures associated with light multi-engine land, airplane. Prerequisite: AET 389.

408 National Airspace System II. (3) S
Airway facilities. Federal and non-federal airspace organization-maintenance, operations and communications. Towers, centers and flight service stations. Airport environment and certification. Security.

410 Aviation Safety. (2) F
Aviation accident prevention, human factors, life support, fire prevention, and crash survivability. Development and analysis of aviation safety programs. Prerequisite: Junior standing.

411 Aircraft Accident Investigation. (3) S
Development and evaluation of evidence, analysis, and recommendations for preventive practices. Prerequisite: AET 410.

414 Combustion Analysis. (3) F
Fuels and combustion, basic analysis of fuels chemistry and chemical kinetics of the combustion process. Prerequisites: AET 288; MAT 260; MET 380; PHY 112; CHM 114 or equivalent. Two lectures, 3 hours laboratory.

415 Propulsion. (3) S
Principles, thrust, performance cycles, combustion systems, mechanical, material and other design considerations, ram jets, rockets, and advanced propulsion systems. Prerequisite: AET 414. Two lectures, 3 hours laboratory.

417 Aerospace Systems Design. (3) F
Performance evaluation for rockets, missiles, and satellites. Introduction to space guidance and control, and life support systems. Prerequisites: AET 300; MET 360.

472 Applied Linear Analysis. (3) F
Linear algebra, differential equations, and computer methods applied to problems in Engineering Technology. Prerequisites: CSC 183; MAT 262.

487 Aircraft Design II. (3) F, S; Reed
Basic aerodynamics and airplane performance analysis methods applied to practical design project. Prerequisites: AET 300, CSC 183.

488 The Air Transportation System. (3) F
Air commerce related to the transportation system, regulatory climate of airline, future operations, career planning. Prerequisite: ECN 111.

489 Airline Administration. (2) S
Administrative organizations, economics of airline administration, operational structure, relationship with federal government agencies. Prerequisite: AET 488.

490 Aerospace Systems Analysis II. (3) S
Solution of aerospace management, planning, and control problems using linear programming. Prerequisites: AET 372, 390.

Special Courses: AET 294, 484, 494, 498, 499, 500, 580, 583, 584, 590, 591, 592, 593, 594, 598. (See pages 35-36.)

ELECTRONIC TECHNOLOGY

ELT 200 Applied Electricity/Electronics. (3) F, S
Introduction to principles and applications of electricity and electronics. Prerequisites: MAT 115. Not recommended for electronics majors.

201 Applied Electricity/Electronics Laboratory. (1) F, S
Basic electricity/electronics devices, circuits and applications. Laboratory techniques, instruments. Corequisite: ELT 200. Three hours laboratory.

202 Applied Electrical Science. (3) F, S, SS
Principles of electric circuit elements. Introduction to
d-c and a-c circuit analysis. Prerequisites: MAT 115;
CET 121 or CON 243.

203 Applied Electrical Science Laboratory. (1) F, S
Basic circuits, laboratory techniques and instruments.
Corequisite: ELT 202. Three hours laboratory.

208 Electric Circuits. (3) F, S, SS
Graphical and analytical analysis of electric circuits and
components. Application of circuit theorems. Transient
and sinusoidal excitation analysis. Computer solutions.
Prerequisites: ELT 202; MAT 115; CET 121 or CSC
181. Corequisite: MAT 260.

210 Active Devices. (3) F, S
Active device characteristics, models, and basic elec-
tronic circuit design principles. Prerequisites: ELT 202,
203; CET 121 or CSC 181. Corequisite: ELT 208.

211 Electronic Circuits Laboratory I. (1) F, S
Active device characteristics and basic electronic cir-
cuitry. Diagnostic principles and instrumentation. Com-
puter solutions. Corequisite: ELT 210. Three hours lab-
oratory.

220 Electronic Circuits and Systems. (3) S
Frequency response, feedback principles, operational
amplifiers, regulators, large-signal amplifiers, oscilla-
tors, pulse circuits, non-linear circuits. Prerequisites:
ELT 208, 210; MAT 260; CET 121.

221 Electronic Circuits and Systems Laboratory. (1) S
Prerequisite: ELT 211. Corequisite: ELT 220.

**482 Industrial Practice: Internship and Cooperative
Programs.** (1-4) F, S, SS
Specially assigned approved activities in selected elec-
tronic industries. Report required. Prerequisite:
Electronics/Computer Technology major enrolled at
junior-senior level. Maximum of 10 credits.

490 Electronics Project. (1-4) F, S, SS
Special individual or small group directed projects in
applied aspects of electronics with emphasis on
laboratory practice or hardware solutions to practical
problems. Prerequisite: approval of instructor.

496 Professional Orientation. (1) F, S
Technical, professional, economic, and ethical aspects
of electronics/computer engineering technology
practice and industrial organization. Lectures, field trips
and projects. Prerequisite: 2nd semester junior
standing (see page 277 under Common Department
Core).

Special Courses: ELT 294, 484, 494, 498, 499, 580,
584, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

ELECTRONIC ENGINEERING TECHNOLOGY

EET 301 Electric Networks I. (3) F, S
Graphical and analytical analysis of electronic networks
using calculus essentials. Transients. Steady-state
sinusoidal frequency response. Transfer functions. Pre-
requisites: ELT 208; MAT 260.

310 Electronic Circuits (3) F, S
Analysis and design of bipolar and FET electronic cir-
cuits using the model approach. Amplifier and transfer
function principles. Prerequisites: ELT 210, 208, CSC
183, MAT 260.

311 Electronic Circuits Laboratory II. (1) F, S
Design and application of electronic circuits. Perfor-
mance evaluation using SPICE, and laboratory tech-
niques. Prerequisite: ELT 211. Corequisites: EET 310.
Three hours laboratory/recitation.

340 Electric Power Circuits and Machines. (3) S
Principles and analysis of electrical power circuits and
components. Transformers. Rotating machines and re-
lated control equipment. Prerequisites: ELT 220 (or ELT
200 or ELT 202) and PHY 112 for non-ELT majors).

341 Electrical Systems Laboratory. (1) S
Prerequisites: ELT 221 (or ELT 201 or 203); PHY 114
for non-majors. Corequisite: EET 340. Three hours lab-
oratory.

400 Electric Networks II. (3) F, S
Graphical and analytical analysis of electrical networks.
Time, frequency and Laplace transform domain tech-
niques. Waveform analysis. Computer solutions. Pre-
requisites: EET 301; CSC 183; MAT 261.

404 Transmission Lines and Waveguides. (3) S
Theory and application of transmission lines,
waveguides and microwave components. Analysis and
matching using the Smith Chart. Prerequisite: EET 301.

406 Control System Technology. (3) S
Control system components, analysis of feedback con-
trol systems, stability, performance, application. Com-
puter simulations techniques. Prerequisites: EET 400
(or EET 301 and MAT 262); CSC 183.

407 Control Systems Laboratory. (1) S
Prerequisite: ELT 221; CET 251. Corequisite: EET 406.
Three hours laboratory.

410 Linear Electronic Circuits. (3) F '86
Frequency response and feedback design of multistage
electronic circuits and systems. Linear integrated cir-
cuitry. SPICE analysis. Prerequisites: EET 301, 310;
CSC 183.

411 Linear Electronics Circuits Laboratory. (1) F '86
Prerequisites: EET 311. Corequisite: EET 410. Three
hours laboratory.

420 Operational Amplifier Theory and Application. (3)
SS '87
Differential and operational amplifier circuitry, feedback
configurations, op-amp errors and compensation, linear
and nonlinear circuitry. Applications. Prerequisites: EET
301, 310, CSC 183.

421 Operational Amplifier Applications Laboratory. (1)
SS '87
Linear integrated circuits and op-amp applications. Pre-
requisite: EET 311. Corequisite: EET 420. Three hours
laboratory.

422 Electronic Switching Circuits. (3) S
Analysis and design of electronic circuits operating in a
switching mode. Waveshaping, timing, logic. SPICE
analysis. Prerequisites: EET 301, 310; CET 350; CSC
183.

423 Electronic Switching Circuits Laboratory. (1) S
Prerequisite: EET 311. Corequisite: EET 422. Three
hours laboratory.

430 Instrumentation Systems. (3) F
Measurement principles and instrumentation tech-
niques. Signal and error analysis. Prerequisites: ELT
220; CET 350; CET 250 or 454.

431 Instrumentation Systems Laboratory. (1) F
Prerequisites: ELT 221; CET 351; CET 251 or 455. Co-
requisite: EET 430. Three hours laboratory.

440 Electrical Power Systems Technology. (3) S
Electrical power system analysis, transmission, dis-
tribution, instrumentation, protection, and related sys-
tem components. Prerequisite: EET 340 or CON 273.

460 Industrial Electronics. (3) SS '86
Analysis and design of electronic circuits for control
and instrumentation. Prerequisites: ELT 220, 208; MAT
260; CET 250.

461 Industrial Electronics Laboratory. (1) SS '86
Prerequisites: ELT 221; CET 251. Corequisite: EET 460.
Three hours laboratory.

470 Communication Circuits. (3) S
Analysis and design of passive and active communication circuits. Coupling networks, filters, impedance matching. Modulation and demodulation techniques. Computer solutions. Prerequisites: EET 310, 400, 472; CET 350; CSC 183.

471 Communication Circuits Laboratory. (1) S
Prerequisite: EET 311. Corequisite: EET 470. Three hours laboratory.

472 Communication Systems. (3) F, S
Systems analysis and design of AM, FM, PCM and SSB communication systems. Noise and distortion performance of communication systems. Prerequisites: ELT 208, 220; MAT 260; CET 250.

476 Video Circuits and Systems. (3) F '85
Radio frequency selectors, video amplifiers, synchronizing circuits, kinescopes and color demodulators. Prerequisites: ELT 220; CET 250.

477 Video Systems Laboratory. (1) F '85
Prerequisites: ELT 221; CET 251. Corequisite: EET 476. Three hours laboratory.

478 Communication Transmission System Design. (3) F '86
Signal propagation, transmission. Antenna principles and applications. Cable TV and other communication transmission systems design. Prerequisites: EET 404, 472; CET 250; MAT 261; CSC 183.

479 Communication Systems Laboratory. (1) F '86
Prerequisite: EET 311. Corequisite: EET 478. Three hours laboratory.

483 Electronic Systems Analysis. (3) SS
Study of electronic systems using operational and state variable techniques with emphasis on computer-aided analysis. Prerequisites: MAT 262; ELT 220; CSC 183.

501 Signal Analysis/Processing. (3) A
Theory: Hardware. Transform and computer techniques. Applications. Prerequisites: EET 400; MAT 262; CSC 183.

506 System Dynamics and Control. (3) S
Time, frequency and transform domain analysis of physical systems. Transfer function analysis of feedback control systems performance and stability. Compensation. Prerequisites: EET 400; MAT 262; CSC 183.

508 Computer Process Control Technology. (3) A
Process computer control hardware, software. Sampled-data control systems, process modeling, microprocessor control techniques, computer-aided design, simulation. Process applications. Prerequisites: EET 406; CET 250; CSC 183.

510 Linear Integrated Circuits and Applications. (3) F '86
Analysis, design and applications of linear integrated circuits and systems. Prerequisites: EET 301, 310; CSC 183.

522 Digital Integrated Circuits and Applications. (3) A
Analysis, design and applications of integrated circuits and systems. Prerequisites: EET 301, 310; CET 350; CSC 183.

530 Electronic Test Systems and Applications. (3) S
Analysis, design and application of electronic test equipment, test systems, specifications, documentation. Prerequisites: EET 301, 310; CET 350, 454; CSC 183.

540 Electrical Power Systems. (3) S
Electrical power system analysis, transmission, distribution, instrumentation, protection, and related system components. Prerequisite: EET 340; CSC 183.

560 Industrial Electronics and Applications. (3) A
Analysis, design and application of special electronic devices, and systems to industrial control, power, communications and processes. Prerequisites: EET 301, 310; CET 350, 454; CSC 183.

570 Communication Circuits and Applications. (3) S
Selected topics in electronic communication circuits. Applications to analog and digital communication. Filter design. Prerequisites: EET 310, 400, 472; CET 350; CSC 183.

578 Communication Transmission Systems. (3) F '86
Electromagnetic signal propagation and transmission, antenna principles and application. Cable TV and other communication transmission systems. Prerequisites: EET 404, 472; CET 250; MAT 261.

Special Courses: EET 294, 484, 494, 498, 499, 580, 584, 591, 592, 593, 594, 598 and 599. (See pages 35-36.)

COMPUTER ENGINEERING TECHNOLOGY

CET 121 Structured Problem Solving. (3) F, S
Methods of defining, organizing, developing ideas and solutions to problems of a technical nature using the computer as a tool. Prerequisite: MAT 106 or equivalent. Corequisite: MAT 115.

CET 250 Digital Systems and Microprocessors. (3) F, S
Fundamentals and applications of digital computers and microprocessors, with emphasis on SSI and MSI applications. Prerequisites: ELT 200 or 202; CSC 183.

251 Digital Systems and Microprocessors Laboratory. (1) F, S
Corequisite: CET 250. Three hours laborabory.

350 Digital Logic Principles. (3) F, S
Binary logic, combinational design and minimization. Introduction to sequential circuits. Introduction to digital computer principles. Prerequisites: CET 250; CSC 183.

351 Digital Electronics Laboratory. (1) F, S
Prerequisite: CET 251. Corequisite: CET 350. Three hours laboratory.

408 Analog-logic Simulation. (3) F '86
Analog-logic simulation of dynamic physical feedback systems. Programming and scaling techniques for linear and nonlinear simulation. Digital simulation. Prerequisites: CET 250; EET 400 or MAT 262; ELT 220, 221; CSC 183.

452 Digital Systems Logic and Applications. (3) S
Analysis and design of sequential logic networks. System design techniques using complex building blocks; programmed logic. Prerequisites: CET 350 and CSC 183.

453 Digital Systems Logic Laboratory. (1) S
Prerequisite: CET 351. Corequisite: CET 452. Three hours laboratory.

454 Microcomputer Systems Principles. (3) F, S
Analysis and design of small computer systems. Computer organization and hardware. Machine language fundamentals and operations. Prerequisites: CET 250; CSC 183 or CSC 100.

455 Microcomputer Applications Laboratory. (1) F, S
Prerequisite: CET 251. Corequisite: CET 454. Three hours laboratory.

456 Minicomputer Systems and Programming. (3) F, S
Assembly language programming. Input-output and offline diagnostics. Utility software. Prerequisites: CET 454; CSC 183 or 101.

457 Microcomputer Systems and Applications. (3) S
Applications of mini-and/or micro-computer hardware and software. Special purpose controllers. Interface de-

sign and applications. Prerequisites: CET 454, 455; CSC 183 or 101; ELT 220, 221.

473 Digital/Data Communication Systems. (3) F
Signals, distortion, noise, error detection/correction. Transmission and system design. Interface techniques and standards. Digital hardware. Applications. Prerequisites: EET 472; CET 250 or 454; CET 350.

475 Communication Systems Laboratory. (1) F
Prerequisites: ELT 221; CET 251, 351. Corequisite: CET 473. Three hours laboratory.

485 Digital Testing Techniques. (3) S
Hardware/software aspects of digital testing technology; board and logic test equipment. Prerequisites: CET 456 or 457; CSC 183 or 101.

486 Electronics Computer Aided Design. (3) F
CAD/CAM for electronics manufacturing; Printed-circuit layout, documentation, schematic plotting. Prerequisites: UET 215; CSC 183; ELT 220; CET 250.

552 Digital Systems and Applications. (3) A
Analysis, design and applications of digital networks and systems. Prerequisites: CET 350, 454; CSC 183.

556 Computer Software Technology. (3) A
Assembly language programming techniques and operations, operating system characteristics, systems software applications. Prerequisite: CET 454, 455; CSC 183 or 101.

557 Microcomputers and Applications. (3) S
Applications of small computer systems, mini- and micro-computer hardware and software. Prerequisites: CET 454, 455; ELT 220, 221; CSC 183 or 101.

Special Courses: CET 294, 484, 494, 498, 499, 580, 584, 591, 592, 593, 594, 598, 599 (See pages 35-36.)

MICROELECTRONICS ENGINEERING TECHNOLOGY

UET 215 Electronic Fabrication Principles I. (2) F, S
Layout, documentation and fabrication techniques for design and manufacture of electronic components and equipment. Project required. Prerequisites: ELT 210, 211. One hour lecture; 2 hours laboratory. Field trips.

414 Applied Materials Science for Electronics. (3) S
Introduction to mechanical, thermodynamic and electromagnetic properties of materials used in electronic technology applications; semiconductor physics, transducer physics, heat transfer. Prerequisites: PHY 111, 112; CHM 113; EET 310; MAT 260; CSC 183.

415 Electronics Fabrication Principles II. (2) F, S
Electronic equipment design and fabrication principles and practice. Completion of electronics hardware design project and report. Prerequisites: UET 215; ELT 220, 221 or EET 310, 311; CET 250 or 350; senior standing. One hour lecture; Two hours laboratory. Field trips.

416 Monolithic Integrated Circuit Technology. (3) F
Processing and fabrication of monolithic bipolar and MOS integrated circuits. Prerequisite: UET 414.

417 Solid State Device Processes Lab I. (1) F
Wafer cleaning, resistivity/conductivity measurements, oxidation growth, predeposition and drive-in diffusion, photo lithography, vacuum deposition and device fabrication. Prerequisite: UET 215. Corequisite: UET 416. Three hours laboratory.

418 Hybrid Integrated Circuit Technology. (3) S
Layout, fabrication, design and manufacture of thin and thick film hybrid circuits. Prerequisite: EET 310; MAT 260; CHM 113; PHY 111, 112.

419 Solid State Devices Processes Lab II. (1) S
Thick and thin film techniques and processes with a comprehensive IC project, field trips and demonstra-

tions. Prerequisite: UET 215. Corequisite: UET 418. Three hours laboratory.

513 Microelectronics Technology. (3) A
Special processes, techniques and advances in monolithic and hybrid technology. Emphasis on manufacturing practice and product application for LSI and VLSI. Prerequisite: approval of instructor.

516 Monolithic Integrated Circuit Technology and Applications. (3) A
Processing, fabrication and manufacturing of monolithic integrated circuits. Applications. Prerequisite: UET 414.

518 Hybrid Integrated Circuit Technology and Applications. (3) A
Theory, processing fabrication and manufacturing of hybrid microelectronics devices and products. Applications. Prerequisite: UET 414, or approval of instructor.

Special Courses: UET 294, 484, 494, 498, 499, 580, 584, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

INDUSTRIAL TECHNOLOGY GRAPHIC COMMUNICATIONS

GRC 135 Graphic Communications. (3) F, S
Introduction to the technologies involved in the design image generation, transmission and production of multiple images for consumer utilization. Two hours lecture and four hours laboratory. Field trips.

136 Industrial Printing Processes. (3) S
Theory and practices of the major industrial printing processes, including photography and other support technologies. Two hours lecture and four hours laboratory. Field trips. Prerequisite: GRC 135.

236 Screen Process Printing. (3) N
Theory and study of industrial applications relating to the technology and uses of screen process printing. Prerequisite: GRC 136. Field trips. Six hours lecture and laboratory.

237 Image Preparation. (3) F
Basic principles of typographic layout. Preparation of thumbnails, roughs, comprehensives and mechanicals. Introduction to photocomposition systems. Six hours lecture and laboratory.

238 Instruments and Controls. (3) N
Instrumentation and methodologies for materials testing and quality control. Prerequisite: GRC 136.

331 Substrates and Inks. (3) N
Technical study of ink and paper with printing capability stressed. Field trips. Prerequisite: approval of instructor.

332 Stripping and Platemaking. (3) N
Stripping negatives and positives; line, halftone, duotone, full color; contacting flats onto various types of lithographic plates. Field trips. Prerequisite: GRC 136. Two hours lecture and four hours laboratory.

333 Sheet-Web Press Technology. (3) F
Function of the offset printing equipment. Lithographic dynamics of both sheet fed and web systems. Prerequisite: GRC 136 or approval of instructor. Two hours lecture and four hours laboratory.

334 Photo-Mechanical Reproductions. (3) F
Theory and production of line work, halftones, contact work and special effects for the graphic arts industry. Prerequisite: GRC 136. Two hours lecture and four hours laboratory.

335 Binding and Finishing. (3) F
Operations, involving cutting, trimming, perforating, stamping, die cutting, laminating, embossing and bindery process. Prerequisite GRC 136.

336 Color Separation. (3) S
Methods of producing separation negatives and positives. Prerequisite: GRC 334.

337 Production management. (3) N
Planning and controlling work flow of graphic arts products. Field trips. Prerequisite: GRC 136.

339 Estimating and Cost Analysis. (3) N
Estimating printing operations and materials; elements of cost finding using selected systems. Prerequisite: GRC 136.

420 Technical Communications. (3) F, S
Planning and preparing technical publications and oral presentations related to current technical topics in chosen technical fields. Prerequisites: Junior or senior standing and demonstrated English.

433 Production Techniques. (3) N
Systematic production planning experience. Six hours lecture and laboratory. Prerequisites: GRC 333, 334.

435 Plant Management. (3) N
Independent documentary research; equipment, personnel, plant site selection and plant management problems. Field trips. Prerequisite: GRC 337.

436 Gravure Technology. (3) N
In-depth study of the production sequences and processes related to the gravure method of printing. Prerequisite: GRC 336.

437 Advanced Color Reproduction. (3) F
Scientific analysis for the engineering of color reproduction systems used in the graphic arts industry. Field trips. Prerequisite: GRC 336.

438 Graphic Arts Techniques and Processes. (3) F, S, SS
Relating materials to graphic arts printed products — production practice. Prerequisite: Junior status. Six hours lecture and laboratory.

439 Photocomposition. (3) S
Detailed study of modern image preparation equipment. Prerequisite: GRC 237.

537 Web Press Problems: (3) N
Directed group study of selected web press problems.
Special Courses:GRC 484, 494, 498, 499, 500, 580, 584, 590, 591, 592, 593, 594, 598. (See pages 35-36)

INTERACTIVE COMPUTER GRAPHICS

ICG 111 Graphic Language. (2) F, S
Fundamentals of graphic languages used in design, manufacturing, and communication. Includes freehand drawing, visualization, descriptive geometry, and computer graphics. Lecture/Laboratory.

212 Applications of Computer Graphics. (3) N
Fundamentals of interactive computer graphics for a variety of professional environments. Field trips. Lecture/Laboratory.

311 Technical Illustration. (3) N
Pictorial drawing, shades and shadows, and multi-media rendering techniques. Prerequisite: ICG 111 or equivalent. Lecture/Laboratory.

312 Computer-Assisted Graphics. (3) N
Practical application of computer-aided design and drafting (CADD) in the industrial environment. Prerequisite: ICG 111 and 212 or equivalent. Field trips. Lecture/Laboratory.

314 Manufacturing Graphics. (3) N
Design and working drawings for manufacturing. Includes documentation standards, dimensioning and tolerancing, and machine mechanisms. Prerequisite: ICG 111 or equivalent. Lecture/Laboratory.

315 Geometric and Positional Tolerancing. (3) N
Precision dimensioning techniques and practices of geometric and positional tolerancing for production manufacturing. Prerequisite: ICG 111 or equivalent. Lecture.

403 Graphic Applications. (3) N
Student selected modules: Architectural, electronic civil/utility drawing, blueprint reading, descriptive geometry, computer graphics, and others. Field trips. Prerequisite: ICG 111 or equivalent. Lecture/Laboratory.

412 Computer Graphics Systems. (3) N
Advanced study in the application of CADD. Field trips. Prerequisite: ICG 312. Lecture/Laboratory.

512 Graphics Systems Development. (3) N
Research and development in Computer Graphics Systems; including applied project management, development, documentation, evaluation and implementation. Prerequisite: ICG 212, 312 and 412 or equivalent or instructor approval. Field trips. Lecture/Laboratory.

Special Courses: ICG 484, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

INDUSTRIAL VOCATIONAL EDUCATION

IVE 120 Production Woods. (3) N
Product design, cost estimating and fabrication of wood products. Emphasis on production support functions. Field trips. Six hours lecture and laboratory.

160 General Metals. (3) N
Machine tools, welding, casting and sheetmetal. Two hours lecture and 4 hours laboratory. Field trips.

202 Design for Industry. (2) N
Project design principles and practices. One hour lecture, 3 hours laboratory.

222 Wood Technology. (2) N
Physical, structural and mechanical properties. Analysis of adhesives, preservatives and hybrid materials. Field trips. Six hours lecture and laboratory.

300 Industry Enterprise. (3) N
Comprehensive study of the free enterprise system relating to construction, manufacturing, transportation, visual communications, electronic communications—occupational emphasis.

321 Light Building Technology. (3) N
Principles and practices as related to light construction inclusive of preliminary considerations and functions through postconstruction concern. Field trips. Prerequisite: approval of instructor. Two hours lecture, 4 hours laboratory.

322 Design and Manufacture in Wood. (3) N
Furniture, cabinet, pricing, experimentation, modified wood products, joining, forming, laminating, structural design. Field trips. Prerequisite: IVE 222. Six hours lecture and laboratory.

361 Industrial Projects Design. (2) N
Design and development of projects for the classroom. Prerequisite: Approval of instructor. Four hours lecture and laboratory.

377 Internal Combustion Engines. (3) N
Engine principles, design, performance testing; fuels. Field trips. Six hours lecture and laboratory. Prerequisite: approval of instructor.

402 Occupational Analysis and Course Development. (3) A
Selecting instruction units through task analysis techniques; industrial and vocational course and training program development. Prerequisite: Approval of instructor.

405 Improving Instruction in Industrial Education. (3) N
Methods, evaluation and instructional improvement in Industrial Education. Prerequisite: IVE 402.

421 Production Wood Technology. (3) N
Design and manufacture of products, economy of materials, structural factors, jigs and fixtures, work environment, assembling, finishing. Field trips. Prerequisite: IVE 222. Six hours lecture and laboratory.

424 Techniques of Construction. (3) N
Buildings, nonbuildings, planning, site preparation, structure, construction materials, personnel. Field trips. Prerequisite: IVE 222. Six hours lecture and laboratory.

427 Industrial Plastics. (3) N
Theory of thermoset plastics. Injection molding, vacuum forming, welding. Casting foam. Compression molding and fabrication. Field trips. Prerequisite: Approval of instructor. Six hours lecture and laboratory.

442 Facility Planning and Management. (3) N
Planning, organizing and managing industrial and vocational education laboratories; equipment and supply selection, facility arrangement. Field trips. Prerequisite: Junior status.

443 Industrial Safety. (3) N
Accident prevention, accident factors, methods of recording and reporting, analysis, psychological aspects, attitudes, recent legislation, safety consciousness and liability.

444 Industrial Organization. (3) N
Basic comcepts of economics, finance and labor. Topics relate to industrial relations, governmental regulations, organizational structure, labor relations and human factors. Prerequisite: Junior status.

445 Industrial Internship. (1-10) N
Work experience assignment in industry commensurate with student's program. Specialized instruction by industry with University supervision. Prerequisites: Approval of advisor, Junior-Senior status, 2.5 GPA.

446 Instructional Aids and Materials. (3) N
Selection, preparation, construction and methods of use in industrial and vocational education. Prerequisite: Approval of instructor.

450 Industrial Training. (3) N
Training techniques and learning processes. Planning, developing, and evaluating training programs in industry and governmental agencies. Prerequisite: Approval of instructor.

451 Materials Control. (3) N
Activities of material handling including purchasing, receiving, warehousing, traffic, plant layout, inventory and production control and shipping relating to technical procedures.

452 Industrial Supervision. (3) N
Supervisory principles as applied to industrial and governmental agencies. Supervisor-employee relations, group morale, leadership techniques, policy interpretation and training. Prerequisite: Approval of instructor.

453 Safety Supervision. (3) N
Controlling physical conditions, environmental control, personal protection controls, cost analysis, systems safety analysis, auxiliary function. Prerequisites: IVE 443, 444.

455 Industrial and Vocational Programs. (1-12) N
Industrial, governmental, factory, and special school programs. Prerequisites: Advisor and IVE faculty approval, and Junior-Senior status.

460 Improving Instruction in Technical Education. (3) N
Methods, evaluation and instructional improvement in Technical Education. Prerequisite: IVE 402.

461 Hot Metal Techniques. (3) N
Properties of metals; sand and investment casting; pattern making. Field trips. Prerequisite: IVE 160. Six hours lecture and laboratory.

465 General Metals. (3) N
Numerical control, chipless machining; study of special interest in metalworking processes. Prerequisite: IVE 160. Six hours lecture and laboratory.

470 Improving Instruction in Pre-Vocational Education. (3) N
Methods, evaluation and instructional improvement in Pre-Vocational Education. Prerequisite: IVE 402.

471 Power Transmission. (3) N
Principles and servicing of clutches, transmissions, differentials, steering and suspension. Prerequisite: Approval of instructor. Six hours lecture and laboratory.

478 Engine Analysis. (3) N
Automotive emission control, air conditioning operation, performance testing ignition and fuel control. Field trips. Prerequisite: Approval of instructor.

480 Teaching Industrial and Vocational Subjects. (3) N
Teaching techniques, philosophy, organization, planning, evaluation of teaching efficiency. Prerequisite: Junior status.

485 Teaching Internship. (1-8) N
Classroom, laboratory and training procedures in postsecondary institutions, industry and/or governmental agencies. Prerequisites: IVE 402, 480, senior status and departmental approval.

491 Organization and Management of Cooperative Programs. (3) N
Workstudy programs for industrial and vocational occupations in high schools and community colleges. Developing and coordinating programs. Instructional materials. Prerequisite: Junior status.

513 Experimental Activities. (3) N
Investigation and solution of technical problems in the student's area of specialization involving material design and analysis.

540 Evaluation in Industrial and Vocational Education. (3) N
Evaluative factors such as attitudes, behavioral factors, skills, technical information; instrument construction; evaluation of program effectiveness.

541 Vocational Education for Special Needs. (3) N
Organizing and administering vocational programs to meet special needs of youth and adults in schools, agencies, and industry.

542 History and Philosophy of Industrial and Vocational Education. (3) N
Evolution of modern programs, current concepts, future trends.

544 Industrial Processes in Special Education. (3) N
Emphasis on task analysis in development of manipulative activities for special needs learners.

545 Legal Aspects of Occupational Education. (3) N
Interpretation of federal and state acts, regulations, and responsibilities related to vocational education programs.

546 Post-Secondary Occupational Education. (3) N
Trends, community surveys, needs, curricula, instruction, evaluation of occupational programs, financing, emphasis on industrial occupational education at the post-secondary level.

548 Administration of Industrial and Vocational Education. (3) N
Improving instruction, fund and material control, student personnel problems, curricular patterns.

549 Research Techniques and Applications. (3) N
Selection of research problems, analysis of literature, individual investigations, preparing reports, proposal writing.

Special Courses: IVE 484, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

MANUFACTURING TECHNOLOGY

MET 101 Manufacturing Processes and Materials. (3) F, S, SS
Basic manufacturing processes and engineering materials, their properties and typical applications. Three hours lecture.

110 Welding Survey. (3) S
Oxy-acetylene, arc, brazing, resistance, and gas tungsten-arc welding procedures for ferrous and nonferrous metals. Six hours lecture and laboratory.

116 Aeronautical Welding. (2) F
Oxy-acetylene and tungsten gas tungsten-arc welding procedures and brazing techniques used for aircraft structures. Four hours lecture and laboratory.

200 Manufacturing Processes. (3) F,
Metal removal processes emphasizing drilling, milling and lathe processes including tool bit grinding. Emphasis on production speeds and feeds. Six hours lecture and laboratory. Prerequisites: MET 101; ICG 111.

300 Applied Metallurgy. (3) F
Principles of metallurgy emphasizing concepts most relevant to typical manufacturing requirements; factors affecting properties and evaluation methods; metallography experiences. Two hours lecture, 3 hours laboratory. Prerequisite: MET 101.

301 Manufacturing Analysis. (3) S
Introduction to the organizational and functional requirements for effective production. Includes writing production operation plans. Prerequisite: MET 200.

303 Machine Control Systems. (3) F, S
Theory and application of electromechanical, hydraulic, pneumatic, fluidic and electrical control systems for manufacturing. Prerequisites: MAT 260; ELT 200 or PHY 112. Six hours lecture and laboratory.

304 Casting and Forming Processes. (3) S '86
Analysis of various casting, molding, and forming processes in terms of equipment requirements, product characteristics, and manufacturing costs. Prerequisite: MET 101.

305 Manufacturing Processes. (3) S
Metal removal processes emphasizing milling, grinding, shaping, turret lathe, tracer lathe, and tool sharpening. Six hours lecture and laboratory. Prerequisite: MET 200.

306 N/C Manual Programming. (3) F
Numerical Control as related to point-to-point and continuous path systems. Methods of programming, setup and operation. Six hours lecture and laboratory. Prerequisite: MET 200.

310 Applied Mechanics-Statics. (3) F, S
Vectors, force systems, friction, equilibrium, centroids and moment of inertia. Prerequisites: PHY 111; MAT 260.

311 Applied Mechanics-Materials. (3) F, S
Deformation of members and bodies under stress. Prerequisite: MET 310. Four hours lecture and laboratory.

320 Welding Survey. (4) F
Theory and application of industrial welding processes; introductory welding metallurgy and weldment design; SMAW, GTAW, GMAW, oxy-acetylene, brazing experi-

ences. Three hours lecture, 3 hours laboratory. Prerequisite: Upperclass standing or instructor's approval.

321 Welding Processes. (3) S '86, F '87
Theory and application of the arc welding processes and oxy-fuel cutting; fixturing, procedures, safety, codes and experimental techniques are covered. Prerequisite: PHY 112; MET 320. Six hours lecture and laboratory.

322 Welding Processes. (3) F '85
Theory and applications of EBW, LBW, solid state bonding, brazing and soldering. Prerequisite: PHY 112; MET 320. Six hours lecture and laboratory.

325 Welding Power Source Analysis. (4) S '86
Design and operating characteristics of welding power sources and related equipment. Equipment selection, setup, and troubleshooting procedures covered. Prerequisites: PHY 112; ELT 200, 201; MET 320. Six hours lecture and laboratory.

343 Material Processes. (3) S
Industrial processing as applied to low, medium and high volume manufacturing. Basic and secondary processing, fastening and joining, coating, quality control. (Not for construction, engineering or technology degree credit.) Prerequisite: IND 350.

354 Mechanics of Materials. (4) F
Vectors, force systems, friction, equilibrium, centroids, and moment of inertia. Concepts of stress, string, and stress analysis applies to beams, columns, and combined loading. (Not for construction, technology or production design degree credit.) Prerequisites: PHY 111; MAT 115.

360 Applied Mechanics-Dynamics. (3) S
Masses; motion kinematics; dynamics of machinery. Prerequisite: MAT 261; MET 310.

380 Applied Thermodynamics. (3) F,
Thermodynamics of engines, compressors, turbines and related components. Not open to engineering students. Prerequisites: MAT 260; PHY 112.

381 Applied Thermodynamics and Heat Transfer. (3) S
Gas mixtures, vapor cycles, gas and vapor mixtures. Fundamentals of conduction radiation and convection. Prerequisite: MET 380.

401 Quality Control. (3) S
Introduction to statistical quality control methods as applied to tolerances, process control, sampling and reliability. Prerequisite: MAT 115

402 Specialized Production Processes. (3) S
Non-traditional manufacturing processes emphasizing EDM, ECM, ECG, CM, PM, HERF, EBW, LBW, etc. Prerequisite: MET 101.

403 N/C Computer Programming. (3) F
Theory and application of computer-aided N/C languages with programming emphasis with APT and suitable postprocessors. Six hours lecture and programming laboratory. Prerequisites: MET 306; CSC 183.

405 N/C Continuous Path Programming. (3) S
Numerical Control continuous path programming related to two-, three-, and four-axis systems. Emphasis on mill and lathe systems. Six hours lecture and laboratory. Prerequisite: MET 306.

406 Machinability Theory. (2) F '85, S '87
Application of machinability theory to practice; implications to adaptive control systems, production costs, tool wear, surface finish. Experiments conducted. Prerequisites: MET 305, 300. Four hours lecture and laboratory.

407 Aerospace Materials. (2) S
Materials used for aircraft powerplants and airframes; emphasis on criteria for selection in terms of me-

chanical properties and manufacturing processes. Prerequisite: MET 101 or equivalent.

408 Production Tooling. (3) S '86
Fabrication and design of jigs, fixtures and special industrial tooling related to manufacturing methods. Prerequisite: MET 200, 305. Six hours lecture and laboratory.

410 Welding Metallurgy. (4) F '86
Metallurgical principles applied to structural and alloy steel and aluminum weldments; laboratory emphasis on welding experiments, metallography and mechanical testing. Prerequisites: CHM 114; MET 320 and 300. Six hours lecture and laboratory.

411 Welding Metallurgy. (3) S '86
Metallurgical principles as applied to stainless steel, super-alloy, titanium and other refractory metal weldments and braze joints. Prerequisite: MET 410.

412 Design of Weldments. (3) S
Design of welded structures and machine elements in terms of allowable stresses, joint configurations, process capabilities and cost analysis; welding procedures emphasized. Prerequisites: MET 320, 311.

415 Welding Codes. (2) F '86
Familiarization with and application of the various codes, standards, specifications applicable to weldments. Prerequisite: MET 320 or equivalent.

418 Machine Design I. (4) F
Integration of materials, mechanics, and drafting skills into engineering designs or modifications. Prerequisites: MET 360, 311; ICG 314. Six hours lecture and laboratory.

419 Machine Design II. (4) S
Integration of materials, mechanics, and drafting skills into engineering designs or modifications. Prerequisite: MET 418. Six hours lecture and laboratory.

440 Fluid Mechanics. (3) F
Static and dynamic properties of fluids. Flow measurement and fluid control design. Prerequisites: MAT 261; PHY 111. Four hours lecture and laboratory.

Special Courses: MET 484, 494, 498, 499, 500, 580, 584, 590, 591, 592, 594, 598. (See pages 35-36.)
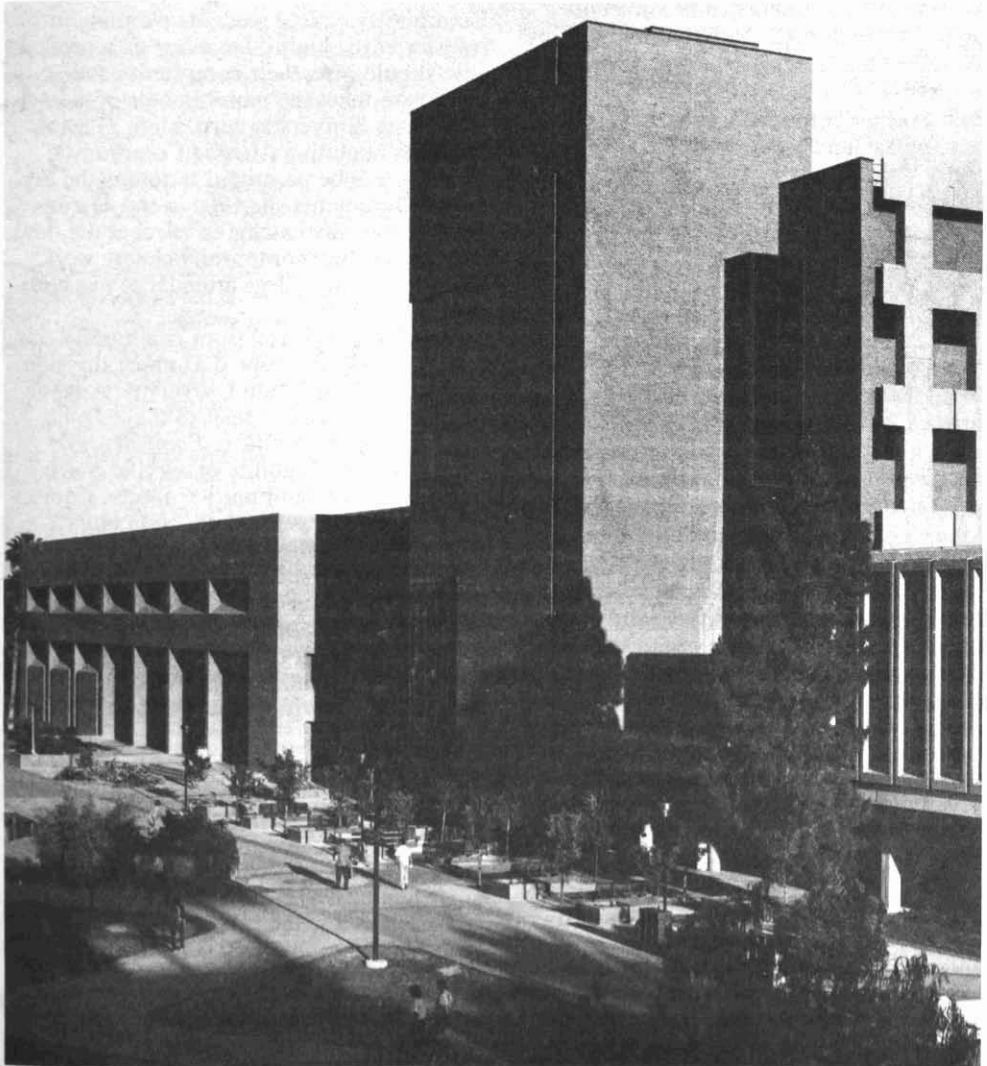
College of Fine Arts

Purpose

The College of Fine Arts provides for pre-professional and professional education in the several arts disciplines and also an opportunity for non-majors to become culturally literate through participation and involvement in the creative and performing arts.

The College, through its programs in art, dance, music, and theatre, reflects a wide range of challenges facing the artist and scholar in the 20th century. The arts as an integral part of our curriculum and of human expression offer the student a rewarding educational development balanced and strengthened by studies in related fine arts areas, the humanities, social sciences, and the sciences.

In addition to professional curricula offered in each department or school, the College makes available courses designed to meet the specific educational needs of students pursuing majors in other colleges. The cultural life of the University community is further enriched by study opportunities offered at off-campus sites. The College of Fine Arts also offers community audiences many hours of cultural enjoyment through the University Art Collections, the Louise Lincoln Kerr Cultural Center, myriad concerts, art exhibitions, music and dance recitals, dramatic productions, opera, lectures, and seminars.

Information

Admissions. Students meeting basic admission standards of Arizona State University can matriculate in the College of Fine Arts. Separate admissions procedures and approvals are required for some programs within the College. Students must contact specific departments or schools for details.

Transfer of Community College Credits. Credits transferred from any accredited junior or community college will be accepted up to a maximum of 64 semester hours. Community college students planning to transfer at the end of their first or second year should plan their community college courses to meet the requirements of the Arizona State University curriculum selected. Students attending Arizona Community Colleges will be permitted to follow the degree requirements specified in the Arizona State University catalog in effect at the time they began their community college work, providing their college attendance has been continuous.

Courses transferred from community colleges will not be accepted as upper division credit at Arizona State University. Arizona students are urged to refer to the *Arizona Higher Education Course Equivalency Guide* for transferability of specific courses from Arizona Community Colleges. Copies of the guide are available in counselors' offices. In choosing courses at a community college students should be aware that a minimum of 50 hours of work taken at the University must not be upper division credits. While attending a community college, it is suggested that students elect General Studies and lower division courses in the major field.

General Transfer Credit. Direct transfer of courses from other accredited institutions to the College of Fine Arts will be subject to: (1) the existence of parallel and equal courses in the College's curriculum, and (2) departmental or school evaluation of studio courses with respect to performance standards. A minimum of 30 semester hours earned in resident credit courses at Arizona State University is required of every candidate for the bachelor's degree. Transfer stu-

dents enrolled in the College of Fine Arts must complete a minimum of 15 semester hours of resident credit in the major as approved by the faculty.

Undergraduate Credit for Graduate Courses. To enable interested students to benefit as much as possible from their undergraduate studies, the Graduate College and the College of Fine Arts extend to seniors, with a grade point index of at least 2.50, the privilege of taking 500-level graduate courses for undergraduate credit. Application for admission to a graduate course for undergraduate credit must be completed in advance of the regular registration period. The application must be approved by the instructor of the class, the student's advisor, the chair or director of the department or school, and dean of the College in which the course is offered.

Certificate of Merit. The Certificate of Merit, awarded by the College of Fine Arts upon recommendation of the faculty of the School of Art, recognizes excellence in some aspect of studio art. The Certificate of Merit seeks to identify outstanding accomplishment and may or may not be awarded every year.

Performer's Certificate. The Performer's Certificate, awarded by the College of Fine Arts upon recommendation of the faculties of the School of Music and Department of Dance, gives special recognition to excellence in interpretation and technical proficiency in music or dance performance. Specific information may be obtained by contacting the Department of Dance or School of Music. The Performer's Certificate parallels the Certificate of Merit in intent and may or may not be awarded every year.

Pre-Professional Programs. Students preparing for admission to professional graduate schools should obtain information regarding admission requirements by writing directly to schools in which they may be interested.

Degrees.

Baccalaureate Degrees.

Bachelor of Arts (B.A.):
    Art, Music, Dance or Theatre
Bachelor of Fine Arts (B.F.A):
    Art:
        Concentrations in Art Education, Ceramics, Drawing, Fibers, Graphic Design, Intermedia, Jewelry, Painting, Photography, Printmaking, Sculpture, Wood
    Dance:
        Concentrations in Performance and Choreography, Dance Education
    Theatre:
        Concentrations in Theatre Education, Performance/Production: (Acting, Child Drama, Design/Technology)
Bachelor of Music (B.M.):
    Choral-General Music
    Instrumental Music
    Music Therapy
    Performance:
        (Voice, Keyboard, Guitar, Orchestral Instrument, Piano Accompanying, Jazz, Music Theatre)
    Theory and Composition

The three baccalaureate degrees differ in curricula with respect to the amount of specialization permitted in the major field. The Bachelor of Arts degree provides a broad, scholarly, humanistic program, while the other two programs place greater emphasis upon the major field. General Studies play an integral role within the educational mission of the university and as such comprise an important component of all undergraduate degrees in the College of Fine Arts. Included in the General Studies program are studies in fine arts, humanities, social-behavioral sciences, and science-mathematics. See below for General Studies requirements.

In cooperation with the College of Education, certification is available at the secondary level in the disciplines of art, dance, music, and theatre for students preparing for a teaching career in the public schools. Students should, with the advice and counsel of their arts education advisors, fulfill the requirements for the appropriate area of specialization under the Bachelor of Fine Arts or Bachelor of Music degrees.

Graduate Degrees.

Master of Arts (M.A.):
    Art, Music History and Literature, or Theatre
Master of Fine Arts (M.F.A.):
    Art:
        Concentrations in Ceramics, Drawing, Fibers, Jewelry, Painting, Photography, Printmaking, Sculpture, Wood
    Dance:
        Concentrations in Performance and Choreography

Theatre:
  Concentration in Child Drama
Master of Music (M.M.):
  Choral Music:
    Choral Music
    General Music
  Instrumental Music
  Performance:
    Solo Performance (Instrumental, Keyboard, Voice)
    Performance Pedagogy
    Piano Accompaying
    Music Theatre Performance
    Music Theatre Musical Direction
  Theory and Composition
Doctor of Musical Arts (D.M.A.):
  Choral Music, Instrumental Music, Solo Performance
Doctor of Philosophy and
Doctor of Education (Ph.D, Ed.D.):
  Major in Secondary Education with concentrations in Art Education, Music Education, Choral Music, General Music or Instrumental Music, Theatre)
  Master's programs range from 30-60 semester hours dependent upon the degree chosen. Doctoral programs vary in scope and curricula. See the *Graduate College Catalog* for specific requirements for the M.A., M.F.A., M.M., D.M.A., Ph.D., and Ed.D. degrees.

Undergraduate Degree Requirements. In addition to the general information given below, consult the sections of this catalog listed under School of Art, Department of Dance, School of Music, or Department of Theatre for specific degree requirements.

Bachelor of Arts Degree (B.A.). The Bachelor of Arts degree requires 45-60 semester hours of credit for the major. Dependent on the major, 18-24 credits must be selected from upper division courses (300 or 400 level). The credit hour requirements in the major are distributed between a field of specialization (30-45 credits) and one or more related fields (an additional 15 credits). The exact content of the major is selected by the student in consultation with his/her advisor under rules and regulations of the department or school concerned.

Bachelor of Fine Arts Degree (B.F.A.). The Bachelor of Fine Arts degree requires 65-85 semester hours of credit for the major. At least 30 of these credits, dependent on the major, must be selected from upper division courses (300 or 400 level). The curriculum

for the major is designed as pre-professional study in art, dance, or theatre. Auditions and/or interviews are required for admission to the B.F.A. program in dance or theatre. Consult these departments for specific information.

Bachelor of Music Degree (B.M.). The Bachelor of Music degree requires 84 semester hours of credit for the major. The required number of upper division courses (300-400 level) is dependent on the area of specialization. The curriculum for the major is designed to provide a broad, yet concentrated, preparation with a choice of specialization among the areas of music performance, music theatre, jazz, music therapy, piano accompaying, theory-composition, instrumental music, or choral-general music. Entering undergraduate music majors, regardless of area of specialization, must perform an entrance audition in their primary performing medium (voice or instrument).

General Studies

To meet the General Studies requirement a minimum of 54 semester hours (exceptions: 48 semester hours for the Bachelor of Arts in music degree and 36 to 42 semester hours for the Bachelor of Fine Arts degrees and the Bachelor of Music degrees, depending on the major) must be completed.

Semester Hours

Humanities 6
  Architecture, communication (COM 210, 222, 225, 241, 243, 271, 274, 341, 344, 420, 422, 441, 442, 443, 474 only), English (except English 101, 102, 105, 107, and 108), foreign languages, humanities, philosophy, and religious studies.

Fine Arts 6
  (Outside of the major department or school) To be selected from art, dance, music, and theatre.

Behavioral and Social Sciences.............................6
  Anthropology, economics, geography (GCU only), history, political science, psychology, and sociology.

Science and Mathematics....................................6
  To include one laboratory science selected from biology, botany, chemistry, geography (GPH only), geology, physical science, physics, and zoology.

It should be noted that special minimum requirements may be higher in certain departments/schools.

General Studies Electives. Additional general courses may be selected from the above areas as well as interdisciplinary studies in

liberal arts (LIA), journalism and telecommunication, and physical education (except activity courses). Courses in the major may NOT be used to meet General Studies requirements; related area courses may not be cross listed in fulfillment of both major and General Studies requirements. Additional electives to complete the total of 126 may be taken in any area of the university.

In addition, the student will meet the University English proficiency requirement: ENG 101 and 102 (six hours) or ENG 105 (three hours). These courses may not be used to meet General Studies requirements.
Foreign Language Requirement. All Bachelor of Arts degrees require the equivalent of 16 semester hours of credit in one foreign language. (Exception: The Bachelor of Arts degree in studio art strongly recommends but does not require foreign language study). Course work may be selected in any language and must follow the sequence of language courses 101, 102, 201, and 202. This requirement may be fulfilled at the secondary school level or by examination. If acquired in secondary school, two years of instruction in one foreign language is considered the equivalent of one year of college instruction. Transfer students will be placed in language study at the level above completed work. Candidates for the Bachelor of Music degree in voice performance may elect more than one foreign language chosen in conference with his/her advisor. There is no foreign language requirement for other areas of specialization of the Bachelor of Fine Arts or Bachelor of Music degrees.
Retention, Disqualification, Reinstatement, Appeals: The terms of disqualification, reinstatement and appeals are consistent with those set forth by the university on pages 38-39 of this catalog, except for Theatre. For the B.F.A. in Theatre, a student must have a 3.00 GPA in the major to enroll in upper division courses and remain in good standing. In addition, a student disqualified in any program is normally not eligible for reinstatement for two semesters.
Graduation Requirements. The minimum graduation requirement is the completion of 126 semester hours of credit with a minimum cumulative scholarship index of 2.0. Of these 126 credits at least 50 must be selected from upper division courses numbered 300 to 400. Many professional programs within the College of Fine Arts require additional semester hours of credit for graduation. To be acceptable as graduation

credit, all course work in the major discipline must show an earned grade of C (2.0) or higher.

School of Art

PROFESSORS:
LEHRER (ART 102), BRECKENRIDGE, BROADLEY, CHOU, FINK, GASOWSKI, GRIGSBY, HAHN, HELLER, JACOBSON, JAY, KELLY, LINDERMAN, MAGENTA, SCHAUMBURG, STULER, J. J. TAYLOR, WAGNER, WOODS

ASSOCIATE PROFESSORS:
BRITTON, DEMARSCHE, deMATTIES, DETRIE, ECKERT, GILLINGWATER, GULLY, HAJICEK, JENKINS, JOHNSON, KRONENGOLD, OTIS, PILE, PIMENTEL, RABINER, SCHMIDT, SHARER, J. R. TAYLOR, WATSON, J. WHITE, K. WHITE, YOUNG

ASSISTANT PROFESSORS:
COCKE, FARNESS, HAYES-THUMANN, KAIDA, RISSEEUW, SHIPP, UMBERGER, WILSON

PROFESSORS EMERITUS:
GOO, HALE, WOOD

Major Requirements

For advisement purposes, all students registering in an art degree program will enroll through the College of Fine Arts. Each degree program and area of specialization has its own check sheet which describes the particulars of course sequence and special requirements. These are available in the School of Art office.

Bachelor of Arts Degree Curriculum

The School of Art offers two emphases at the Bachelor of Arts level: Studio Art and Art History. These emphases are intended to give the student a broadly-based general education in the field with some more specialized work at the upper division level.

Studio Art—Consists of a minimum of 45 semester hours of credit as approved by the student's advisor. An emphasis in studio art requires 30 credit hours in studio including ART 111, 112, 113, 115 and 15 hours in a related field(s) including ARH 101 and 102. Normally the related field is art history. At least 18 of the 45 hours must be upper division credit. All credit applied to the emphasis must be a "C" or better. The foreign language requirement of the B.A. degree is optional but strongly recommended.

Art History—Consists of a minimum of 45 semester hours of credit as approved by the student's advisor.

An emphasis in art history requires 33 credit hours of art history courses and 12 in a related field(s). Normally the related field is studio art. At least 18 of the 45 hours must be upper division credit. All credit applied to the major must be with a "C" or better. The art history areas of Ancient, Medieval, Renaissance, Baroque, Modern and Non-Western Art must each be represented with at least one course. Satisfactory completion of ARH 480, Research Methods, is required before the senior year. Other requirements are ARH 101, 102, lower division ARH - non-western course, one ARH 498 Pro-Seminar; ART 111, 112 and 115. Knowledge in at least one foreign language is required, equivalent to the level obtained through the completion of two years' study at the college level. For specific courses, see Foreign Languages Department.

Bachelor of Fine Arts Degree Curriculum

Art—Consists of 75 semester hours of credit, with a concentration in one area selected on the basis of the student's interests. The following concentrations are available to the student: art education, ceramics, drawing, fibers, graphic design, intermedia, jewelry, painting, photography, printmaking and sculpture, wood.

All students in this degree program follow the same pattern of courses in art for the first two semesters: ART 111, 112, 113 and 115; ARH 101 and 102.

At least 30 upper division credit hours must be earned within the major, with a minimum of 12 credit hours within the concentration.

All course work counted in the major must be "C" or better. The specific requirements for the concentration are determined by the faculty advisors of the area, and are listed on School of Art checksheets.

Courses from other departments, when approved by the advisor and the School of Art, may be applied to the major if deemed appropriate to the students' program of study.

Graphic Design—The concentration in graphic design requires a special application procedure. The application procedure for new and transfer students is separate from, and in addition to, the required admission to Arizona State University. Acceptance is determined by the graphic design faculty and is based on an application, test, and portfolio. Applications must be made between February 15 and March 15 for admission for the following fall semester. Students are accepted for entry into the graphic design program in the fall semester only of each academic year. Selection of applicants is made by April 1. Due to space limitations, not all qualified applicants can be accommodated and the admission process is necessarily selective. For application forms and further information contact the School of Art.

Art Education—The concentration in art education consists of 75 semester hours of credit in art including ART 111, 112, 113, 115, 201, 223, one three dimensional course (either ART 231, 261, 272, 274, 276); ARH 101, 102 and two ARH upper division electives (including one in 20th Century art); and ARA 488. The following art education courses are required: ARE 300, 302, 474, 480, 484 (Internship: Art Education), and 490. In addition, a minimum of 21 hours (including 12 hours of upper division credit) are to be taken in a specific area of art proficiency approved by an advisor in art education. The art proficiency can be in drawing, painting, intermedia, photography, printmaking, sculpture, ceramics, jewelry, wood, fibers, or art history.

A student with a GPA of 2.5 or better, pursuing a BFA with a concentration in art education may also choose to become certified for teaching art K-12. If certification is elected, 25 semester hours are required of specified course work in the College of Education. For additional certification requirements, see an art education advisor.

Elementary Education Major, Minor in Art—Consists of 27 semester hours including ART 111, 112, 113, 115; ARH 101, 102; ARE 302, 474 and 484.

Secondary Education Major, Minor in Art—Consists of 24 semester hours including ART 111, 112, 115; ARH 101, 102; ARE 474, 480 and 484.

Graduate Programs

The School of Art offers programs leading to the degree of Master of Arts with a major in Art, including an emphasis in art education or art history, and the Master of Fine Arts degree with emphases in ceramics, drawing, fibers, jewelry, painting, photography, printmaking, or sculpture, wood. In cooperation with the College of Education, the degrees of Master of Arts in Education, Doctor of Edu-

cation and Doctor of Philosophy are offered with concentration in art education. Consult the *Graduate College Catalog* for requirements for all graduate degrees.

ART

ART 111 Beginning Drawing I. (3) F, S, SS
Fundamental technical and perceptual skills using common drawing media and their application to pictorial organization. Six hours a week.

112 Two-dimensional Design. (3) F, S, SS
Fundamentals of pictorial design. No prerequisites. Six hours a week.

113 Color. (3) F, S, SS
Principles of color theory as related to the visual arts. Prerequisite: ART 111 and 112. Six hours a week.

115 Three-dimensional Design. (3) F, S, SS
Fundamentals of three-dimensional form. Prerequisites: ART 111 and 112. Six hours a week.

DRAWING

ART 211 Beginning Drawing II. (3) F, S, SS
Continued development of technical and perceptual skills. Emphasis on materials and pictorial content. Prerequisite: ART 111, 112, 113 and 115. Six hours a week.

214 Beginning Life Drawing. (3) F, S, SS
Development of skill and expressiveness in drawing the basic form, construction and gesture from the human figure. Prerequisite: ART 111, 112, 113 and 115. Six hours a week.

311 Intermediate Drawing. (3) F, S
Emphasis on composition, exploration of drawing media. Prerequisite: ART 211, 214 and approval of instructor. Six hours a week.

314 Intermediate Life Drawing I. (3) F, S
Drawing from the model with greater reference to structural, graphic and compositional concerns. Prerequisite: ART 214 or approval of instructor. Six hours a week.

315 Intermediate Life Drawing II. (3) F, S
The human figure as the subject for drawing. Emphasis on conceptual alternatives and management of materials. Prerequisite: ART 314 or approval of instructor. Six hours a week.

411 Advanced Drawing. (3) F, S
Visual and intellectual concepts through problem solving and independent study. Emphasis on the individual creative statement. May be repeated for credit. Prerequisites: ART 311 and approval of instructor. Six hours a week.

412 Drawing Techniques of the Old Masters. (3) N
Techniques of drawing from early Renaissance to the present; silver point, bistre ink, quill pen, pastels and chiaroscuro drawings. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

414 Advanced Life Drawing. (3) F, S
Various media and techniques on an advanced level. The human figure as an expressive vehicle in various contexts. May be repeated for credit. Prerequisite: ART 315 or approval of instructor. Six hours a week.

415 Art Anatomy. (4) N
Study of human anatomical structures as applied to the practice of figure oriented art. Prerequisite: ART 214. Three hours lecture; 5 hours studio a week.

PAINTING

ART 223 Beginning Painting. (3) F, S, SS
Fundamental concepts and materials of traditional and experimental painting media. Emphasis on preparation of painting supports, composition and color. Prerequisites: ART 111, 112, 113 and 115. Six hours a week.

227 Beginning Watercolor. (3) F, S
Painting in all water-soluble media. Emphasis on techniques, composition and color. Prerequisites: ART 111, 112, 113 and 115. Six hours a week.

323 Intermediate Painting I. (3) F, S
Development of competency in skills and expression. Assigned problems involve light, space, color, form and content. Prerequisites: ART 223 and approval of instructor. Six hours a week.

324 Intermediate Painting II. (3) F, S
Continuation of ART 323. Prerequisites: ART 323 and approval of instructor. Six hours a week.

325 Figure Painting. (3) F, S
The human figure clothed and nude as the subject for painting in selected media. Prerequisites: ART 314 and 323. Six hours a week.

327 Intermediate Watercolor. (3) A
Explorations using a variety of surfaces, and a combination of media and materials. Prerequisite: ART 227. Six hours a week.

421 Painting Materials and Techniques. (3) A
Traditional and modern materials and techniques of painting. Experimental problems in tempera, encaustic, casein emulsions, Maroger's Medium and synthetic media. Prerequisite: approval of instructor. Six hours a week.

423 Advanced Painting. (3) F, S
Continuation of ART 324. May be repeated for credit. Prerequisite: ART 324. Six hours a week.

425 Advanced Figure Painting. (3) F, S
Continuation of ART 325. May be repeated for credit. Prerequisites: ART 315, 324 and 325. Six hours a week.

427 Advanced Watercolor. (3) F, S
Continuation of ART 327. May be repeated for credit. Prerequisite: ART 327. Six hours a week.

INTERMEDIA

ART 340 Intermedia. (3) F, S
Experimental, conceptual and inter-disciplinary studio art with emphasis on new media and technologies. Prerequisites: ART 111, 112, 113 and 115 and six hours additional studio requirements or approval of instructor. Six hours a week. May be repeated once for credit.

341 Mixed Media. (3) A
Exploring visual effects by combining traditional and non-traditional methods, techniques and concepts. Repeatable once for credit. Prerequisites: ART 111, 112, 113, 115, and six hours additional studio requirements or approval of instructor. Six hours a week.

440 New Media Concepts. (3) F, S
Continued experiments with new media and interdisciplinary concerns in art. Repeatable once for credit. Prerequisite: ART 340. Six hours a week.

PHOTOGRAPHY

ART 201 Beginning Photographic Art. (3) F, S
Development of skills and techniques of black and white photography. Emphasis on camera work and darkroom procedures. Two lectures, 3 hours laboratory.

301 Intermediate Photography. (3) F, S
Photography as an art medium with additional exploration into personal photographic esthetics. Prerequisites: ART 111, 112, 113, 115, 201 or approval of instructor. Six hours a week.

304 Advanced Photography. (3) F, S
Interpretation and manipulation of light as a tool in the performance of expressive photography. Prerequisites: ART 205 or 206 and approval of instructor. Six hours a week.

305 Color Photography. (3) F, S
Application of color transparencies and prints to photographic art. Prerequisites: ART 304 and approval of instructor. Six hours a week.

306 Photo Techniques. (3) F, S
Exploration of camera and darkroom techniques with emphasis on creative control for the well crafted black and white print. Prerequisites: ART 205 or 206 and approval of instructor. Six hours a week.

401 Nonsilver Photography. (3) F, S
Recognition of the inherent characteristics of nonsilver processes and the use of these processes in the communication of ideas. Prerequisite: ART 306 and approval of instructor. May be repeated for credit. Six hours a week.

403 Black and White Photography. (3) F, S
Advanced exploration of experimental, interpretive, and straight photography. May be repeated for credit. Prerequisites: ART 304 and approval of instructor. Six hours a week.

404 Portraiture Photography. (3) F, S
Photographing people. Critical discussions and slide lectures on issues in portraiture. May be repeated for credit. Prerequisite: ART 304, 306 or approval of instructor. Six hours a week.

405 Advanced Color Photography. (3) F, S
Intensive use of subtractive color process in photographic printing. Prerequisites: ART 305 and approval of instructor. May be repeated for credit. Six hours a week.

409 Photographic Exhibition. (3) A
Care of photographic prints, print presentation and exhibition. Practical experience in gallery operations. Prerequisite: ART 304 and approval of instructor. May be repeated for credit. Six hours a week.

PRINTMAKING

ART 252 Lithography. (3) F, S
Black and white planographic printmaking utilizing stone and aluminum plate processes. Prerequisites: ART 111, 112, 113 and 115. Six hours a week.

351 Intaglio. (3) F, S
Introduction to contemporary and traditional developmental techniques for black and white prints. Prerequisite: approval of instructor. Six hours a week.

352 Intermediate Lithography. (3) F, S
Continuation of ART 252. Introduction to color techniques and advanced image-formation processes. Prerequisite: ART 252 and approval of instructor. six hours a week.

354 Screen Printing. (3) A
Various methods and applications including the photographic, stencil and transfer techniques. Prerequisite: approval of instructor. Six hours a week.

355 Photo Process for Printmaking. (3) A
Introduction to photographic principles and skills for photo-mechanical printmaking processes, including photo-silkscreen, photo-litho and photo-etching. Prerequisite: approval of instructor. Six hours a week.

451 Advanced Intaglio. (3) F, S
Various contemporary and traditional methods of printing to achieve color prints. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

452 Advanced Lithography. (3) F, S
Continuation of ART 352. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

454 Advanced Screen Printing. (3) A
Continuation of ART 354. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

455 Advanced Photo Processes for Printmaking. (3) A
A continued study of photomechanical techniques and applications to printmaking or photographic processes. Prerequisites: ART 355 or approal of instructor.

456 Fine Printing and Bookmaking I. (3) A
Letterpress printing and typography as fine art. Study of history, alphabets, mechanics of hand typesetting, presswork and various forms of printed matter. Prerequisite: approval of instructor.

457 Fine Printing and Bookmaking II. (3) A
Continuation of ART 456. Bookbinding, book design and printing, advanced typography, theory and presswork. May be repeated once for credit. Prerequisite: ART 456.

458 Papermaking. (3) F, S
History, theory, demonstrations, sheet forming, collage treatments and three-dimensional approaches. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

459 Monoprinting. (3) F, S
The non-multiple printed image using a variety of technical approaches. Prerequisites: ART 311 or 323 or any 300-level printmaking class and approval of instructor. Six hours a week.

SCULPTURE

ART 231 Beginning Sculpture. (3) F, S, SS
Exploration and expression of sculptural form through ideas and concepts related to basic materials; studio safety. Prerequisites: ART 111, 112, 113 and 115. Six hours a week.

331 Intermediate Sculpture. (3) F, S
Continuation of ART 231. Prerequisite: ART 231. Six hours a week.

332 Advanced Sculpture. (3) F, S
Sculptural problems related to architecture and man's environment. Exploration in all media. Color relationships as applied to sculpture. Prerequisite: ART 331. Six hours a week.

333 Experimental Sculpture. (3) N
An experimental approach to form-material relationship toward atmospheric, kinetic, audio, electronic and earth works. Prerequisite: ART 332 or approval of instructor. Six hours a week.

431 Special Problems in Sculpture. (3) F, S
Development of a personal approach to sculpture, emphasis on form, individual problems and related color technology. Professional practices and presentation. May be repeated for credit. Prerequisite: ART 332 and approval of instructor. Six hours a week.

432 New Directions in Sculpture. (3) A
Examination of environment as resource for images and ideas. Experimentation in nontraditional methods and inter-relating disciplines. May be repeated for credit. Prerequisite: ART 332 or approval of instructor. Six hours a week.

436 Architectural Sculpture. (3) N
Sculptural concepts as related to architecture and other man-made environments. Scale drawing, models, and

relief sculpture. May be repeated for credit. Prerequisite: ART 332 or approval of instructor. Six hours a week.

437 Non-Permanent Sculpture. (3) N
Art of a temporary nature including sequential and conceptual works. Attitudes may be presented in films or other visual media. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

438 Experimental Systems in Sculpture. (3) N
Systems and concepts for phase changes of materials, temperature/ pressure field, time compression/ extension, and electronic activation of dimensional forms. May be repeated for credit. Prerequisite: approval of instructor. Six hours a week.

CERAMICS

ART 261 Ceramic Survey. (3) F, S, SS
Handforming methods, throwing on the wheel, decorative processes, glaze application. Prerequisites: ART 111, 112, 113 and 115. Six hours a week.

360 Ceramic Throwing. (3) F, S
Design analysis and production of functional pottery. Emphasis on throwing techniques, surface enrichment and glaze application. May be repeated once for credit. Prerequisite: ART 261. Six hours a week.

364 Ceramic Handbuilding. (3) F, S
Search for form and personal expression through hand building techniques. Kiln firing and related problems. May be repeated once for credit. Prerequisite: ART 231 and 360. Six hours a week.

460 Ceramic Clay. (3) A
Research into various clay body formulations, local natural materials, slip glazes and engobes. Prerequisite: ART 365 or approval of instructor. Six hours a week.

463 Ceramic Glaze. (3) A
Glaze formulation and calculation. Prerequisite: ART 364 or approval of instructor. Six hours a week.

466 Advanced Ceramics. (3) F, S, SS
Emphasis on personal expression within structure of seminars, critiques, studio work. Professional methods of presentation/documentation of work. May be repeated for credit. Prerequisite: ART 364 or approval of instructor. Six hours a week.

CRAFTS

272 Beginning Jewelry. (3) F, S
Emphasis on fabrication in jewelry making. Basic techniques of forming, cutting and piercing, forging and soldering. Six hours a week.

274 Beginning Wood. (3) F, S
Fundamental woodworking techniques to produce creative functional three-dimensional objects. Six hours a week.

276 Beginning Fiber Arts. (3) F, S
Structural use of fiber utilizing a variety of techniques. Surface treatment including batik, block printing, fold and tie-dye. Six hours a week.

372 Intermediate Jewelry. (3) F, S
Fabricated approach to jewelry making. Techniques in stone setting and surface embellishment. Prerequisite: ART 111, 112, 113, 115, and 272 or approval of instructor. Six hours a week.

373 Metalworking. (3) A
Compression, die and stretch forming as applied to hollow form construction. Hot and cold forging techniques as applied to smithing. Prerequisite: ART 111, 112, 113, 115, and 272 or approval of instructor. Six hours a week.

374 Intermediate Wood. (3) F, S
Individual and directed problems in wood, related to the production of unique functional art objects. Prerequisites: ART 111, 112, 113, 115, and 274 or approval of instructor. Six hours a week.

376 Intermediate Fibers: Loom Techniques. (3) A
Investigation of loom controlled techniques. Plain weave, double weave, tapestry will be explored. Prerequisites: ART 111, 112, 113, and 276 or approval of instructor. Six hours a week.

377 Intermediate Fibers: Surface Design. (3) A
Surface design techniques: silk screening, painting, stamping, dyeing on fabric will be explored. Prerequisites: ART 111, 112, 113 and 276 or approval of instructor. Six hours a week.

378 Furniture I. (3) A
Design and building of contemporary furniture. Exploration in the technique of joinery, lamination, carving and finishing procedures. Prerequisites: ART 111, 112, 113, 115, and 274 or approval of instructor. Six hours a week.

472 Advanced Jewelry. (3) F, S
Jewelry making with emphasis on developing personal statements and craftsmanship. May be repeated for credit. Prerequisite: ART 372 and approval of instructor. Six hours a week.

473 Advanced Metalworking. (3) A
Forging and forming techniques in individualized directions. May be repeated for credit. Prerequisites: ART 373 and approval of instructor. Six hours a week.

474 Advanced Wood. (3) F, S
Extended experience and advanced techniques in the use of wood to create functional works of art. May be repeated for credit. Prerequisite: ART 374 and approval of instructor. Six hours a week.

476 Advanced Fiber Arts. (3) F, S
Experimentation with advanced techniques in fiber and fabric. May be repeated for credit. Prerequisite: ART 376 and approval of instructor. Six hours a week.

478 Furniture II. (3) A
Form concepts are explored in construction of inventive furniture. Emphasis on media experimentation. May be repeated for credit. Prerequisite: ART 378. Six hours a week.

GRAPHIC DESIGN

ART 283 Letterforms I. (3) F
Drawing of letterforms with focus on proportion and structure. Introduction to letterform nomenclature and classifications. Prerequisites: ART 111, 112, 113, 115 and acceptance into graphic design program. Must have concurrent enrollment with ART 284. Six hours a week.

284 Visual Communications I. (4) F
Theoretical and applied studies in shape, drawing and color. Prerequisites: ART 111, 112, 113, 115 and acceptance into graphic design program. Must have concurrent enrollment with ART 283. Eight hours a week.

285 Typeset I. (3) S
Theoretical exercises in spatial and textural qualities of type. Problems in tension, activation and balance. Exercises in simple typographical applications. Prerequisites: ART 283, 284 and acceptance into graphic design program. Must have concurrent enrollment with ART 286. Six hours a week.

286 Visual Communications II. (4) S
Transition from theoretical to applied problems. Emphasis on refinement of visual skills. Prerequisites: ART 283, 284 and acceptance into graphic design program.

Must have concurrent enrollment with ART 285. Eight hours a week.

382 Graphic Representation. (3) F
Studio practice in drawing with an application towards graphic communication. Prerequisites: ART 284 and approval of instructor. Six hours a week.

385 Typeset II. (3) F
Problems in composition, choice and combinations of type faces, formats and their application to a variety of design projects. Prerequisites: ART 285, 286; concurrent enrollment in ART 386. Six hours a week.

386 Visual Communications III. (3) F
Problems in specific design applications such as poster, packaging, publications, etc. Emphasis on development of concepts in visual communications. Prerequisites: ART 285, 286. Concurrent enrollment in ART 385. Six hours a week.

387 Visual Communications IV. (3) S
Client oriented projects. Problems will be multi-faceted and the emphases will be on continuity of design in more than one medium and format. Prerequisite: ART 386. Six hours a week.

481 Visual Communications V. (3)
Studio problems with an emphasis on analysis, problem-solving, and professional portfolio preparation. Prerequisites: ART 387 and approval of instructor. Six hours a week.

485 Graphic Design Workshop. (3-6) F, S, SS
Professional graphic design experiences in actual client/designer situations. Involvement in the complete graphic design process from concept to finished piece. Advanced graphic design majors only. Prerequisites: Portfolio presentation and approval of instructor. Six to twelve hours a week.

SPECIAL STUDIO COURSES

ART 621 Studio Problems. (3) F, S, SS
Advanced study in the following areas:

(a) Drawing	(f) Ceramics
(b) Painting	(g) Jewelry
(c) Photography	(h) Wood
(d) Printmaking	(i) Fiber Art
(e) Sculpture	(j) Studio Art

Prerequisite: approval of instructor. May be repeated for credit. Six hours a week each section.

680 Practicum: M.F.A. Exhibition. (1-15) F, S, SS
Studio work in preparation for required M.F.A. exhibition. Public exhibit to be approved by the student's supervisory committee and accompanied by a final oral examination. Photographic documentation and written statement of problem. Prerequisite: approval of the student's supervisory committee.

Special Courses: ART 294, 484, 493, 494, 498, 499, 591, 592, 594, 598. (See pages 35-36.)

ART EDUCATION

ARE 300 Educating in the Visual Arts. (3) F, S
Studio experiences and inquiry into the ways people learn in art. An introduction to the literature in art and art education. Two lectures, 2 hours studio.

301 Art in the Elementary School. (3) F, S
(For non-majors only.) Self-understanding through the use of art, concurrent with the study of children's art work from early childhood to mid-adolescence. One lecture, 4 hours studio.

302 Child Art and Artists. (3) F, S
(Majors only.) Curriculum development, instructional resources, learning and the psychology of the child, cur-

rent issues in art instruction and classroom management. Two hours lecture, 2 hours studio.

420 Crafts for the Elementary School Teacher. (3) A
Practical laboratory experiences stressing a variety of media and activities for classroom teaching. (Not for MA credit in Art Education). One lecture, 4 hours studio.

474 Planning Art Instruction. (3) S
Introduction to problems and approaches in planning instruction related to the production and viewing of art.

480 Adolescent Art and Artists. (3) F
Strategies for teaching art, understanding design and exploring concepts related to art and artists in school and community art programs. Two hours lecture, 2 hours studio.

485 Women's View of Art. (3) A
Study of women visual artists, their lives, and the social, political, esthetic and educational issues related to their art. Lecture-discussion, readings and studio experiences. Prerequisite: approval of instructor. Three hours a week.

490 Instructional Resources in Art. (3) F
Development of audiovisual materials in art and inquiry into strategies for their implementation. Two lectures, 2 hours studio.

510 Art in the Self-Contained and Open Classroom. (3) A
Alternate teaching/learning strategies, art concepts, and skills relevant to elementary school art experiences for teachers.

511 Issues in Art Education. (3) A
Investigation of issues in art education.

515 Foundations of Art Education. (3) A
Behavioral foundations of education as related to art education. Emphasis on psychological and philosophical frame-of-reference.

520 Creativity in Art Education. (3) A
The nature of creative behavior, especially as it applies to the teaching of the visual arts.

525 Art and Society. (3) A
Interrelationship of art, society, and social change and their relevance to areas such as government, museums, and technology.

540 Instructional Resources, Art Education. (3) N
Development of audio visual materials in art and inquiry into strategies for their implementation. May be repeated once for credit.

545 Perception and Learning. (3) A
Concepts of perception and learning in art instruction.

550 Aesthetic Inquiry. (3) A
Literature on aesthetics, methods of inquiry and implications for art education.

570 Analyzing Works of Art. (3) N
The critical examination of art or statements about art and the development of ways for guiding this examination.

575 Curriculum in Art and Education. (3) A
Literature in art education and education on existing strategies for developing curriculum, the issues and problems of differing curriculum orientations.

610 Issues and Trends in Art Education. (3) N
Doctoral level investigation of historical and contemporary issues related to teaching and research in art education.

611 Curriculum Development in Art Education. (3) N
Doctoral level inquiry into the philosophical, psychological and sociological foundations of curriculum development.

Special Courses: ARE 294, 484, 493, 494, 498, 499, 590, 591, 592, 593, 594, 598, 599, 690, 691, 692, 790, 791, 792, 799. (See pages 35-36.)

ART HISTORY

ARH 100 Introduction to Art. (3) F, S, SS
Development of understanding and enjoyment of art and its relationship to everyday life through the study of painting, sculpture, architecture and design. May not be taken for credit by student who has completed ARH 300, nor used as art history credit by art majors.

101 History of Art from the Dawn of Civilization to the Renaissance. (3) F, S, SS
Ancient Near Eastern, Egyptian, Greek, Roman and medieval European art to the Renaissance. Lecture, discussion.

102 History of Art from Renaissance to the Present Day. (3) F, S, SS
Western art during the Renaissance, mannerist, baroque, rococo, neo-classic, romantic, and modern epochs. Lecture, discussion.

201 Art of the Non-Western World. (3) F
An historical survey of the visual arts in African, Oceanic, East Asian (China, Japan), Southeast Asian, pre-Columbian, Native American Indian, Islamic cultures. Prerequisites: ARH 101 and 102 or approval of instructor.

300 Introduction to Art. (3) F, S, SS
Course content same as ARH 100 but requires a higher level of accomplishment and comprehension. May not be taken for credit by student who has completed ARH 100, nor used as art history credit by art majors.

401 American Art I. (3) F
History of art in the United States from European settlement of the New World to the Columbian Exposition of 1893. Prerequisites: ARH 101 and 102 or approval of instructor.

402 American Art II. (3) S
History of art in the United States from the last decade of the 19th century to World War II. Prerequisites: ARH 101 and 102 or approval of instructor.

403 Pre-Columbian Art I. (3) A
Architecture, sculpture, ceramics, manuscripts, painting and other arts of Mesoamerica prior to European contact. Prerequisite: ARH 101 and 102 or approval of instructor.

404 North American Indian Art. (3) A
Native American Art forms of the United States and Canada from prehistoric times to present. Prerequisites: ARH 101 and 102 or approval of instructor.

405 Southwest Indian Art. (3) A
American Indian art in the southwestern states from its origins to the present day. Prerequisites: ARH 101 and 102, or approval of instructor.

406 Mexican Art. (3) A
Art of Mexico and related Central American cultures from the prehistoric to the contemporary schools. Prerequisites: ARH 101, 102 or approval of instructor.

408 Pre-Columbian II. (3) A
Architecture, sculpture, ceramics, textiles and metalwork of Central and South America prior to European contact. Prerequisite: ARH 101 and 102 or approval of instructor.

409 History of Printmaking. (3) A
History of the print as an art form and its relation to other modes and forms of artistic expression. Prerequisites: ARH 101 and 102 or approval of instructor.

410 Ancient Near Eastern Art. (3) N
History of painting, sculpture, and architecture in Mesopotamia, Egypt, and the Aegean. Prerequisites: ARH 101 and 102 or approval of instructor.

411 Greek Art. (3) A
Art and architecture of Greece and the Hellenistic Empire. Prerequisites: ARH 101 and 102 or approval of instructor.

412 Roman Art. (3) A
Art and architecture of Etruria, Rome, and the Roman Empire. Prerequisites: ARH 101 and 102 or approval of instructor.

414 Early Christian and Byzantine Art. (3) A
Art and architecture of the early church and the Byzantine Empire from the 4th to the 15th century. Prerequisites: ARH 101 and 102 or approval of instructor.

420 Early Medieval Art. (3) A
Architecture, sculpture, and painting in the Latin West from the 7th century to the end of the Ottonian Period. Prerequisites: ARH 101 and 102 or approval of instructor.

422 Romanesque Art. (3) A
Sculpture, painting, architecture, and minor arts in western Europe during the Romanesque period. Prerequisites: ARH 101 and 102 or approval of instructor.

424 Gothic Art. (3) A
Painting, sculpture and architecture in western Europe during the Gothic period. Prerequisites: ARH 101 and 102 or approval of instructor.

428 Art of the Renaissance in Northern Europe. (3) A
Painting, sculpture, and architecture during the 1400s and 1500s north of the Alps. Prerequisites: ARH 101 and 102 or approval of instructor.

432 Early Renaissance Art in Italy. (3) A
Painting, sculpture and architecture in Italy from 1300 to 1500. Prerequisites: ARH 101 and 102 or approval of instructor.

434 Art of the Italian High Renaissance and Mannerism. (3) A
History of Italian art during the 16th century, including the achievements and influence of Leonardo da Vinci, Raphael, and Michelangelo. Prerequisites: ARH 101 and 102 or approval of instructor.

440 Italian Baroque Art. (3) A
Italian painting, sculpture and architecture of the 17th century. Prerequisites: ARH 101 and 102 or approval of instructor.

441 Art of Spain and Its Colonies. (3) A
Architecture, painting and sculpture from 1500 to 1800. Colonial focus on Mexico and American Southwest. Prerequisites: ARH 101 and 102 or approval of instructor.

442 Art of the 17th Century in Northern Europe. (3) A
Baroque painting, sculpture and architecture in Flanders, the Netherlands, France and England. Prerequisites: ARH 101 and 102 or approval of instructor.

444 Art of the 18th Century. (3) A
History of painting, sculpture, architecture, graphic arts and the decorative arts from 1700 to the French Revolution (1789). Prerequisites: ARH 101 and 102 or approval of instructor.

450 Art and Revolution. (3) A
Impact of American and French Revolutions and the Napoleonic epoch on visual arts. Concentration on Goya, David, Gericault, Blake, etc. Prerequisites: ARH 101 and 102, or approval of instructor.

451 Romanticism and Realism. (3) A
History of the visual arts in the first half of the 19th century. Prerequisites: ARH 101 and 102 or approval of instructor.

452 Impressionism and Late 19th Century Art. (3) A
History of painting, sculpture and graphic arts in latter half of the 19th century. Prerequisites: ARH 101 and 102 or approval of instructor.

454 Art of the 20th Century. (3) A
Developments and directions in art between 1900 and World War II. Prerequisites: ARH 101 and 102 or approval of instructor.

456 Art Since 1940. (3) A
Art since World War II, with consideration of new concepts and experimentation with media and modes of presentation. Prerequisites: ARH 101, 102 and 454 or approval of instructor.

460 19th Century Photography. (3) A
History of photography from the medium's pre-history to 1914: personalities, processes, images, and ideas. Prerequisite: ARH 101, 102 or approval of instructor.

462 20th Century Photography. (3) A
Personalities, processes, images and ideas in photography from 1914 to present. Prerequisites: ARH 101 and 102 or approval of instructor.

466 Photographic Publications of the 19th Century. (3) N
Photographs for magazine and book illustrations from Fox Talbot's *Pencil of Nature* to Stieglitz's *Camera Work.* Prerequisite: ARH 460 or approval of instructor.

471 Art of China. (3) A
Study of major forms in Chinese art: ritual bronze, sculpture, ceramic, calligraphy, painting and architecture. Prerequisites: ARH 101, 102 or approval of instructor.

472 Art of Japan. (3) A
Japanese art from the Joman period to the present. Prerequisite: ARH 101, 102 or approval of instructor.

474 Chinese Painting. (3) A
From Ku K'ai-chin to Ch'i Pai-shih. Major artists, styles and movements in Chinese painting. Prerequisite: ARH 101, 102 or approval of instructor.

480 Research Methods. (3) F, S
Methodology and resource material for art historical research. Techniques of scholarly and critical writing and evaluation of bibliographic sources. Prerequisites: ARH 101 and 102 or approval of instructor.

482 History of Visual Arts Criticism I. (3) N
History of theories of criticism of the visual arts. Readings from visual arts critical literature from Plato to 18th century. Prerequisites: ARH 101 and 102 or approval of instructor.

483 History of Visual Arts Criticism II. (3) N
Continuation of ARH 482, focusing on various theories of criticism of the visual arts from late 18th century to present. Prerequisite: ARH 482.

486 Twentieth Century Art Criticism. (3) N
Seminal, influential writings in development of modern art criticism. Role of art critic, art journals in relation to art community. Prerequisite: ARH 454, 483 and/or approval of instructor.

488 Art Criticism Writing. (3) N
Traditional and contemporary approaches to the criticism of art. Students will write critical essays. The latter half of the semester will stress the criticism of contemporary art in various media. Prerequisites: ART 486 and/or approval of instructor.

498 Pro-Seminar. (3-6) A
Undergraduate seminar in topics selected from the following. Prerequisite: approval of instructor.

Problems or criticism in

(a) Chinese Art   (f) Modern Art
(b) Ancient Art   (g) American Indian Art
(c) Medieval Art   (h) Pre-Columbian Art
(d) Renaissance Art   (i) Photographic History
(e) Baroque Art

591 Seminar. (3-6) A
Graduate seminar in topics selected from the following. Prerequisite: approval of instructor.
Problems or criticism in:

(a) Chinese Art   (f) Modern Art
(b) Ancient Art   (g) American Indian Art
(c) Medieval Art   (h) Pre-Columbian Art
(d) Renaissance Art   (i) Photographic History
(e) Baroque Art

Special Courses: ARH 294, 484, 492, 493, 494, 499, 500, 590, 592, 598, 599. (See pages 35-36.)

AUXILIARY COURSES

ARA 202 Introduction to Photo Aesthetics. (3)
Slide lecture course in understanding photography as a fine art form.

288 Understanding Art. (3) A
Critical/historical distinguishing of artistic concepts and values, alternative forms and directions of art. May not be taken for credit by students who have completed ARA 488.

454 Museum Studies I. (3) A
History of the origins and development of museums. Topics covered will be the history of collecting, connoisseurship and conservation. Prerequisite: Approval of instructor.

456 Museum Studies II. (3) N
Practical operation of museums; methodology: theory /practice including organization, administration, fund raising, grant proposals, collecting, registration, budgets, personnel and education programs. Prerequisite: ARA 454.

460 Gallery Exhibitions. (3) F, S
Practical experience in all phases of department gallery operations and preparation of gallery publications. Prerequisites: approval of instructor. May be repeated for credit.

488 Understanding Art. (3) F, S
Course content same as ARA 288 but requires a higher level of accomplishment and comprehension. May not be taken for credit by a student who has completed ARA 288.

Special Courses: ARA 294, 484, 494, 498, 584, 591, 594, 598. (See pages 35-36.)

Department of Dance

PROFESSORS:
LESSARD (PEBE 115), JONES, NAGRIN
ASSOCIATE PROFESSORS:
HUSKEY, LUDWIG
ASSISTANT PROFESSORS:
CHLISTOWA, MARION
INSTRUCTORS:
HARPER, MATT

Departmental Major Requirements

For advisement purposes, all students registering in a dance degree program will enroll through the College of Fine Arts. Each degree program and area of specialization has its own check sheet which describes the particulars of course sequence and special requirements. These are available in the Department of Dance office.

Bachelor of Arts Degree Curriculum

Dance—Consists of a minimum of 45 semester hours of credit in dance, of which the following are required: DAH 401, 402; DAN 130, 131†, 134, 135, 232, 234†, 235, 261†, 262, 334 and 464. Fifteen additional hours approved by an advisor must be in no more than two related fields. Two years of credit or equivalent in one foreign language is required. For specific courses see page 83. Additional requirements are listed on the departmental check sheet.

At least 50 credit hours, including 24 in the major, must be upper division. Grades in classes required for the major must be C or better. First semester students should take: DAN 134 Modern; DAN 135 Ballet; ENG 101; MUS 100; and two General Studies electives.

Bachelor of Fine Arts Degree Curriculum

Dance—Consists of 65 to 85 hours of credit with a concentration in either Performance and Choreography or Dance Education. Core courses required are: DAH 401, 402; DAN 130, 131†, 134, 135, 230†, 232†, 234†, 235, 261, 262, 263†, 334†, 464†, 465†, 490†. For the concentration in Performance and Choreography additional requirements include DAN 331, 332†, 335, 371†, 434†; MUS 100; MUS 347 or 355 or 356; THP 101. For the specialization in secondary education, MUS 100, DAN 360, 361 and 367

must be completed as well as all state secondary certification requirements. Other requirements for each option are listed on the departmental check sheet.

At least 50 credit hours, including 30 in the major, must be upper division. Grades in classes required for the major must be C or better. First semester students should take: DAN 134 Modern; DAN 135 Ballet; ENG 101; MUS 100; and two General Studies electives.

Departmental Graduate Program

The faculty in the Department of Dance offer a program leading to the Master of Fine Arts degree with a major in Dance. The program is designed to train professionals in the technique, performance, choreography and theoretical bases of modern dance. Consult the *Graduate College Catalog* for requirements.

DANCE HISTORY

DAH 100 Introduction to Dance. (3) F, S
Orientation to the field of dance with particular reference to trends.

300 Introduction to Dance. (3) F, S
Course content same as DAH 100 but requires a higher level of accomplishment and comprehension. May not be taken by student who has completed DAH 100.

301 History and Philosophy of Dance. (3) N
Dance from ancient times to the present. Consideration of dance as an art in relation to other arts; primitive, preclassic, and modern forms.

401 Dance History I. (3) F
Cultural and theatrical development of dance from prehistoric times through the Renaissance.

402 Dance History II. (3) S
Cultural and theatrical development of dance from the Renaissance through contemporary times.

550 Cultural Concepts of Dance. (3) S
Cultural concepts; trends, economic, political, and geographical forces in major eras of dance history.

560 Dance Philosophy and Criticism. (3) F
Theories of criticism; esthetic experience in dance in relationship to other art forms; concepts of creativity, style, and artistic truth. (Intended to integrate and give meaning to studio skills.)

Special Courses: DAH 500, 580, 590,591, 593, 594, 598. (See pages 35-36).

DANCE

DAN 130 Dance. (1) F, S, SS
Ballet, folk, improvisation, jazz, modern, social, square or other dance activities. Two hours a week. May be repeated for credit.

131 Music Theory for Dance. (2) S
Elements of music, music structures and their relationship to dance. Emphasis on rhythmic analysis and dance accompaniment. Prerequisite: MUS 100† or approval of instructor.

134 Technique and Theory of Modern Dance. (3) F, S
Elementary concepts of modern dance technique. Development of movement quality and performance skills.

Six hours weekly. May be repeated for credit. Placement audition required. Dance majors only.

135 Technique and Theory of Ballet. (2) F, S
First year ballet technique for Dance majors. Four hours weekly. May be repeated for credit. Placement audition required.

230 Dance. (1) F, S
Intermediate levels. Continuation of DAN 130. Two hours a week. May be repeated for credit.

232 Dance Notation I. (3) F
Survey of systems of dance notation. Emphasis on learning of elementary Labanotation. Prerequisite: MUS 100 or approval of instructor.

234 Technique and Theory of Modern Dance. (3) F, S
Intermediate concepts of modern dance technique. Development of movement quality and performance skills. Six hours weekly. May be repeated for credit. Placement audition required. Dance majors only.

235 Technique and Theory of Ballet. (2) F, S
Second year ballet technique for dance majors. Four hours weekly. May be repeated for credit. Placement audition required.

242 Ideokinesis. (3) F, S
A study of posture using the visualization of image/goals to facilitate improved alignment and movement efficiency.

261 Fundamentals of Choreography. (3) F, S
Analysis of theme and dramatic ideas drawn from poetry, drama, music and other art forms for use in dance choreography. Prerequisite: approval of instructor.

262 Dance Production I. (2) F
Theory of lighting and scenery as related to dance.

263 Dance Production II. (2) S
Theory and practice of programming, make-up, costuming and sound as related to dance production. One lecture, 2 hours laboratory. Prerequisite: DAN 262 or approval of instructor.

330 Dance. (1) F, S
Advanced levels. Continuation of DAN 230. Two hours a week. May be repeated for credit.

331 Music Literature for Dance. (3) F
Historical survey of music relative to dance. Emphasis on dance music and relation of musical vs. choreographic forms. Prerequisite: DAN 131 or approval of instructor.

332 Dance Notation II. (2) S
Intermediate study of Labanotation. Introduction to effort-shape analysis of movement. Prerequisite: DAN 232 or equivalent.

334 Technique and Theory of Modern Dance. (3) F, S
Advanced concepts of modern dance technique. Development of movement quality and performance skills. Six hours weekly. May be repeated for credit. Placement audition required.

335 Technique and Theory of Ballet. (2) F, S·
Third-year ballet technique for dance majors. Four hours weekly. May be repeated for credit. Placement audition required.

360 Theory and Practice of Teaching Dance. (2) F
Folk, square, social and other dance forms. Analysis and acquisition of teaching techniques and teaching materials suitable for school and recreational use. One lecture, 2 hours laboratory.

361 Theory and Practice of Teaching Dance. (3) F
Creative and modern. Analysis and acquisition of teaching techniques and teaching materials suitable for school and recreational use.

367 Children's Dance. (3) F, S
Theory and practice of teaching creative and other dance forms for children. Designed for dance majors and related curriculum, but open to all students.

371 Dance Theatre Performance/Production. (1) F, S
Performance or technical theatre work in designated dance productions. Prerequisite: approval of instructor. Three hours a week per credit hour. May be repeated for credit.

434 Technique and Theory of Modern Dance. (3) F, S
Preparation in the performance and comprehension of professional level modern dance technique. Six hours weekly. May be repeated for credit. Placement audition required.

435 Technique and Theory of Ballet. (2) F, S
Fourth year ballet technique for dance majors. Four hours weekly. May be repeated for credit. Placement audition required.

464 Choreography and Accompaniment. (3) F
Function of accompaniment for dance; experience in the use of percussion, voice, records, piano and selected instruments in relation to their use in choreography.

465 Advanced Choreography. (3) S
Investigation and practice of contemporary styles of choreography. Prerequisite: DAN 261, or approval of instructor.

490 Senior Performance in Dance. (2) F
Original choreography for solo or group performance with analysis and critique of problems encountered in production. Must be repeated for total of 4 hours. Prerequisites: DAN 261†, 464 and 465.

530 Advanced Problems in Analysis of Dance Technique. (3) F
Theories and principles of human anatomy and biomechanics applied to analysis and evaluation of dance movement. Prerequisite: PED 335 or approval of instructor.

531 Choreographer/Composer Workshop. (3) N
Analysis of, experimentation with, and practice in working with composers of music for choreography. Open to experienced choreographers and composers. Prerequisites: Approval of instructor.

534, 634 Technique and Theory of Modern Dance. (3) F, S
Preparation in the performance and comprehension of professional level modern dance for first year 534 and second year 634 graduate students. Six hours weekly. May be repeated for credit. Placement audition required.

535 Technique and Theory of Ballet. (2) F, S
Graduate level ballet technique. Four hours weekly. May be repeated for credit. Placement audition required.

542 Ideokinesis. (3) F, S
A theoretical examination of Ideokinetic methods of facilitating postural change and movement efficiency.

562 Dance Stagecraft and Production. (3) N
Theory of lighting, costuming, make-up, scenery and sound as related to dance performance. May be repeated once for credit. Prerequisite DAN 262 and 263 or equivalent.

563 Individual and Group Choreography. (3) F
Original choreography created for solo and group performance. May be repeated once for credit. Prerequisite: DAN 464 and 465† or equivalent.

571 Dance Theatre. (1) F, S
Performance in specially choreographed dance productions. Prerequisite: Approval of instructor. Three hours a week. May be repeated for credit.

591 Seminar. (1-3) N
Topics may be selected from the following:
- (a) Dance Education and Administration
- (b) Film and Dance (c) Effort-Shape

632 Dance Notation III. (3) S
Advanced study of Labanotation. Experiences in notating and reconstruction of Labanotation dance scores. Prerequisite: DAN 332† or equivalent.

680 MFA Performance. (3-12) F, S
Studio work in preparation for required MFA concert. Public performance to be approved by the student's supervisory committee and be followed by a final oral examination. A written bound document as well as video documentation must be left with the department.

Special Courses: DAN 294, 484, 494, 498, 499, 500, 580, 584, 590, 591, 593, 594, 598, 691. (See pages 35-36.)

School of Music

PROFESSORS:
UMBERSON (MUSIC 183), ANDRESS, ATSUMI, BOSWELL, BRITTON, CARROLL, CLARK, COHEN, ENGLISH, HAMILTON, HOOVER, LOCKWOOD, LOMBARDI, LoPRESTI, MAGERS, McEWEN, McLEOD, PERANTONI, RUCCOLO, SEIPP, SKOLDBERG, SPINOSA, STOCKER, STRANGE

ASSOCIATE PROFESSORS:
COSAND, DEBENPORT, DeGROOTE, de KANT, DOAN, FLEMING, HACKBARTH, HAEFER, HANNA, HARRIS, HICKMAN, HOFFER, KLIEWER, MAROHNIC, METZ, RAUSCH, RAVE, REYNOLDS, SHINN, SMITH, STALZER, SUNKETT, SWAIM, WELLS, WILLIAMSON, WILSON, WYTKO

ASSISTANT PROFESSORS:
BARROLL, CROWE, DeMARS, HOLBROOK, KOONCE, MEYER, OLDANI, SHAW, WHITE

The School of Music is a member of the National Association of Schools of Music, and the requirements for entrance and graduation set forth in this catalog are in accordance with the published regulations of the Association. The following statement of Basic Musicianship is endorsed by the School of Music:

"All musicians, whether performers, composers, scholars or teachers, share common professional needs. Every musician must to some extent be a performer, a listener, an historian, a composer, a theorist, and a teacher. For this reason, certain subject matter areas and learning processes are common to all baccalaureate degrees in music.

"Basic musicianship is developed in studies which prepare the student to function in a variety of musical roles which are supportive of his/her major concentration. All undergraduate curricula, therefore, provide the following:

1. A conceptual understanding of such musical properties as *sound, rhythm, melody, harmony, texture* and *form* and opportunities for developing a comprehensive grasp of their interrelationships as they form the cognitive-affective basis for listening, composing and performing.
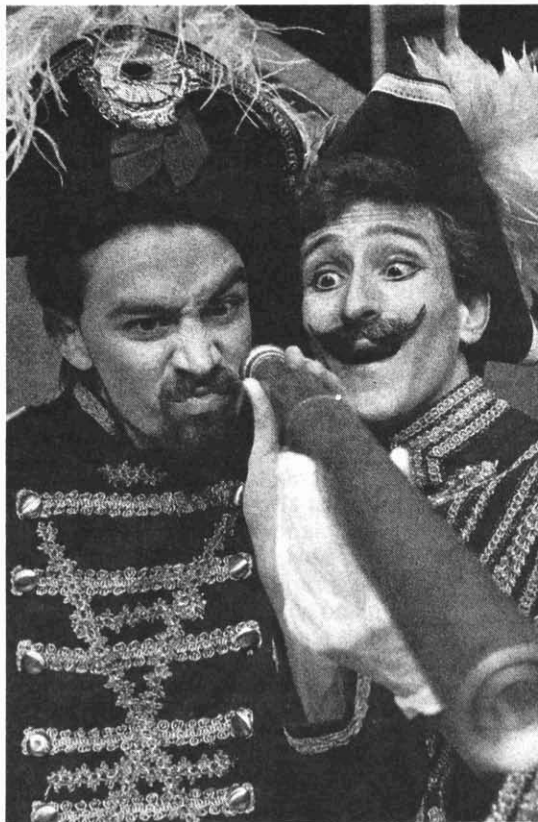
2. Repeated opportunities for enacting in a variety of ways the roles of listener (analysis), performer (interpretation), composer (creation), scholar (research), and teacher.
3. A repertory for study that embraces all cultures and historical periods."

Major Requirements

For advisement purposes, all students registering in a music major program will enroll through the College of Fine Arts. All music degree programs require a minimum of 126 hours of graduation. In addition to the major requirements listed below, General Studies and other academic requirements are listed on pages 39-40 and 43-44 of this catalog.

Placement Examination. All students who enroll in an undergraduate music degree program are required to perform an entrance audition in their primary performing medium (instrument or voice). Audition forms and specific audition requirements for each instrument or voice may be obtained upon request by writing the School of Music. Official dates for these auditions will be set for each academic year. Students may request to audition on other dates if necessary or may send a tape recording if distance prohibits coming to the campus. Entering students must also take placement tests in theory and piano at the time they enter the university. This includes transfer students who have completed four semesters of theory and piano at another institution; they are required to reach a minimum level of achievement indicated on the Theory Placement Exam and Piano Placement Exam.

Bachelor of Arts Degree Curriculum in the Music Program—Consists of 50 credit hours. The following courses are required:

Music Theory: MTC 125, 221, 222, 223, 320, 327, 422

Music History: MHL 341, 342

Major Performing Medium: Eight credit hours (MUP 111/311)

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Recital Attendance: Six semesters of MUP 100

Note: The remaining hours in music will be selected by the student in consultation with his/her advisor. Areas of study may include music history, ethnomusicology and music theory. At least 23 credit hours, 12 in field of specialization, must be upper division.

Bachelor of Music Degree Curriculum in the Music Program—Consists of 84 credit hours. This curriculum offers fields of specialization in choral-general music, instrumental music, performance, music therapy, and theory and composition. Choral-general music and instrumental music majors are provided for students wishing to meet certification requirements for teaching in the public schools. The following requirements are included in each field of specialization:

Choral-General Music

(Note: This degree program may include a teaching minor in instrumental music.)

Music Theory: MTC 125, 221, 222, 223, 327, 431

Music History: MHL 341, 342

Conducting: MUP 209, 339

Music Education: MUE 313, 315, 480

Major Performing Medium: Eight credit hours of MUP 111 and 8 credit hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 completes the requirement.

Minor Performing Medium: A proficiency equal to six semesters of study in keyboard or voice (whichever is not the major performing medium). Students wishing to extend their proficiency beyond this level may continue to study in MUP 321.

Ensemble: Eight different semesters of participation including at least six semesters of MUP 352 and/or MUP 353, four of which must be at Arizona State University.

Recital Attendance: Six semesters of MUP 100

Instrumental Music

(Note: It is strongly recommended that this degree program include a minor in choral music or a minor in jazz education.)

Music Theory: MTC 125, 221, 222, 223, 327

Music History: MHL 341, 342

Conducting: MUP 210, 340

Music Education: MUE 315, 317, 318, 327, 328, 336, 337, 338, 481, 482

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Major Performing Medium: Eight credit hours of MUP 111 and 8 credit hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital re-

quirement. MUP 495 completes the requirement.

Ensemble: Eight different semesters of participation, four of which must be at Arizona State University. For wind and percussion players, two of the four ASU semesters must be in marching band. String players must have a minimum of six semesters of MUP 345. Wind and percussion players must have a minimum of six semesters of MUP 361.

Recital Attendance: Six semesters of MUP 100.

Recommended Minors: Choral-General Music (13 hours). MUE 480, MTC 431, MUP 339, 350 or 352/353 (two semesters), and voice (4 hours). Or Jazz Education (13 hours). MUP 141-142, MUP 217-218, MUP 386, MUP 341, MUP 235-236, and MUP 379 (if MUP 142 is waived).

Performance

Keyboard Concentration

Music Theory: MTC 125, 221, 222, 223, 320 or 321, 327, 425 (or 428)

Music History: MHL 341, 342, 447

Repertoire and Pedagogy: MUP 451 or 452, 481 or 482

Conducting: MUP 209 or 210 or 211

Major Performing Medium: Sixteen credit hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital (MUP 496) are required.

Ensemble: Eight credit hours within a minimum of six different semesters, of which two semesters of accompanying and two semesters of chamber music are required.

Recital Attendance: Six semesters of MUP 100

Performance

Orchestral Instrument Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 327, 425

Music History: MHL 341, 342, 447

Repertoire and Pedagogy: MUP 451 or 481

Conducting: MUP 210, 340

Major Performing Medium: Sixteen credit hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital (MUP 496) are required.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Ensemble: Eight credit hours of large ensembles within a minimum of six different semesters, plus four credit hours of small ensembles within a minimum of four different semesters.

Recital Attendance: Six semesters of MUP 100

Performance

Voice Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 327, 425

Music History: MHL 341, 342, 447

Repertoire and Pedagogy: MUP 451, 481: Two credits selected from MUP 453, 454 or a repeated enrollment of MUP 451.

Diction: MUP 250; four credit hours of diction for singers—English, Italian, German, French.

Conducting: MUP 209

Major Performing Medium: Sixteen credit hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital (MUP 496) are required.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Ensemble: Four different semesters of large ensembles, plus five credit hours of ensembles within five different semesters to be selected from large and/or small ensembles.

Recital Attendance: Six semesters of MUP 100

Additional Requirements: Sixteen credit hours of credit in more than one foreign language, chosen from French, German or Italian. A student may elect one year of one language, and either one or two semesters of the other(s), chosen in conference with the advisor.

Performance

Guitar Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 327

Music History: MHL 341, 342, 447

Repertoire and Pedagogy: MUP 451, 481

Conducting: MUP 210

Major Performing Medium: Sixteen credit hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A

half recital (MUP 495) and a full recital (MUP 496) are required.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Ensemble: Eight credit hours of ensemble within a minimum of six different semesters. Four of the eight credits must be MUP 379: Chamber Music Ensemble - Guitar.

Recital Attendance: Six semesters of MUP 100.

Performance

Piano Accompanying Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 327, 428

Music History: MHL 341, 342, 447.

Diction and Repertoire: MUP 250 (2 semesters), 451, 453, 454

Conducting: MUP 209 or 210 or 211

Major Performing Medium: Sixteen credit hours of MUP 127, 8 credit hours of MUP 311, 8 credit hours of MUP 337. In addition, student will accompany two half-recitals (MUP 495), one for a singer, one for an instrumentalist during the junior year. (A half solo recital may be substituted for either of the above.) During the senior year the student will accompany two full recitals (MUP 496), one vocal and one instrumental.

Ensemble: Two semesters of MUP 379 (chamber music), one semester of MUP 379 (two-piano ensemble); one semester of MUP 487 (piano accompanying); four semesters of MUP 388; two semesters of ensemble elective (minimum of six different semesters)

Recital Attendance: Six semesters of MUP 100

In addition, the student will elect two semesters of one foreign language (French, Italian, German recommended).

Performance

Music Theatre Concentration

Music Theory: MTC 125, 221, 222, 223, 327

Music History: MHL 341, 342, 447 and 2 elective hours

Conducting: MUP 209 or 210 or 211

Major Performing Medium: Eight credit hours of MUP 111 and 8 credit hours of MUP 311 to attain a proficiency level necessary to meet the graduation requirement of a public performance of two roles, one of which must be of major proportion.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Ensemble: Three semesters of MUP 370, five semesters of MUP 371 and eight semesters of MUP 373

Recital Attendance: Six semesters of MUP 100

Additional requirements: Minimum of six credit hours each in theatre and dance.

Performance

Jazz Performance Concentration

Music Theory: MTC 125, 221, 222, 223, 324, 315, 316, 321, 327, 441

Music History: MHL 152, 341, 342, 352

Conducting: MUP 210

Pedagogy: MUP 341

Major Performing Medium: Eight credit hours of MUP 111 and 8 credit hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirements. Two half-recitals (MUP 495) are required, with one in the jazz idiom.

Class Piano: MUP 131, 132, 231, 232, 235, 236, 335, 336

Improvisation: MUP 141, 142, 217, 218, 417, 418

Ensemble: Eight semesters including two semesters of MUP 386 and six semesters of MUP 379 (CME: Jazz)

Recital Attendance: Six semesters of MUP 100

Music Therapy

Music Theory: MTC 125, 221, 222, 223, 327, 422

Music History: MHL 341, 342

Conducting: MUP 211

Music Education: MUE 211, 313, 319, 329, 335, 336, 339

Music Therapy: MUE 161, 261, 361, 362, 381, 384, 385, 386, 387, 388, 441, 475, 476

Major Performing Medium: Six to eight semesters, must include at least four hours of MUP 311.

Piano: Proficiency equal to four semesters of study

Voice: Two semesters of study

Ensembles: Six semesters of participation with at least four semesters in large groups.

Recital Attendance: Six semesters of MUP 100

Additional requirements: Four credit hours of functional dance; specified courses in Science and Social and Behavioral Sciences

(Note: Student must apply to the National Association for Music Therapy for registration as a Music Therapist on completion of the requirements for graduation.)

Music Theory and Composition
Music Theory Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 321, 323 327, 422, 425, 428, 496, 10 hours electives in MTC courses 300 or above, to be chosen in consultation with advisor.

Music History: MHL 341, 342, 447, and three elective hours.

Conducting: MUP 211, or MUP 209 and 339 or MUP 210 and 340.

Applied Music: Twelve credit hours of study, eight of which must be MUP 111.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination.)

Ensemble: Eight semesters of participation.

Final Project: MTC 496

Recital Attendance: Six semesters of MUP 100.

Language: The equivalent of 16 semester hours of credit in one foreign language; the choice of language subject to approval of advisor.

Music Composition Concentration

Music Theory: MTC 125, 221, 222, 223, 320, 321, 323 (four semesters), 327, 422, 425, 428, 429, 430, 433.

Music History: MHL 341, 342, 447 and three elective credit hours.

Conducting: MUP 211, or MUP 209 and 339, or MUP 210 and 340.

Applied Music: Twelve credit hours of study, eight of which must be MUP 111.

Class Piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Ensemble: Eight semesters of participation.

Final Project: MTC 495.

Recital Attendance: Six semesters of MUP 100.

Music Minor
Elementary Education Minor

Music Theory: MTC 100.

Music History: MUS 340.

Music Education: MUE 311.

Piano: Four semesters.

Electives: Two credit hours.

Secondary Education

Minors for students in Secondary Education and students in Liberal Arts are available through the School of Music. Consult with the Music School office for advisement sheets and advisors.

Graduate Programs
The School of Music offers the following graduate programs: the Master of Arts degree provides advanced studies in history and literature of music; the Master of Music degree has majors in the fields of performance (voice, keyboard, instrumental, piano accompanying, pedagogy, music theatre musical direction, music theatre performance), choral music (choral music, general music), instrumental music, and theory and composition. The Master of Education degree—Secondary Education, with a focus on choral, general or instrumental music, the Doctor of Musical Arts degree, the Doctor of Education degree in Secondary Education (Music Education), and the Doctor of Philosophy degree in Education—Secondary Education (Music) are offered in cooperation with the College of Education. Consult the *Graduate College Catalog.* A document on graduate degree programs in music may be obtained by writing to the School of Music.

MUSIC
(General Studies Electives)

MUS 100 Fundamentals of Music Notation. (3) F, S, SS
Provides nonmusic majors with sufficient symbol literacy to begin work in the field of musical learning. No credit for music majors.

107 Introduction To Music. (2) F, S, SS
Correlation of music with literature, science, and art. A nontechnical course in the humanities for nonmusic majors.

230 Beginning Group Piano. (1) F, S
Provides a basic introduction to playing piano through music reading, chords, rhythmic, and written activites. No experience necessary, but practice is essential. 2 hours weekly.

340 Survey of Music History. (3) F, S, SS
Major periods, composers and compositions in the history of music. May be used to meet the music history requirement for a minor in music.

347 Jazz in America. (3) F, S, SS
Current practices employed by contemporary jazz musicians; the historical development of jazz techniques.

353 Survey of Afro-American Music. (3) A
Afro-American music traced from its origins in Africa to the present with emphasis on spiritual, blues, jazz, gospel, and classical styles.

354 Popular Music. (3) A
Emphasis on historical, cultural and performance patterns in a variety of popular music idioms.

355 Survey of American Music. (2) F, S, SS
Growth and development of America's music.

356 Survey of the Musical Theatre. (3) N
Music's place in the theatre, viewed in terms of historical importance and relative function.

357 Aesthetic Perception in Music Performance. (3) F, S, SS
Introduces the nonmusic major to the aesthetics of performance by stressing their physical and emotional involvement in the direction, motion, intensity and color spectrum of music.

Special Courses: MUS 294, 494

MUSIC EDUCATION

MUE 161 Introduction to Music Therapy. (2) F
Overview of music therapy. Orientation to mental health, special education and related therapies. Required on-site visits.

211 Music in Recreation. (2) F
Materials, methods and organizational structures appropriate for recreational music.

261 Music Therapy I. (2) F
Orientation to pre-clinical experience with an emphasis on observation skills, assessment, goal setting and professional ethics. Required off-campus observations. Prerequisite: MUE 161.

310 Music in Early Childhood Education. (3) F
Identifying and understanding musical needs of young children. Methods and materials for program development for classroom teachers.

311 Music for the Classroom Teacher. (3) F, S
Development of the classroom music program in the elementary school. No previous music experience or course work required. Not for music majors or minors.

313 Music in the Elementary School. (3) F
Methods of instruction, organization and presentation of appropriate content in music. For music majors only.

314 Music in the Elementary School. (3) S
Selected problems in elementary school classroom music and choral program. Observation and participation in school music classrooms. Prerequisite: MUE 313.

315 Music in the Junior High School. (2) A
Student characteristics, curriculum, and teaching strategies for choral and general music. For music majors only.

317, 318, 327, 328, 335, 336, 337, 338 Educational Methods for Teaching Instruments (1) F, S
Teaching and playing skills for school music teachers, instrument(s) named. Three hours per week.

317 Educational Methods for Violin and Viola.

318 Educational Methods for Cello and String Bass.

327 Educational Methods for Trumpet and Horn.

328 Educational Methods for Trombone, Euphonium and Tuba.

335 Educational Methods for Guitar.

336 Educational Methods for Percussion.

337 Educational Methods for Flute, Clarinet, Saxophone.

338 Educational Methods for Double Reed Instruments.

319 Educational Methods for Strings. (1) F
Teaching and playing skills for music therapists and music minors. Three hours per week.

329 Educational Methods for Brass. (1) S
Teaching and playing skills for music therapists and music minors. Three hours per week.

339 Educational Methods for Woodwinds. (1) F
Teaching and playing skills for music therapists and music minors. Three hours per week.

361 Music Therapy II. (3) F
Influence of music on behavior; principles and practices of music therapy and psychiatric clients. Prerequisite: MUE 261. Music Therapy majors only.

362 Music Therapy III. (3) S
Organization, administration, and use of music in rehabilitation with various client populations. Prerequisite: MUE 361. Music Therapy majors only.

381 Music Therapy Research. (3) S
Statistics and research design appropriate for investigations in music therapy.

384, 385, 386, 387, 388 Therapy Pre-Clinical I-V. (1) F, S
Paired students will provide music therapy for small groups at a community agency for mentally retarded, geriatrics, or physically disabled clients for a minimum of ten clock hours. Prerequisites: MUE 211 and 261.

441 Psychology of Music. (3) S
Psychological and physiological aspects of music emphasizing musical behavior, function, perception and learning. Prerequisite: MUE 362.

475 Therapy Practicum. (1) F
Activities for music therapy majors, professional writing skills, professional considerations. Prerequisites: MUE 362. Music Therapy majors only.

476 Internship in Music Therapy. (1) F, S
A six-month residency in an approved clinical institution.

480 Choral Music Practicum. (3) S
Methods of instruction, organization and presentation of appropriate content in choral music classes. Must be majoring in secondary education.

481, 482 Instrumental Music Practicum. (5, 5) F, S
Instrumental music as a means of developing music skills, understandings and attitudes in elementary and secondary school students. Must be majoring in secondary education.

549 Foundations of Music Education. (3) A
A treatment of historical perspectives, philosophy-aesthetics identified with music education, and learning theories applied to music teaching/learning. Basic research and writing skills appropriate to graduate studies in music education.

550 Studies in Music Curricula. (3) A
Scope and sequence of musical experiences. Development of criteria for the evaluation of music curricula.

551 Advanced Studies in Elementary School Music. (3) A
For experienced teachers; organization and content of the general music classes in kindergarten and the first six grades of elementary school. Emphasis on teaching music reading and ear training to young children.

552 General Music, Music Theory and Music History Classes in the Junior and Senior High School. (3) N
Organization and content of school music classes which are not performance oriented.

553 Contemporary Elementary Music. (3) F
Identification and development of materials and techniques for teaching special units of music study to elementary (K-8) children.

560 Teaching Contemporary Music. (3) N
Strategies for using contemporary music with school music classes and organizations.

564 Instrumental Music, Advanced Rehearsal Techniques. (3) A
An in-depth analysis of instrumental techniques in preparation for a thorough discussion of band tuning problems and solutions. Discussion of productive conducting and rehearsal techniques for school music teachers.

566 Instrumental Literature for Schools. (3) N
Comprehensive study and analysis of all types of instrumental music.

568 Choral Music, Advanced Rehearsal Techniques. (3) A
Musical and vocal techniques necessary for presentation of choral literature. Analysis and experimentation with psychological, acoustical and other problems of rehearsal and performance.

570 Choral Literature for Schools. (3) A
Comprehensive study and analysis of choral music for the high school with special emphasis on octavo literature.

579 Psychology of Music. (3) N
The nature of musicality and its evaluation. A review of recent research.

585 Vocal Acoustics and Production. (3) A
An in-depth approach to the psychological/physiological workings of the vocal mechanism.

733 Experimental Projects and Recent Trends in Music Education. (3) S
Recent trends and research developments which challenge traditional practices.

744 Major Problems in the Education of Music Teachers. (3) F
Patterns of music teacher education and a projection of course outlines designed to accommodate the most comprehensive demands of the changing school music curriculum.

755 Philosophy and Aesthetics in Music Education. (3) SS
Philosophy and aesthetics as they influence curriculum content and teaching procedures.

Special Courses: MUE 294, 484, 494, 498, 499, 580, 590, 591, 592, 594, 598, 599, 680, 693, 700, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

MUSIC HISTORY

MHL 152 Jazz Listening. (1) S
An introduction to jazz forms, idioms, and major innovators.

341, 342 Music History. (3) F, S
Western music from the Greeks to the present day. Prerequisite: MTC 221. Need not be taken in sequence.

352 The Evolution of Jazz. (3) A
Origin, development and styles of jazz music and its exponents. Prerequisite: MTC 223.

438 Music in the Classic Era. (3) N
Development of the classic style of the 18th century; major works of Haydn, Mozart, and Beethoven. Prerequisites: MHL 341, 342, MTC 327.

439 Music in the 19th Century. (3) N
European art music after Beethoven. Prerequisites: MHL 341, 342, MTC 327.

441 Music of the Baroque Era. (3) N
Works of major composers and stylistic tendencies of the period. Prerequisites: MHL 341, 342, MTC 327.

447 Music Since 1900. (3) F, SS
Survey of the works by major composers and stylistic trends. Prerequisites: MHL 341, 342; MTC 327.

466 North American Indian Music. (3) N
Various styles of Indian music in the United States, Canada and Mexico. Open to music majors and non-majors.

532 Music Bibliography. (3) N
Major historical and analytical writings; systematic and historical collections of music. Reading knowledge of a foreign language recommended.

535 Medieval Music. (3) N
Music of Europe in the Middle Ages, Gregorian chant, religious and secular monophony and polyphony to 1430.

536 Music of the Renaissance. (3) N
Musical thought in Europe, with emphasis on stylistic concepts and changes, c. 1430-1580.

544 World Music I. (3) N
Music of traditional and folk cultures of Africa, Europe, and the Americas.

545 World Music II. (3) N
Traditional, folk, and art music of the Pacific, Near East, and Asia.

547 Topics in American Music. (3) S
Selected topics in the history of music composers working in the Americas with emphasis upon music since 1900.

575 History of Choral Music. (3) F, SS
Major choral works.

644 Notation of Polyphonic Music. (3) N
Music notation from the 15th through 17th centuries, including problems of transcription into modern notation.

Special Courses: MHL 294, 492, 493, 494, 498, 499, 583, 590, 591, 592, 594, 598, 599, 690, 691, 693, 783. (See pages 35-36.)

MUSIC THEORY AND COMPOSITION

MTC 125 Basic Music Theory. (3) F, S
For music majors designed to develop aural and notational skills. Meets daily.

221 Music Theory-18th Century. (3) F, S
Music from the 18th century with a view toward developing students' abilities to analyze, theorize, perform and create examples within the style. Development of related aural, visual and keyboard skills. Prerequisite: MTC 125.

222 Music Theory-19th Century. (3) F, S
Musical compositions chosen from the late 18th and 19th centuries. Harmonic progressions, melodic construction and rhythmic developments; development of related aural, visual and keyboard skills. Prerequisite: MTC 221.

223 Music Theory-20th Century. (3) F, S
Representative 20th century compositions with particular emphasis on those elements of melodic, harmonic and rhythmic treatment which break with past conventions. Development of related aural, visual and keyboard skills. Prerequisite: MTC 222.

315 Modern Arranging. (2) F
Techniques in arranging for the contemporary jazz, radio, television, and studio orchestra. Prerequisite: MTC 223.

316 Modern Arranging. (2) S
Continuation of MTC 315. Prerequisite: MTC 315.

317 Composition for Non-Composition Majors. (2) N
Phrase and period structure, melodic composition and accompaniment, composition of small forms. Not to be elected by composition majors. Prerequisite: MTC 223. May be repeated once for credit.

320, 321 Counterpoint. (2, 2) F, S
First semester, strict counterpoint in modal style; second semester, strict and free tonal counterpoint. Prerequisite: MTC 221. Need not be taken in sequence.

323 Composition. (2) F, S
Creative writing in the smaller forms including the use of harmonic textures and contrapuntal devices. Prerequisite: MTC 223. May be repeated for credit.

324 Survey of Jazz Styles. (2) A
Large ensemble compositions and recorded improvised solos. Prerequisite: MHL 352.

327 Form and Analysis I. (2) F, S
Organizing elements in the most important contrapuntal and homophonic musical forms from the Renaissance through the 19th century. Prerequisite: MTC 223.

422 Musical Acoustics. (4) F, S
Properties of sound and tone. Harmonic series, instruments, the ear, auditorium acoustics, and the reproduction of sound. A thorough knowledge of musical notation, intervals, scales and harmony, or two years of music theory will be assumed.

425 Studies in 20th Century Theory. (3) F
Continued development of analytical techniques and aural skill, with an examination of theoretical systems applicable to 20th century music. Prerequisite: MTC 223.

428 Form and Analysis II. (2) S
Organizing principles of the large forms of musical composition in the 19th and 20th centuries. Prerequisite: MTC 327.

429, 430 Canon and Fugue. (2,2) N
Polyphonic studies in form and technique. Prerequisite: MTC 321.

431 Choral Arranging. (2) S
Practical studies in editing and arranging for choral organizations. Preparation of suitable materials for young choirs and advanced groups. Study of accompaniments. Prerequisite: MTC 223.

433 Orchestration. (3) N
Theoretical and practical study of scoring for orchestral instruments in various combinations, ranging from small ensembles to symphonic orchestra and concert band. Prerequisite: MTC 223.

436 Electronic Studio Techniques. (2) F, S
Principles of electronic music systems and their applications in the composition and recording of electronic music. May be repeated for credit. Cannot be used to fulfill theory requirements on graduate degrees.

441 Jazz Composition. (3) F
Creative writing in the smaller forms and in the idiom of jazz. Prerequisite: MTC 321.

495 Final Project. (0) F, S
A half recital of compositions or approval of a large scale composition or a research paper.

496 Theory Project. (3) F, S, SS
Supervised individual writing project dealing with music theory.

501 Theory Techniques. (2) F, S
Two hours a week. Credit cannot be applied toward the graduate theory requirement.

520 Advanced Analytical Techniques. (2) S, SS
Analytical techniques systematically applied to music. Concentration on structural and compositional procedures.

523 Advanced Composition. (2) F, S
Creative writing in the larger forms for chorus, orchestra and band. Prerequisites: MTC 323, 428; MHL 447 or equivalent. May be repeated for credit.

525 Pedagogy of Theory. (3) N
Practices and principles of teaching music theory. Emphasizes most desirable and practical offerings possible. Comparative studies of existing practices.

527, 528 Evolution of Musical Theory. (3,3) F, S
Theory from Pythagoras to the present. Need not be taken in sequence.

553 Advanced Choral Arranging. (2) F
Choral techniques in composition and arranging. Vocal writing through analysis of choral works. Projects in both arranging and composition.

554 Advanced Scoring Problems. (2) N
Instrumentation. Playing characteristics of each instrument; writing and arranging idiomatic music for the instrument. Projects in both scoring and composition.

Special Courses: MTC 294, 484, 492, 493, 494, 498, 499, 580, 590, 591, 592, 594, 598, 599, 690, 693, 783. (See pages 35-36.)

MUSIC PERFORMANCE

MUP 100 Concert Attendance. (0) F, S
Required of all music majors for six semesters in each degree program, with a minimum of seven (7) concerts attended each semester.

111, 311, 511 Studio Instruction. (2,2,2) F, S
For majors in music degree program. Placement audition required. Piano, organ, harpsichord, voice, harp, flute, oboe, clarinet, saxophone, bassoon, trumpet, cornet, horn, euphonium, guitar, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of one hour plus studio class weekly. May not be taken for audit.

121, 321, 521 Studio Instruction. (1,1,1) F, S, SS
For secondary or minor instrument instruction and nonmajors in the university. Placement examination and audition required. Piano, organ, harpsichord, voice, harp, flute, oboe, guitar, clarinet, saxophone, bassoon, trumpet, cornet, horn, euphonium, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of one-half hour per week. May not be taken for audit.

127, 327, 527 Studio Instruction. (4,4,4 or 2) F, S
For performance majors in Bachelor of and Master of Music degree programs only. Placement examination and audition required. Piano, piano accompanying, organ, harpsichord, voice, harp, flute, oboe, clarinet, guitar, saxophone, bassoon, trumpet, cornet, horn, euphonium, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of one hour plus studio class weekly. May not be taken for audit.

131, 132, 231, 232 Class Piano. (1,1,1,1) F, S
A four-semester sequence of courses designed for those lacking piano experience and those who need piano as a classroom tool. Emphasis on keyboard technique, sight reading simple accompaniments and improvisation. Two hours a week. May not be taken for audit.

133, 134, 233, 234 Class Voice. (1,1,1,1) F, S
Open to all students interested in the development of basic singing techniques. Two hours a week. May not be taken for audit.

141 Jazz Fundamentals. (1) F
Principles, methods, and theory of jazz performance, especially designed for the small jazz ensemble. Two hours per week.

142 Jazz Fundamentals. (1) S
Continuation of MUP 141. Two hours per week.

209 Beginning Choral Conducting. (1) F, S
Essentials of choral conducting techniques. Two hours a week.

210 Beginning Instrumental Conducting. (1) S
Essentials of instrumental conducting techniques. Two hours per week.

211 General Conducting. (2) S
Essentials of conducting choral and instrumental music designed for music therapy and theory-composition majors. Three hours per week.

217, 218 Improvisation Workshop. (2,2) F, S
Emphasis on basic jazz literature, chord symbol reading, melodic patterns, ear training, melodic concepts and analysis of improvised solos. Prerequisite: MTC 125, one semester of MUP 111. Must be taken in sequence. May not be taken for audit.

235, 236 335, 336 Jazz Piano. (1, 1, 1, 1) F, S
A four-semester sequence designed for jazz keyboard experience. Emphasis will be on chord symbol reading, simple improvisation and voicing. Prerequisite: MUP 132. Two hours per week.

250 Diction for Singers. (1) F, S
Use of phonetics in the study of song and opera literature. Language emphasis differs each semester. May be repeated for credit.

301 Advanced Class Piano. (1) F
Required for choral and general majors. Prerequisite: MUP 232 or proficiency. Open to other music majors who have completed MUP 232. Emphasis on accompaniments, ensemble playing, score reading, advanced harmonizations, repertoire, technique, and improvisation. Placement examination required. May not be taken for audit. Two hours per week.

302 Advanced Class Piano. (1) S
Required for choral and general majors. Open to other music majors who have completed MUP 301. A sequential continuation of MUP 301 skills which include both group and studio instruction. Prerequisite: MUP 301 or proficiency. Placement examination required. May not be taken for audit. Two hours per week.

328 Fretboard Harmony and Pedagogy. (3) S
Application of traditional melodic and harmonic concepts to the fingerboard. Method books and pedagogical approaches. Prerequisite: MTC 223.

337 Studio Instruction-Piano Accompanying. (2) S
Lessons for accompanying majors only. Repertoire to be selected from vocal and instrumental literature. Placement examination required. One hour lesson a week. May be repeated for credit.

339 Choral Conducting. (2) F, S
Elements of choral conducting technique and interpretation. Prerequisite: MUP 209 or MUP 211. Three hours a week.

340 Instrumental Conducting. (2) F
Fundamentals of score reading and interpretation of instrumental music. Prerequisite: MUP 210 or MUP 211. Three hours a week.

341 Jazz Pedagogy. (3) S
Training and supervised practice in conducting jazz ensembles with emphasis on literature, programming and rehearsal techniques. Prerequisite: MUP 210. Two class hours and two field experience hours each week.

344 Chamber Orchestra. (1) F, S
Membership by audition. Important masterpieces from all periods of music will be performed throughout the year. May be repeated for credit.

345 Symphony Orchestra. (1) F, S
Open to all students who can qualify on the basis of auditions with the director. Over a four-year period, the student is introduced to the masterpieces of symphony orchestra literature. Three times a week. May be repeated for credit.

350 Choral Union. (1) F, S
Open to all students in the University and to interested singers in the community by audition. Preparation and performance of the larger choral works. Two hours per week. May be repeated for credit.

352 Concert Choir. (1) F, S
Membership chosen by audition. May be repeated for credit. Four hours a week.

353 University Choir. (1) F, S
Membership chosen by audition. May be repeated for credit. Four hours a week.

355 Men's Chorus. (1) F, S
Open to all male students in the University who can qualify on the basis of auditions. Rehearsal and performance of music for male voices. Two hours a week. May be repeated for credit.

357 Women's Chorus. (1) F, S
Membership chosen by audition. Two hours a week. May be repeated for credit.

361 Marching and Concert Bands. (1) F, S
Open to all students who can qualify on the basis of auditions with the director. Staging of formations and drills for football games and other events (Fall); masterpieces of symphonic band literature (Spring). Meets daily. May be repeated for credit.

362 Concert Bands. (1) F
Night rehearsals. Membership chosen by audition. May be repeated for credit.

370 Music Theatre: Techniques. (1) F, S
Exercises and improvisations for the singing actor emphasizing body awareness, isolations, and freedom of the vocal and breath mechanisms. Section 1 (Interpretation); Section 2 (Expression); Section 3 (Movement for Singers). Each section: Three hours per week. May be repeated for credit.

371 Music Theatre: Workshops. (1) F, S
Development of specific skills for musical-dramatic interpretation. Section 1 (Role Preparation); Section 2 (Styles); Section 3 (Opera Scenes); Section 4 (Musical Comedy); Section 5 (Revue Ensembles). Each section: One lecture demonstration, 1 laboratory per week. May be repeated for credit.

372 Music Theatre: Orchestras. (1) F, S
Open to all students who can qualify on the basis of auditions with the instructor. Participation in Lyric Opera Theatre productions. Section 1 (Orchestra); Section 2 (Chamber Orchestra); Section 3 (Chamber Ensemble). May be repeated for credit.

373 Music Theatre: Performance. (1) F, S
Open to all students who can qualify on the basis of auditions with the instructor. Participation in Lyric Opera Theatre productions. Section 1 (Principal Roles); Section 2 (Chorus). May be repeated for credit.

374 Music Theatre: Production. (1) F, S
Participation in Lyric Opera Theatre productions. Section 1 (Vocal Performance); Section 2 (Technical Music Theatre); Section 3 (Problems in Production) to be taken concurrently with MUP 373, Section 2. May be repeated for credit.

379 Chamber Music Ensembles. (1) F, S
String, brass, woodwind, percussion, keyboard, vocal and mixed ensembles. Prerequisite: approval of instructor. Two hours a week. May be repeated for credit.

382 Collegium Musicum. (1) F, S
Singers and instrumentalists specializing in the performance of early and unusual music. Prerequisite: ap-

proval of instructor. Two hours a week. May be repeated for credit.

383 New Music Ensemble. (1) F, S
Rehearsal and performance of music written in the last 20 years. Prerequisite: approval of instructor. May be repeated for credit.

384 Brass Choir. (1) F, S
Specializing in public performance of music written for brass instruments. Prerequisite: approval of instructor. Three hours a week. May be repeated for credit.

385 Percussion Ensemble. (1) F, S
Rehearsal and performance of standard and original repertoire for the percussion ensemble and related instruments. Membership by approval of the instructor. Two hours a week. May be repeated for credit.

386 Stage Band. (1) F, S
Rehearsal and performance of literature for the stage band. Membership by approval of the instructor. Four hours a week. May be repeated for credit.

388 Piano Accompanying. (1) F, S
Accompanying majors (others at the discretion of instructor). Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. May be repeated for credit. Two hours a week.

417, 418 Advanced Improvisation. (2,2) F, S
Emphasis on analysis and performance of advanced jazz literature; composition in contemporary styles. Prerequisite: MUP 218. Must be taken in sequence. May not be taken for audit.

440 Keyboard Harmony. (1) F
Performance-oriented class emphasizing chord progressions, harmonization, figured bass realization, stylistic improvisation, transposition, open score reading and sight reading. Keyboard majors only or approval of instructor.

451 Repertoire. (2) F, S
Literature available for performance in all performing media. Prerequisite: junior standing in major performance field. May be repeated for credit.

452 Piano Repertoire II. (2) S
Continuation of MUP 451 (Piano). Romantic and contemporary keyboard literature. Prerequisites: Junior standing as piano major; approval of instructor.

453 Song Literature. (2) A
American, Russian, Spanish, Scandinavian and contemporary song.

454 Song Literature. (2) A
Early Italian, English, German and French art song.

481 Performance Pedagogy and Materials. (2) F, S
Principles and methods of performance techniques for each performance field. Prerequisite: senior standing or approval of instructor. May be repeated for credit.

482 Piano Pedagogy II. (2) N
Continuation of MUP 481 (Piano). Problems and techniques of teaching intermediate to advanced piano students. Prerequisites: Junior standing as piano major; approval of instructor.

487 Piano Accompanying. (1) F, S
Keyboard majors. Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. May be repeated for credit. Two hours per week. May not be taken for audit.

495 Solo Performance. (0) F, S
For Bachelor of Music degree candidates where one-half recital is a graduation requirement.

496 Solo Performance. (0) F, S
For Bachelor of Music in Performance degree candidates where a full recital is a graduation requirement. Prerequisite: MUP 495.

507 Group Piano Practicum. (2) F
Curricula, materials, teaching techniques for group teaching at the university and community college levels. Observation/supervised teaching in group piano.

508 Studio Observation. (1) F, S
Weekly observation of studio teaching by various piano faculty. Paper as final requirement. M.M. Performance/Pedagogy piano students only.

540 Advanced Conducting. (3) F
Score preparation and conducting techniques for instrumental music. Concentration on study of historical styles.

541 The Art Song. (3) N
Solo song from its beginning to the present day.

544 Chamber Orchestra. (1) F, S
Membership by audition. Important masterpieces from all periods of music will be performed throughout the year. May be repeated for credit.

545 Symphony Orchestra. (1) F, S
Open on the basis of audition with the director. Masterpieces of symphony orchestra literature. Three times a week. May be repeated for credit.

550 Choral Union. (1) F, S
Open to all students in the University and to interested singers in the community by audition. Preparation and performance of the larger choral works. Two hours per week. May be repeated for credit.

551 Repertoire. (2) N
Literature available for performance in all performing media. May be repeated for credit.

552 Concert Choir. (1) F, S
Membership chosen by audition. May be repeated for credit. Four hours a week.

553 University Choir. (1) F, S
Membership chosen by audition. May be repeated for credit. Four hours a week.

555 Men's Chorus. (1) F, S
Open to male students in the University who can qualify on the basis of audition. Rehearsal and performance of music for male voices. Two hours a week. May be repeated for credit.

557 Women's Chorus. (1) F, S
Membership chosen by audition. Two hours a week. May be repeated for credit.

561 Marching and Concert Bands. (1) F, S
Open by audition only. Staging of formations and drills for football games and other events (Fall); masterpieces of symphonic band literature (Spring). Meets daily. May be repeated for credit.

562 Concert Bands. (1) F, S
Membership chosen by audition (Fall). May be repeated for credit.

570 Music Theatre: Techniques. (1) F, S
Exercises and improvisations for the singing actor emphasizing body awareness, isolations and freedom of the vocal and breath mechanisms. Section 1 (Interpretation); Section 2 (Expression); Section 3 (Movement for Singers). Each Section: Three hours per week. May be repeated for credit.

571 Music Theatre: Workshops. (1) F, S
Development of specific skills for the musical-dramatic interpretation. Section 1 (Role Preparation); Section 2 (Styles); Section 3 (Opera Scenes); Section 4 (Musical Comedy); Section 5 (Revue Ensembles). Each section:

one lecture-demonstration, 1 laboratory per week. May be repeated for credit.

572 Music Theatre: Orchestras. (1) F, S
Open to all students who can qualify on the basis of auditions with the instructor. Participation in Lyric Opera Theatre productions. Section 1 (Orchestra); Section 2 (Chamber Orchestra); Section 3 (Chamber Ensemble). May be repeated for credit.

573 Music Theatre: Performance. (1) F, S
Open to all students who can qualify on the basis of auditions with the instructor. Participation in Lyric Opera Theatre productions. Section 1 (Principal Roles); Section 2 (Chorus). May be repeated for credit.

574 Music Theatre: Production. (1) F, S
Participation in Lyric Opera Theatre productions. Section 1 (Vocal Performance); Section 2 (Technical Music Theatre); Section 3 (Problems in Production) to be taken concurrently with MUP 373, Section 2. May be repeated for credit.

579 Chamber Music Ensembles. (1) F, S
String, brass, woodwind, percussion, keyboard, vocal and mixed ensembles. Prerequisite: approval of instructor. Two hours a week. May be repeated for credit.

581 Performance Pedagogy and Materials. (2) N
Principles and methods of performance techniques for each performance field. May be repeated for credit.

582 Collegium Musicum. (1) F, S
Singers and instrumentalists specializing in the performance of early and unusual music. Prerequisite: approval of instructor. Two hours a week. May be repeated for credit.

583 New Music Ensemble. (1) F, S
Rehearsal and performance of music written in the last 20 years. Prerequisites: approval of instructor. May be repeated for credit.

584 Brass Choir. (1) F, S
Public performance of music written for brass instruments. Prerequisite: approval of instructor. Two hours a week. May be repeated for credit.

585 Percussion Ensemble. (1) F, S
Rehearsal and performance of standard and original repertoire for the percussion ensemble and related instruments. Membership by approval of the instructor. Two hours a week. May be repeated for credit.

586 Stage Band. (1) F, S
Rehearsal and performance of literature for the stage band. Membership by approval of the instructor. Four hours a week. May be repeated for credit.

588 Piano Accompanying. (1) F, S
Piano accompanying majors (others at the discretion of the instructor). Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. May be repeated for credit. Two hours per week.

595, 596 Solo Performance. (1,1) F, S
For Master of Music candidates in applied music only. May be full recital, major operatic role, solo performance with orchestra, or an ensemble or lecture recital.

727 Studio Instruction. (4 or 2) F, S
For DMA candidates only. May be repeated for credit. Miminum contact of one hour per week.

796 Solo Performance. (1-5) F, S
For DMA candidates only. May be repeated for credit.

Special Courses: MUP 294, 484, 494, 498, 499, 580, 591, 594, 598, 690, 693, 783, 784, 791, 792. (See pages 35-36.)

Department of Theatre

PROFESSORS:
WRIGHT (GHALL 232), AKINS, DOBKIN, DOYLE, WITT, YEATER
ASSOCIATE PROFESSORS:
BARTZ, VINING
ASSISTANT PROFESSORS:
BARKER, EDWARDS, ENGEL, JAFFE, KARASZ, KUPKA, SALDAÑA, THOMSON

Departmental Major Requirements

For advisement purposes, all students registering in a Theatre degree program will enroll through the College of Fine Arts. Special advisement check sheets, providing complete information regarding requirements and suggested electives, are available in the Department of Theatre office for each degree program and area of concentration.

Bachelor of Arts Degree Curriculum

Theatre—Consists of a minimum of 45 semester hours and a maximum of 60 semester hours. Within the major (including related area studies considered part of the major), only courses with a grade of C or higher may be applied towards graduation. The following core of course work in Theatre is required: THE 100, 320, 321; THP 101, 213, 315, 330, 340, 345; at least two hours credit in THP 301, chosen from different production options; and at least three hours credit in THE 325. Theatre electives, chosen in consultation with an advisor, may be concentrated in one area of Theatre specialization or selected to provide a balanced general program. Up to 15 hours of approved course work in a related area or areas may be included in the major.

General Studies—A minimum of 54 semester hours. See page 298 for approved areas of study and distribution of hours as required by the College of Fine Arts (exception: only upper division courses in Foreign Languages may be used in fulfillment of the Humanities requirement).

Foreign Language Requirement—
Knowledge of one foreign language equivalent to the completion of two years' study at the college level is required. For specific courses, see Foreign Language Department. Courses taken to satisfy the foreign language requirement may be cross-listed as General Studies electives.

Bachelor of Fine Arts Degree Curriculum

Consists of 84 hours in theatre (including approved related area studies considered part of the major). On the basis of personal interests and professional objectives, the student may select one of two curriculum options: Theatre Education or Performance/ Production with an emphasis in acting, child drama, or design/technology. Candidates for the BFA degree must take the last 60 hours of course work in residence at ASU. Retention in the BFA program will be determined by annual faculty review of all candidates for the degree; the review process will include consideration of the student's academic record, professional activities and growth, and artistic potential. A minimum of 42 hours in General Studies is required. See page 298 for approved areas of study and distribution of hours as required by the College of Fine Arts. Some adjustments are made in the Theatre Education option in order to meet certification requirements. Admission procedures and theatre course requirements for each curriculum option/ emphasis follow:

Performance/Production

Acting—Students should declare an Acting emphasis at the time of admission. Retention in the emphasis will be determined by audition at the end of each school year. The following theatre courses are required: THE 100, 320, 321, 325 (3 hrs.); THP 101, 110, 113, 213, 294 (Acting Techniques--4 hrs.), 301 (4 hrs.), 307, 310, 313, 370 (4 hrs.), 375 (4 hrs.), 394 (Intern in Acting Techniques--3 hrs.), 401 (3 hrs.), 407, 470 (4 hrs.), 475 (4 hrs.), 494 (Acting Techniques, and 498 (Senior Project); 9 hours of theatre history and literature; and general studies electives selected in consultation with an advisor.

Child Drama—Acceptance in this emphasis is by interview only (or submission of three letters of recommendation and a letter of intent if distance prohibits coming to campus), and with the approval of the faculty of the Department of Theatre. Application will normally be made at the end of the sophomore year; applications for early admission of ASU freshmen will be accepted towards the end of the second semester of full-time study. Retention in this emphasis is determined at the end of each semester of the junior year. The following Theatre and Professional courses are required: THE 100, 320, 321, 325 (3 hrs.); THP 101, 113, 213, 311,

312, 315, 318, 330, 340, 345, 411, 418, EED 313, LIS 410. Two hours credit in THP 301 chosen from different production options; three hours of theatre history or literature; and theatre and related area electives selected in consultation with an advisor to complete the major requirement of 84 hours.

Design/Technology—Acceptance in this emphasis is by interview and portfolio review. Retention in the emphasis is determined at the end of each semester of the junior year. The following theatre courses are required: THE 100, 320, 321, 325 (3 hrs.); THP 101, 213, 315, 330, 340, 345, 406, 431, 435, 440, 445, 499 (Senior Project), three hours of theatre history or literature; and theatre related area electives selected in consultation with an advisor, to complete the major requirement of 84 hours.

Theatre Education—Acceptance in this option is by interview only (or submission of three letters of recommendation and a letter of intent if distance prohibits coming to campus), and with the approval of the faculty of the Department of Theatre. Application will normally be made at the end of the sophomore year; applications for early admission of ASU freshmen will be accepted towards the end of the second semester of full-time study. The student will also be required to meet admission standards mandated for state certification. See page 194. The following Theatre and Professional courses are required: THE 100, 320, 321, 325 (3 hrs.), 480; THP 101, 110, 213, 311, 315, 330, 340, 345, 415, 498 (Production Practicum); a minimum of two hours credit in THP 301, chosen from different production options; theatre and related area electives, selected in consultation with an advisor to complete the major requirement of 84 hours. For retention in the Theatre Education option a grade point average of 3.0 in the major and professional courses, and a 2.5 in general studies course work, and 25 hours of professional education course work in addition to an annual review is required.

Departmental Minor Teaching Field Requirements

Elementary Education Major: Minor in Theatre—Consists of 27 semester hours, including: THE 100, THP 101, 213, 315, 311, 318, and 411; plus one additional course in theatre history and one additional course in technical theatre.

Secondary Education Major: Minor in Theatre—Consists of 24 semester hours, including: THE 100, 480, THP 101, 213, 215, 311, 315 and 415; plus one additional course in theatre history, and one additional course in technical theatre.

Department Graduate Programs

The Department of Theatre offers programs leading to the degree of Master of Arts in Theatre and the Master of Fine Arts in Child Drama. Consult the *Graduate College Catalog* for requirements.

THEATRE

General Studies in Theatre:
History, Literature, and Theory

THE 100 Introduction to Theatre. (3) F, S
Elements and principles of the theatre. Lecture and discussion.

300 Film: The Creative Process. (3) F, S, SS
Elements of the theatrical film: cinematography, sound, editing, directing, acting, scriptwriting, producing, and criticism. Three lectures, 2 hours laboratory.

313 Theatre Design. (3) S
Survey of modern theatre design/technology principles and elements. Intended for non-majors and BFA acting students. Prerequisite: THP 213.

320, 321 History of the Theatre. (3,3) F, S
First semester traces major developments in theatre production from its beginning through the 17th century; second semester continues the survey to modern times.

325 Play Reading. (1) F, S, SS
Assigned independent reading programs of plays most frequently included in the modern repertory. May be repeated for credit in different sections. Majors only.
Areas of emphasis:

(a)   Modern European

(b)   Modern English and Irish

(c)   Modern American

(d)   Plays for High School Production.

400 Focus on Film. (1) F, S, SS
Intensive study of a particular film, director, actor, genre, or other film topic. May be repeated for credit. Prerequisite: THE 300 or ENG 360 or approval of instructor.

420 History of the American Theatre. (3) S
History of the plays, artists, and events in the development of American theatre from colonial to modern times.

421 History of the English Theatre. (3) F
History of the plays, artists, and events in the development of the theatre in England since the Restoration.

425 History of the Oriental Theatre. (3) N
History and production techniques of theatre forms in India, China, and Japan. Prerequisite: six hours of theatre history or approval of instructor.

480 Methods of Teaching Theatre. (3) F
Analysis, organization, and presentation of textual and other classroom materials.

500 Research Methods. (3) F
Introduction to graduate study in theatre.

504 Studies in Dramatic Structure and Criticism. (3) F
Structural principles and critical theory from the classical period to the present; related readings in dramatic literature.

510 Studies in Literature. (1) F, S
Assigned individual reading programs in standard sources and masterpieces in theatre literature. May be repeated for credit in different sections. Topics may be selected from the following:

(a) Acting-Directing   (c) History

(b) Design-Technical   (d) Criticism

520, 521 Theatre History and Literature. (3-3) F, S
A survey of historical periods, dramatic genres, and theatre literature. THE 520: Beginning - 17th Century; THE 521: 17th Century - Present.

591 Seminar. (3) A
Selected topics in child drama, community theatre, and theatre history. Prerequisite: written approval of instructor.

Special Courses: THE 294, 394, 492, 494, 498, 499, 500, 590, 592, 594, 598, 599. (See pages 35-36.)

THEATRE PERFORMANCE AND PRODUCTION

THP 101 Introduction to the Art of Acting. (3) F, S, SS
Lectures, exercises, and projects in acting. Special sections provided for the nonmajor and theatre students who plan no additional acting courses.

110 Acting II: Scene Study. (3) F, S
Rehearsal and performance of modern plays with emphasis on realistic acting style. May not be taken concurrently with 415. Prerequisites: THP 101, and/or written approval of instructor. Six hours a week including laboratory/rehearsal period.

113 Makeup. (3) F, S
Techniques of theatrical make-up. One hour lecture; 2 hours laboratory.

213 Introduction to Technical Theatre. (3) F, S
Procedures of technical theatre production and demonstration. Topics include design and construction of scenery; lighting; and properties. Two hours lecture; 3 hours laboratory.

270 Introduction to Stage Speech. (3) A
Exercises and techniques to free the voice and improve projection, resonance, and articulation. International Phonetic Alphabet and Standard Stage Speech covered. Prerequisites: THP 101 or approval of instructor, non-BFA acting majors only.

275 Introduction to Stage Movement. (3) A
Movement vocabulary and physical training in relaxation, alignment, conditioning, rhythm and poise. Prerequisites: THP 101 or approval of instructor, non-acting majors only.

294 Special Topics. (1-4) A
(a) Acting Techniques.

301 Theatre Production. (1-4) F, S, SS
Participation in University Theatre productions. Prerequisite: written approval of instructor. May be repeated for credit.

307 Acting: The Method. (3) F
An advanced class for individualized work on concentration, personalization, self-awareness, visualization, substitution, creating inner and outer character. Exercises, monologues, and scenes. Prerequisites: THP 110, 310 and written approval of instructor.

310 Acting III: Advanced Scene Study. (3) F
Script analysis and performance of modern classics. Prerequisites: THP 110, BFA acting majors or approval of instructor. Six hours a week.

311 Creative Drama. (3) F, S, SS
Theories, procedures, and materials for creative drama in the elementary and junior high schools. Related drama activities — storytelling and choral speaking. Not open to freshmen.

312 Puppetry With Children. (3) F
Construction and manipulation of puppets; practice in performance skills. Emphasis on educational and recreational uses of puppetry by and with children. Prerequisite: THP 311 or approval of instructor.

315 Directing: Theatre Techniques. (3) F, S
Basic tools of the director: composition, blocking, floor plans, stage business, auditions, rehearsal techniques, etc. Prerequisites: THP 101, 213 or written approval of instructor.

318 Theatre for Children. (3) F
Dramatic literature for children. Experience in acting, directing, and production techniques for child audiences. Prerequisite: written approval of instructor; not open to freshmen.

330 Introduction to Costuming. (3) F, S
History of theatrical costume. Laboratory experience in construction of costumes. Three lectures, 2 hours laboratory.

340 Scene Design. (3) F, S
Studio projects in designing realistic scenery for the contemporary proscenium stage. Prerequisite: THP 213 or approval of instructor.

345 Lighting Design. (3) F, S
Principles of modern stage lighting. Two lectures, 2 hours laboratory. Prerequisite: THP 213 or approval of instructor.

370 Voice for the Stage I. (2) F, S
Exercises to develop vocal flexibility and power; integrating voice/body/emotion; creative vocal characterization; phonetics; beginning dialects. Emphasis on individual voice and speech problems. Prerequisites: BFA acting majors or approval of instructor. Four hours a week. May be repeated for credit.

375 Stage Movement I. (2) F, S
Physical training for a strong, well-aligned, flexible, expressive body. Units in tumbling, juggling, combat, characterization and pyscho-physical technique. Prerequisites: BFA acting major or approval of instructor. Four hours a week. May be repeated for credit.

394 Special Topics. (1-4) A
Intermediate Acting Techniques.

401 Theatre Practicum. (1-3) F, S, SS
Performance and production assignments for advanced students of acting, technical production, and design. Prerequisites: BFA students only. May be repeated for credit.

406 Scenography. (3) N
Concepts of total design direction. Production analysis and design incorporating all major visual elements including scenery, lighting, costumes, and makeup. Prerequisites: THP 330, 340, 345, senior standing and/or consent of instructor.

407 Acting: TV, Film. (3) F
Special technical aspects of acting before a camera. Prerequisite THP 310 and/or written approval of instructor. Six hours a week.

410 Acting: Advanced Workshop. (3) A
Rehearsal and performance of period, classical, and non-realistic plays. Emphasis on delivery of poetic language. Prerequisites: THP 310 and/or approval of instructor. Six hours a week.

411 Advanced Studies in Creative Drama. (3) S
Application of theories, techniques, and materials for dramatization. Regular participation with children. Prerequisite: THP 311 or approval of instructor.

415 Directing Workshop. (3) F, S
Rehearsal and performance of scenes and short plays. May not be taken concurrently with THP 110. Prerequisites: THP 315 and/or written approval of the instructor.

417 Stage Management. (3) F, S
Readings in stage management and participation as a stage manager in a University Theatre production. Prerequisite: written approval of instructor.

418 Advanced Studies in Theatre for Children. (3) F
Concentration on specific directing and producing techniques in theatre for young audiences. Practical experience in directing scenes from plays. Prerequisites: THP 318.

430 Costume Design. (3) N
Principles of costume design, with projects in both modern and period styles. Prerequisites: THP 330.

431 Costume Construction. (3) A
Uses of materials and techniques for stage costumes with actual construction of period apparel. Prerequisites: THP 330.

435 Advanced Technical Theatre. (3) N
Selection of materials, drafting of working drawings, tool operation, and construction techniques. Two lectures, 2 hours laboratory. Prerequisite: THP 213, 340, 345 and approval of instructor.

440 Advanced Scene Design. (3) A
Advanced studio projects in designing nonrealistic scenery for a variety of stage forms. Prerequisite: THP 340 or approval of instructor.

441 Scene Painting. (3) A
Studio projects in painting stage scenery. Prerequisite: THP 340 or approval of instructor.

445 Advanced Lighting Design. (3) N
Specialized techniques in stage lighting. Two lectures, 2 hours laboratory. Prerequisite: THP 345 or approval of instructor.

450, 451 Theatre Organization and Management. (3-3) F, S
Box office, publicity, production budgeting, and house management procedures. Second semester includes study of organizational structures, physical facilities, and financial planning for theatre companies at an administrative level.

460 Dramatic Composition for the Stage and Screen. (3) A
Fundamentals of and practice in writing for the theatre, the motion picture, and television. Prerequisite: written approval of instructor.

461 Playwrights Workshop. (3) F, S
Staged readings and discussion of completed works and works in progress by advanced students of playwriting. Prerequisite: THP 460 or written permission of instructor. May be repeated for credit.

470 Voice for the Stage II. (2) F, S
Advanced dialects. Vocal techniques for the classical and non-realistic theatre. Knowledge of the International Phonetic Alphabet is required. Prerequisites: THP 370. BFA acting majors and graduate students only or approval of instructor. Four hours a week. May be repeated for credit.

475 Stage Movement II. (2) F, S
Movement techniques for the classical and non-realistic theatre. Prerequisites: THP 375 or approval of instructor. BFA acting majors and graduate students only. Four hours a week. May be repeated for credit.

494 Special Topics. (1-4) A
Topics may be selected from the following:

(a) Advanced Acting Techniques

(b) Curriculum and Supervision of Child Drama in the School

(c) Playwriting for Children

(d) Puppetry in Performance

(e) Storytelling

(f) Drafting for the Theatre

(g) Materials and Technology

(h) Properties and Dressings Design and Construction

(i) Rendering

498 Pro-Seminar. (1-7) A
Topics may be selected from the following with written approval of instructor:

(a) Senior Project: Acting

(b) Children's Theatre Tour

(c) Theatre in Education

506 Scenography. (3) N
Concepts of total design direction. Production analysis and design incorporating all major visual elements including scenery, lighting, costume, and makeup. Prerequisites: THP 330, 340, 345, senior standing and/or consent of instructor.

511 Creative Drama in Professional Practice. (3) A
Survey of current research and literature, with emphasis on professional applications of creative drama techniques; empirical research projects required. Prerequisites THP 311, 411, and/or approval of instructor.

515 Problems in Directing. (3) A
Analysis of common directing problems. Topics include: creating the ensemble; conceptual unity; metaphor; non-literal strategies; organizational responsibilities of the director. Prerequisites: THP 215, 315, 415, and/or approval of the instructor.

518 Directing Practicum in Theatre for Young Audiences. (3) A
Practical experience in directing and producing an entire play or musical for young audiences. Prerequisites: THP 318, 418 and approval of instructor.

584 Internship. (1-3) A
Field research and on-site training in child drama, community theatre, and production techniques. Prerequisite: written approval of instructor.

594 Conference and Workshop in Child Drama.
Prerequisite: approval of instructor.

Special Courses. THP 294, 394, 492, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

College of Law

Paul Bender, LL.B.
Dean

Purpose

The prime function of the College of Law is to train men and women for the practicing legal profession and related professional assignments. In addition, the College has the responsibility to contribute to the quality of justice administered in our society.

Juris Doctor Degree

The College of Law offers a three-year program of professional studies at the graduate level leading to the degree of Juris Doctor and entry into the many branches of the legal profession and careers in government, business, finance, industry and education.

To fulfill the requirements for a J.D. degree, a student must satisfy all of the following: (1) Admittance to the College as a candidate for the degree and satisfaction of any conditions imposed at the time of admission or prior to graduation during the law course. (2) Satisfaction of residency requirements for the College of Law. (3) Successful completion of a minimum of 87 hours of academic credit of which 66 must be graded with a cumulative weighted average of 70 or better and no more than eight credit hours of D (60-69) grade work after the first year can be applied toward the 87 hours. (4) Completion of all required College courses. (5) Completion of the degree requirements within five years of entry into law school. (6) Completion of one substantial paper.

Except in the case of a transfer student, a student must be in residence at the College as a full-time student for a minimum of six semesters or their equivalent. A semester in residence is earned where a student has been enrolled in a minimum of ten hours of course work. A transfer student must complete the work of at least three semesters in the College immediately preceding the granting of a degree.

The College of Law and the Department of Economics offer a joint degree program in which participating students can earn the J.D. degree and an M.S. in Economics, usually in three and one-half years of study. Additional information about the program is available from the Department of Economics or the College of Law.

Admissions

First-year students are admitted only for the fall semester. The formal requirements for admission to the College of Law are: (1) An undergraduate degree from an accredited four-year college or university (B.S., B.A., or equivalent). (2) A score on the Law School Admission Test (administered by the Law School Admissions Services, Box 2000, Newtown, PA 18940, in centers throughout the country). Both are to be at a level of achievement giving the applicant reasonable prospect for success in law study.

To be assured of consideration completed applications, college transcripts on all completed course work, the Law School Data Assembly Service Report and the Law School Admission Test score, including a typed two-page writing sample, should be received by the College of Law no later than March 1.

Each year many more students apply than can possibly be accommodated within the educational program of the College. Accordingly, the admission process is selective. Basic factors for evaluation are the undergraduate academic record and the score on the Law School Admissions Test. These are not the only factors considered, however. The admission requirements are flexible and other evidences of ability and an applicant's prospect for significant contribution to the

educational program of the law school and to public service are considered with the object of selecting those who are likely to succeed in law study. As a state institution, the College weighs residency as a factor in admission.

Course of Study

The program of study in the College of Law is designed for full-time students. In the first year of the three-year program, the course of study is prescribed and incorporates the time-proven techniques of legal education. This first year gives the student—by the "case method," by the "problem method," by "moot court" and through other techniques—an intensive exposure to the basic legal processes.

As a part of the program, each first year student is assigned to a small section where emphasis is placed on writing and problem solving. The second and third years contain a wide range of courses varying in format as well as subject matter, allowing students to pursue both the basic subjects of law study as well as more specialized interests. By offering the student great freedom in the selection of subjects, the educational experience is in sharp contrast to the curriculum of the first year. In addition, an extensive clinical internship program is sponsored by the College.

Grading

College of Law courses are graded under the following numerical scale:

99-90 A, Distinction
89-80 B, Excellent
79-70 C, Good
69-60 D, Deficient
59-50 F, Failure

A grade of 60 or above is required to receive credit for any course.

Most limited enrollment courses are taken for credit without a numerical grade. Students are limited in the number of credits which may be taken without a numerical grade, having to complete 66 hours of numerically graded courses. In non-numerically graded classes performance below 70 is so recorded.

Retention Standards. To be eligible to continue in the law school, a student must maintain a cumulative weighted average of 70 or better at the end of each semester, or summer session. However, any student whose average for the first semester of the

first year falls below 70 is placed on probation, except that an average below 65 disqualifies such a student from further attendance. Any student who fails to achieve a 70 average in any one semester, regardless of cumulative average, is automatically placed on probation. Continuation of enrollment by probationary students shall be upon such terms and conditions as the College may impose.

A student whose cumulative average falls below the required level or whose semester average is less than 70 in the consecutive semesters will be dismissed but may apply to the Office of the Dean for readmission. The Office of the Dean shall refer the application to a faculty Committee on Re-admission. Where the academic average deficiency is slight and evidence of extenuating circumstances is convincing, readmission may be granted on a probationary status after a review of the reasons contributing to unsatisfactory performance and a finding that there is substantial prospect for acceptable academic performance. Continuation in school thereafter may be conditional on achieving a level of performance higher than the overall 70 average.

Special Honors at Graduation. At the time of graduation, students with academic distinction in the study of law may be awarded the respective designations *cum laude, magna cum laude* and *summa cum laude.* The College also bestows membership in the Order of the Coif upon distinguished graduates. Recipients of these awards are selected by the Law Faculty on the basis of academic performance.

Law Building and Law Library

The John S. Armstrong Law Building is in the central campus near other colleges of the University and the Hayden Library. The Law Building provides every modern facility for legal education and has been described by experts on planning law buildings as setting a new standard in functional design.

With an "open stack" policy of accessibility to all law students and a rated seating capacity of three-fourths of the total student body, the Law Library contains a substantial collection of law and law-related books. The modern facility has shelf capacity for approximately 200,000 volumes. The goal is to make the Arizona State University Law Library one of the most outstanding in the country.

Center for the Study of Law, Science and Technology

The Board of Regents has recently established a Center for the Study of Law, Science and Technology to be operated by the College of Law.

Accreditation

The College is fully accredited by the American Bar Association and by the Association of American Law Schools.

Information

Further detailed information concerning the course of study, admission practices, expense and financial assistance will be found in the Bulletin of the College of Law. Requests for the Bulletin and for application forms should be addressed to the Admissions Office, College of Law, Arizona State University, Tempe, AZ 85287.

Law

PROFESSORS:
BENDER (AH 102D), ALTMAN, ARTERIAN FURNISH, BARTELS, BERCH, CALLEROS, EFFLAND, ELLMAN, FURNISH, GOLD, GUERIN, KADER, KARJALA, KAYE, LESHY, LOWENTHAL, MATHESON, MISNER, MORGAN, MORRIS, PULASKI, ROSE, SCHROEDER, STANTON

ASSOCIATE PROFESSORS:
BROWN, MEAD, TESON, WINER

DIRECTORS:
CIVIL CLINIC, WEEKS
PUBLIC DEFENDER CLINIC, DALLYN

LAW 515 Contracts I. (3) F
Contract doctrines and their role in the judicial process. Judicial doctrines and, where applicable, the Uniform Commercial Code are studied in the context of contracts covering employment, personal and family arrangements, building and construction, the sale of goods, loans, assignment of wages and accounts receivable.

516 Criminal Law. (3) F
Legislative and judicial formulations designed to deal with anti-social activity, the substantive elements of particular crimes, problems in the administration of criminal law and the penal system.

517 Torts. (4) F
Protection through the judicial process of personality, property and relational interests against physical, appropriational and defamatory harms.

518 Civil Procedure. (3) F
The nature of judicial power, viewed in the context of historical development and constitutional grants and limitations.

519 Legal Research and Writing I. (2) F
Techniques of research; use of the law library; preparation of legal memoranda.

520 Contracts II. (3) S
Continuation of 515.

521 Criminal Procedure. (3) S
The nature of the criminal procedural system with special focus on constitutional protections for the accused.

522 Constitutional Law I. (3) S
Role of courts in the federal system, distribution of powers between state and federal governments, role of procedure in litigation of constitutional questions.

523 Property. (4) S
Law of real and personal property, various legal and equitable estates in land, life estates, remainders, concurrent interests, executory interests, limitations on creation of future interests. Modern concepts of property.

524 Legal Research and Writing II. (2) S
Continuation of 519.

600 Administrative Law. (3) A
Administrative process, emphasizing nature of powers exercised by administrative agencies of government, problems of procedure and scope of judicial review.

601 Antitrust Law. (3) F, S
Legislation and its implementation to prevent monopoly and business practices in restraint of trade, including restrictive agreements involving price-fixing, trade association activities and resale price maintenance.

602 Partnership Taxation. (2,3) A
Federal tax consequences of forming, operating, terminating or transferring partnerships.

603 Conflict of Laws. (3) A
Problems arising when the operative facts of a case are connected with more than one state or nation. Choice of law, bases of jurisdiction, effect of foreign judgments, underlying federal and constitutional issues.

605 Evidence. (3) A
Principles and practice governing the competency of witnesses and presentation of evidence, including the rules of exclusion and roles of lawyer, judge and jury under the adversary system.

606 Federal Income Taxation. (3) F, S
Federal income tax in relation to concepts of income, property arrangement, business activity and current tax problems, with focus on the process of tax legislation and administration.

607 Advanced Civil Procedure. (3) F, S
Obtaining and exchanging information in advance of trial, isolating the area of controversy, disposing of cases or issues without trial, defining the scope of litigation in terms of parties and subject matter, and the relationship between successive litigations. Litigation through appeal, including jurisdiction, right to jury, selection of jury, withdrawing case from jury, instructing jury, verdicts, judgments, appellate review.

608 Business Associations I. (3) A
Partnerships, limited partnerships and small business corporations. Includes a brief introduction to accounting. Detailed analysis of the problems of forming a close corporation, state law duties of care and loyalty, management, dividends and redemptions, issuance of stock, internal dispute resolution, dissolution and the general law of derivative actions.

609 Business Associations II. (3) A
Interrelationship of federal and state law and a brief introduction to corporate finance (1933 Act). A broad overview of large company regulations including reporting rules, proxy regulation, insider trading, sale of control, tender offers and takeovers and going private. Prerequisite: LAW 608.

610 Advanced Criminal Procedure. (3) A
Topics in criminal procedure, with emphasis on legal constraints on grand jury investigations, police practices, pre-trial release, preliminary hearings, prosecutorial discretion, and plea bargaining.

611 Estate Planning I. (3) A
Tax laws relating to transfer of wealth both at death and during lifetime, including federal estate tax, gift tax and income taxation of estates and trusts.

612 Family Law. (3) A
Legal and nonlegal problems which an individual may encounter because of a situation as a family member.

613 Federal Courts. (3) A
Federal judicial system; relationship of federal and state law; jurisdiction of federal courts and their relation to state courts.

614 Labor Relations. (3) A
Collective bargaining, including the right of employees to organize and to engage in concerted activities; resolution of questions concerning the representation of employees; duty of employers and unions to bargain; administration and enforcement of collective bargaining agreements.

615 Public International Law. (3) A
Role of law in international disputes. Drafting and interpretation of treaties and multilateral conventions will be considered.

616 Jurisprudence. (3) A
Introduction to legal philosophy, with readings on the nature of law and legal reasoning, the relationship between law and morality, and equality and social justice.

617 The Legal Process. (3) N
Institutions and processes of the American legal system and their interrelationships.

618 Trusts and Estates I. (3) A
Substantive concepts involved in transmitting wealth, including intestate succession, wills and will substitutes, the modern trust as a family protective device, creation of future interests in a planned estate, social restrictions of a nontax nature and methods of devoting property to charitable purposes.

619 Trusts and Estates II. (2, 3) A
Continuation of 618.

620 Civil Rights Legislation. (2, 3) S
Coverage of the rights and remedies provided by federal civil rights legislation, principally, the key provisions of the Reconstruction Era Civil Rights Acts, portions of the employment discrimination legislation and voting rights legislation.

621 Commercial Law—Sales and Negotiable Instruments. (3) A
Transactions in the sales of goods and mechanisms for payment and credit. Subjects include: contract information, warranty, risk of loss, damages and documentary transactions in sales of goods under Uniform Commercial Code Article 2; the use of checks, promissory notes, letters of credit and other instruments under UCC articles 3, 4, and 5; related banking practices and credit transactions.

622 Commercial Law—Secured Transactions. (3) A
Secured transactions under Article 9 of the Uniform Commercial Code and other relevant sections. An overview of the creation, perfection and priority effects of security interests. Financing of business enterprise and consumer credit.

623 Commercial Torts. (3) A
Involves an analysis of actionable wrongs against a business entity or against proprietary rights held by that entity, covering the entire spectrum of private remedies for competitive wrongs.

624 Community Property. (1,2) A
Property rights of husband and wife; the Arizona community property system; homestead.

625 Constitutional Law II. (3) A
Fundamental protection for person, property, political and social rights.

627 Corporate Taxation. (3) A
Problems in taxability of the corporation, corporate distributions and corporate reorganizations.

628 Creditor-Debtor Relations. (3) A
Creditors' remedies in satisfaction of claims and debtors' protection and relief under bankruptcy, other laws.

629 Criminal Trial Process. (3) A
Criminal court procedure, from pre-trial motions through sentencing, including discovery, jury selection, jury composition, examination of witnesses, misconduct of counsel, continuances, mistrials, jury instructions and jury deliberations.

630 Employment Discrimination. (2) A
Focus on Title VII of the Civil Rights Act of 1964 which forbids discrimination in employment based upon race, religion, national origin or sex. The substance and procedural aspects of Title VII are covered in detail including coverage, administrative procedures, burdens of proof, special problems of religious and sex discrimination, statutory and court created defenses, senioritiy systems and remedies.

631 Environmental Law. (3) A
Litigation, administrative law and legislation relating to problems of environmental quality. Topics covered may include air and water pollution, toxic substances, pesticides and radiation.

632 Indian Law. (3) A
Inquiry into legal problems special to American Indians and tribes.

633 Insurance. (3) N
Current trends in the business of insurance; role of government in the insurance field.

634 Judicial Remedies. (3) A
The nature and limits of injunctive, restitutionary and compensatory remedies for the protection of personal, property, political, and civil rights.

635 Juvenile Justice System. (3) N
Special problems in the juvenile system.

636 Land Use Regulation. (3) N
Legal problems in the regulation and control of land development by state and local governments. Administration of zoning, subdivision, and other planning controls; issues of fairness and procedure in the utilization of such controls.

637 Lawyering Process. (3) N
Roles and responsibilities of lawyers, as advocates negotiation, witness examination (direct and cross), and argument.

638 Legal Profession. (2) F, S
Organized bar, distribution of legal services in modern society, economics of the profession, professional canons of ethics for the bar and judiciary and problems in policing the profession.

639 Natural Resource Law. (3) A
Examines the constitutional basis for federal land management and the different kinds of public lands management schemes (e.g., parks, forests, wildlife refuges), emphasizing acquisition of right to, and regulation of, the different uses of public lands and resources (e.g., mining, grazing, timber wildlife habitat, recreation).

640 Securities Regulation. (2) A
Selected problems arising under the major statutes concerned with regulating the securities market.

641 State and Local Government. (2,3) N
Legal problems involved in the organization and administration of governmental units including the city, county, town, village, school district and special district.

643 Water Law. (3) A
Acquisition of water rights; water use controls; interstate conflicts.

644 Intellectual Property. (3) N
The protection of intellectual property and encouragement of creativity—trade values, trade secrets, patents, copyrights, performing arts, and visual arts.

701 Arizona Criminal Code. (2,3) N
In-depth study of the substantive law and sentencing provisions of the 1978 Arizona Criminal Code.

704 Corporate Finance. (2,3) N
Application of legal materials, training and judgment to problems of small- and large-scale corporate enterprises. Problems include selection of the capital structure, public offerings of corporate securities, reorganizations of solvent corporate enterprises and corporate dissolution.

707 Corrections and Sentencing. (2,3) N
Justifications for punishment, the effect of punishment upon the individual and society, statutory basis for sentencing in Arizona and the role of the lawyer in the sentencing process.

709 International Human Rights. (2,3) N
International rules and procedures governing the protection of human rights.

714 Law and Social Science. (2,3) N
Investigation of the use of social science research and methods in the legal system. Topics include: psychology of eye-witness identification, social-psychological studies of decision making, statistical evidence of discrimination, econometric studies of the deterrent effects of capital punishment, and clinical predictions of violent behavior.

715 Professional Sports. (2,3) N
Unique legal problems relating to professional sports, including their relationship to antitrust laws, the nature of the player contracts and associated tax problems.

717 Legislative Process. (2,3) N
Explore both the legal and the practical context within which the legislative process operates with a major component of the course being a legislative drafting project.

718 Non-Profit Corporations. (2,3) N
Tax, corporate and trust legal problems involving the nonprofit corporation and comparison with for-profit counterparts as to efficacy in performing certain economic functions.

720 Problems in Evidence. (2,3) N
An examination of the use (and abuse) of statistical methods in proving facts and in studying rules of evidence and procedure. Prerequisite or corequisite: LAW 605.

721 Education and the Law. (2,3) N
Current legal problems affecting institutions of higher education, faculty, students and governing boards.

727 Federal Income Tax Policy. (2,3) N
Advanced consideration of federal personal income tax policy with reference to selected problems, including the income-sheltering process. Prerequisite: LAW 606.

733 Professional Skills: Negotiation. (2,3) N
Theoretical models of negotiations; techniques, strategy; examination of the bargaining process.

735 Estate Planning II. (2,3) N
Preparation of actual estate plans, and implementing legal documents for a variety of typical private clients. Both tax and nontax elements in preparation of the plans will be considered. Prerequisite: LAW 611.

736 Planning for the Business Client. (2,3) A
Planning transactions involving business organizations with special emphasis on income tax and corporate considerations.

737 Planning Private Real Estate Developments. (2,3) N
Legal aspects of real estate development, including negotiation, legal devices for financing, promotion of sales, leasing problems and compliance with legal controls, as well as creation of private controls over land use.

738 Practice Court. (2,3) A
Students act as lawyers in conducting a case through all stages of trial, from commencement of the action to final judgment.

739 Techniques of Advocacy. (2,3) N
Designed to familiarize students with the skills of the advocate by observation, instruction and participation.

740 Problems of Litigation. (2,3) N
Current developments in the fields of practice, procedure, and evidence.

741 Freedom of Speech. (2,3) N
Freedom of speech in competition with a number of governmental and individual interests. Problems arising from governmental control of information, with particular emphasis upon regulation of the mass media.

742 Equality in Modern Society. (2,3) N
Discrimination, its social and legal effects and remedies. Focus on constitutional, statutory and private organizational attacks upon discrimination on the basis of race, religion, sex or other classifications.

745 The Supreme Court. (2,3) N
Intensive examination of selected current decisions of the U.S. Supreme Court.

751 Problems in Labor Law. (2,3) N
Advanced questions in the collective bargaining area.

758 The Competitive Economy. (2,3) N
Legal and economic characteristics of selected problems of the industrial organization in the modern economy. Prerequisite: LAW 601.

761 Selected Problems in Antitrust. (2,3) N
Analysis of the private enforcement techniques in antitrust. Review and analysis of the various defenses, procedural problems and damage issues.

767 Selected Problems in Developing Nations. (2, 3) N
The effect of law in social change and development through agrarian reform, industrial development, economic integration. Emphasis on Latin America.

768 International Business Transactions. (2, 3) N
Problems and policy considerations involved in international trade; tariffs, international monetary controls, development loans, etc.

770 Law Journal. (1, 2) F, S
Academic credit for successful completion of work by a member of the staff of *Arizona State Law Journal*; 5 credit hour maximum.

771-779 Internships in Law. (1-6) F, S
Civil, defender or prosecutor placement and related classroom component.

780 Moot Court. (1-3) F, S
Academic credit for successful completion of work as a member of the Moot Court Board of Directors; 3 credit hour maximum.

781-782-783 Individual Study. (1-3) F. S
With the approval of a faculty member, a student may research a legal subject of special interest and prepare a paper suitable for publication.

784 Moot Court Competition. (1-3) S
Successful participation and completion of a national moot court competition.

785 Externship. (1-10) S, F. S
Supervised, practical lawyering in an external placement proposed by the student or established by a sponsoring agency and approved by the law school. In addition, an associated academic component is established by the student with a member of the faculty.

790 Field Work. (1-6) F, S
Specialized study outside the law school in a particular area where law has an impact. The work must be approved and supervised by a member of the faculty.

791 Seminar in Law. (1-10) F. S
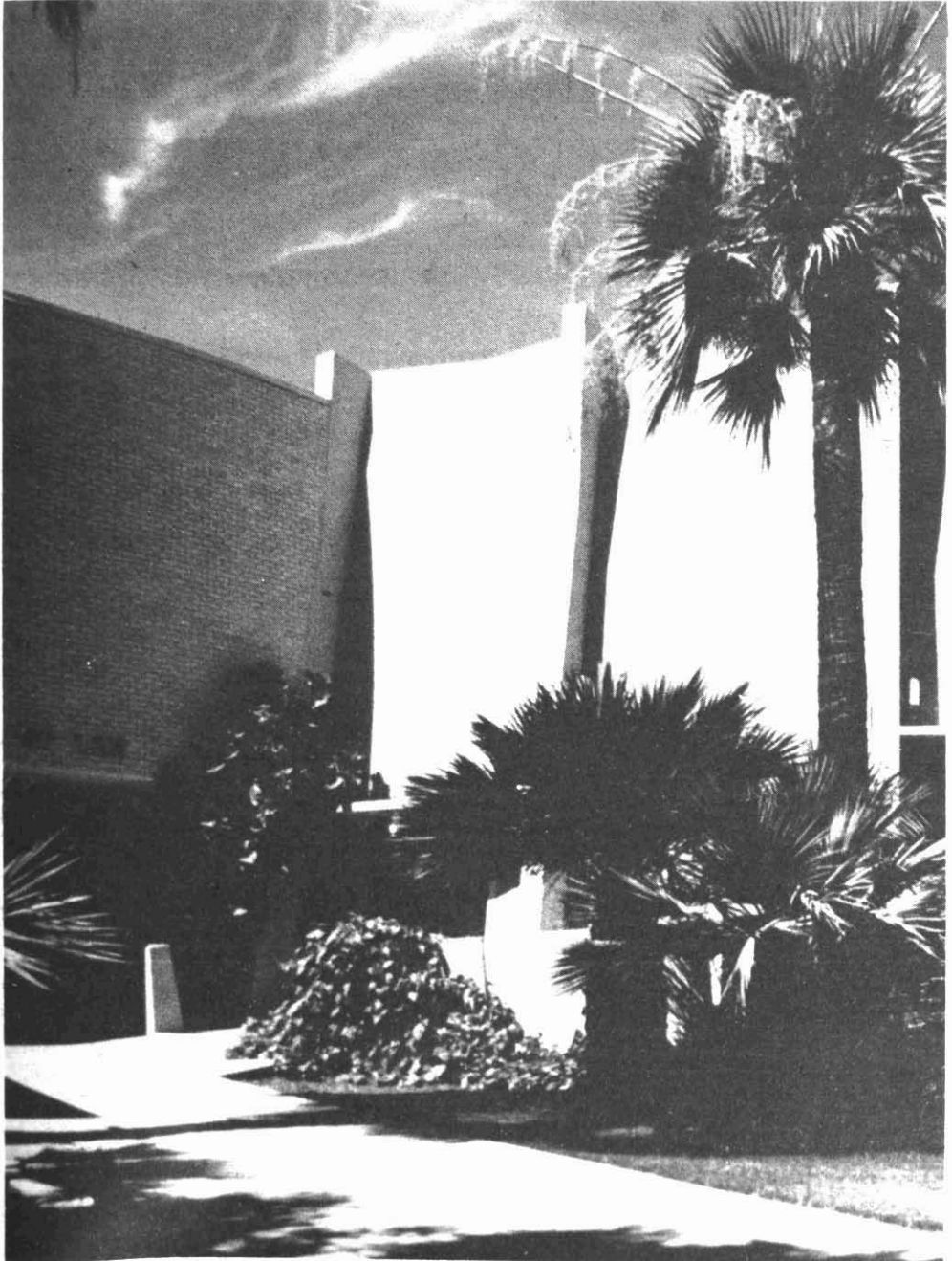
College of Nursing

Janelle C. Krueger, Ph.D.
Dean

Purpose

The faculty of the College of Nursing acknowledges its responsibility to health care consumers for the preparation of individuals who will provide nursing care of professional quality through teaching, research and service. The purpose of the College is to provide educational programs which prepare beginning professional nurses and specialists who consider the emotional, biophysical, socio-cultural and ecological needs in the prevention and treatment of human ills. This nursing care is based on the belief that all human life has dignity and worth, that there is potential for growth in every individual, and that every individual should have the opportunity to achieve and maintain health.

It is the belief of the College of Nursing faculty that professional preparation in nursing is most appropriately composed of a combination of liberal and specialized educational content, and that the professional nurse is committed to the utilization of knowledge and skills to help other human beings achieve and maintain well-being. We also believe that the professional nurse must be prepared as a competent practitioner for the betterment of nursing and health care.

Organization

The College of Nursing is organized as follows:

Baccalaureate Program

The baccalaureate program is a generic four-year curriculum leading to the Bachelor of Science in Nursing degree. It is designed with an upper division professional nursing major. The first two years of the four-year baccalaureate program consist of required preprofessional nursing and elective courses. All students seeking the Bachelor of Science in Nursing degree are admitted to the generic baccalaureate program, including graduates of Diploma and Associate Degree in Nursing programs. Several program modifications and options including evening sections are offered to accommodate Registered Nurses who wish to pursue a Bachelor of Science in Nursing degree. Interested Registered Nurses are encouraged to plan a program of study with a College of Nursing advisor.

Graduate Program

The graduate program is a Master of Science degree with a major in Nursing. This program offers specialization in the following areas:

Adult Health Nursing

Community Health Nursing

Community Mental Health-Psychiatric Nursing

Nursing of Children

Continuing Education Program

This program presents a variety of non-credit offerings on the main ASU campus, ASU West, and at off-campus locations. These offerings are designed to assist practicing professional nurses to maintain and enhance their competencies, to broaden their scientific knowledge base and to further develop their skills in this accelerated period of emerging health technologies, advances in nursing research and changing patterns of health care delivery. Programs

are organized in response to both the nursing care needs of the population and the learning needs of nurses engaged in a variety of professional roles and clinical specialties. Workshops, conferences, institutes, short evening courses and special programs are offered at times convenient to the working professional. Some offerings are multidisciplinary and are open to other than Registered Nurses.

In addition, to meet continuing education needs and interests, registered nurses may also choose to enroll as unclassified students in selecting nursing credit courses offered by the College of Nursing. Registered nurses who want more information about the degree programs or the courses that may be taken by unclassified students should contact the Nursing Student Services Office (602-965-2987).

For descriptions of current continuing education offerings, please contact the Continuing Education Program, College of Nursing (602-965-7431).

Degrees

Bachelor of Science in Nursing. The completion of the four-year curriculum in nursing leads to the degree of Bachelor of Science in Nursing. The purpose of the baccalaureate program in nursing at Arizona State University is to prepare beginning professional nurses who possess clinical competence to function in various health care settings. The graduate is prepared to deliver nursing and health care services to individuals, families, and communities. The program provides a foundation for graduate studies in nursing.

The program objectives for the baccalaureate curriculum are directed toward preparation of graduates with generalist abilities. With a base of theoretical and empirical knowledge from the humanities, physical, biological and behavioral sciences, and nursing, graduates are prepared to: 1) provide comprehensive patient care in concert with individuals, families, and other health team members, by utilizing skills of observation and assessment, decision-making, intervention and evaluation; 2) assume responsibility for the provision of nursing care and accountability for identifying and evaluating outcomes of that care; 3) apply the scientific process and utilize research findings in the delivery of health care; 4) assume a leadership role in the promotion, maintenance and restoration of

health through teaching and collaborative planning within the interdisciplinary team; and 5) continue professional development in response to trends in health care, changing nursing roles, and the impact of these and other health issues on the consumer.

The candidate for the degree of Bachelor of Science in Nursing must complete a minimum of 126 semester credit hours. The curriculum is planned to include 40 semester credit hours of General Studies required by the University for graduation. These 40 credit hours are part of the approximately 64 semester credit hours required before entering the professional nursing major. The professional nursing major consists of 53 semester credit hours. Registered Nurse students who are eligible for admission to the Professional Nursing Major may earn credit by examination for up to 26 of the 53 semester hours of Professional Nursing Major courses. There are 9 semester credit hours of additional free electives required to meet the minimum number of credits for graduation.

The 9 free elective hours may be in approved nursing courses. A limit of 6 credit hours in approved professional nursing courses with the NCE prefix may be substituted and applied toward the baccalaureate degree, either as general electives or as nursing electives. All elective nursing courses must have had prior approval by the Baccalaureate Curriculum Committee. To apply for approval of any nursing credit toward minimum graduation requirements, other than courses offered at Arizona State University with the NUR prefix, students must petition to the Baccalaureate Standards Committee. A limit of 3 semester credit hours for experiential courses in physical education may be applied toward the minimum 126 semester credit hours required for the Bachelor of Science in Nursing.

Fifty of the 53 semester credit hours in the professional major sequence, plus three upper division nursing elective credits with the NUR prefix, comprise the professional major requirements.

Master of Science. The College of Nursing offers a program leading to a Master of Science degree which requires 36 semester credit hours. Requirements for this program are given in the *Graduate College Catalog*. Persons interested in applying for admission to the program should write to the Arizona

State University Graduate College for a catalog and application form.

General Information

Accreditation. The baccalaureate and master's programs of the College of Nursing are accredited by the Arizona State Board of Nursing and the National League for Nursing. The Continuing Education Program is accredited by the Western Regional Accrediting Committee of the American Nurses' Association as a provider of Continuing Education for Nursing. The College is a member of the Council of Member Agencies for the Baccalaureate and Higher Degree Programs of the National League for Nursing, and the Western Council on Higher Education for Nursing.

Scholarships and Financial Aid. For information regarding scholarships and loans, see page 33 of this catalog. Information about scholarship and loan funds for nursing students may be obtained from the University Director of Financial Aids, College of Nursing Office of Student Services, or the Associate Dean for Academic Programs.

Student Activities. Nursing students are members of the general student body of the University, and participate in those campus activities which are of interest to them. They are represented on selected University and College of Nursing committees. Students enrolled in the Baccalaureate Program of the College of Nursing are members in BSNO and are eligible for membership in the Arizona Association of Student Nurses, the National Student Nurses Association, and Associated Students. Students are represented in the Student Senate of Associated Students.

Baccalaureate Student Nurse Organization. The Baccalaureate Student Nurse Organization (BSNO) is the coordinating body for nursing students in the baccalaureate program. It is responsible for providing information to faculty and students on student affairs and for coordinating student-faculty affairs. All prenursing and nursing students are members of this organization.

Graduate Nurse Organization. The Graduate Nurse Organization (GNO) is the coordinating body for nursing students in the graduate program. It provides programs, information, and orientation services for graduate students and complements their academic experiences.

Student Nurses Association. SNA is a professional nurse organization. By being a member of SNA the student belongs to the National Student Nurses Association which is a counterpart of the American Nurses Association for registered nurses. NSNA provides means for financial assistance, career planning, a voice in Washington, an opportunity for involvement and low cost comprehensive malpractice insurance.

Nursing College Council. The council consists of the officers of BSNO, GNO and SNA and serves as governing body of all student activities.

Sigma Theta Tau. Beta Upsilon chapter of Sigma Theta Tau was chartered at Arizona State University College of Nursing in 1976. Membership in Sigma Theta Tau is an honor conferred on students in baccalaureate and graduate programs who have demonstrated outstanding academic and professional achievement.

Learning Resources. The College of Nursing offers learning resources which include the University's Hayden Library, the Noble Science Library and Engineering Library, and the College of Nursing's Learning Resources Center.

Clinical Facilities. Learning experiences with patients and families are provided under the supervision of qualified faculty with the cooperation of a variety of federal, state, county, private health and other agencies. The College of Nursing has contracts with more than 80 different agencies in the Phoenix metropolitan area. Thus a variety of clinical laboratory facilities is available to students in this significant component of the programs.

Student Transportation. Students are responsible for their own transportation to and from health agencies and other selected experience settings, such as home visits to clients.

Bachelor of Science in Nursing

The program leading to the Bachelor of Science in Nursing degree is divided into the pre-professional courses and the professional nursing major. The pre-professional nursing courses consists of 64 semester credit hours of prescribed prerequisite study. The professional nursing major consists of a 53 credit four-semester nursing sequence. The remaining 9 semester credit hours are free electives, non-nursing and/or nursing.

Admission to the professional nursing major is not automatic. Students admitted to Arizona State University declaring nursing as their interest are classified as having pre-professional nursing status. There is a separate College of Nursing procedure for admission to the professional nursing major.

Students are admitted to the professional nursing major each fall and spring semester. Admissions are competitive and selective due to limitations in terms of College of Nursing physical facilities, clinical resources, and availability of qualified faculty. The number of qualified applicants may exceed the number which can be accepted into each entering class.

The time required to complete the professional nursing major may vary for the Registered Nurse student who chooses to enroll full time and earn credits by examination for selected nursing courses.

Pre-Professional Nursing

Admission Requirements. Students admitted to the University automatically qualify for admission to pre-professional nursing status.

Academic Advisement. Students admitted to pre-professional nursing status are advised by the College of Nursing academic advisors. All students are encouraged to seek advisement in order to plan an appropriate program of study. Students in the professional nursing major are advised by College of Nursing baccalaureate faculty.

Pre-Professional Nursing Curriculum. There are approximately 64 semester credit hours of prerequisite course work. Comparable courses may be completed at other accredited colleges or universities. Credit for transfer is initially evaluated by the Admissions Office of ASU. In addition, the College of Nursing reviews each transcript to determine course equivalency with the prescribed prerequisite courses and applicability of credit toward the Bachelor of Science in Nursing degree. The College of Nursing does not accept credit toward the baccalaureate nursing degree for lower-division courses in nursing or for courses of a vocational-technical, or community interest nature. Course work, particularly in the natural sciences, completed more than 10 years before the date of application to the professional nursing major will be evaluated for acceptability by the Baccalaureate Standards Committee. Prerequisite courses taken for pass/fail credit do not qualify toward the minimum 126 semester credit hour requirement.

Prerequisite Courses

	Semester Hours
ENG 101 and 102 or 105	3-6
Humanities (See Humanities under General Studies) to include a human communications course	8
Social and Behavioral Sciences:	
PGS 100 Psychology	3
SOC 101 or 301 Sociology	3
ASB 102 or 351 Anthropology	3
CDE 232 Child Development	3
FAS 331 Family Relationships	3
Science and Mathematics:	
CHM 101 Inorganic Chemistry	4
CHM 231 Organic Chemistry	4
MIC 201 and 202 Microbiology	4
ZOL 201 and 202 Anatomy and Physiology	8
ZOL 241 Human Genetics	3
FON 141 Human Nutrition	3
Statistics	3
MAT 106 Intermediate Algebra	3
NUR 219	2
	60-64

Any prerequisite course substitution must be approved through the Nursing Academic Advisors.

Professional Nursing Major

Admission to the professional nursing major is a process separate from admission to Arizona State University and to pre-professional nursing status. Eligible individuals are responsible for initiating the application procedure and submitting the required documents in accordance with the designated deadlines. Qualification requirements and application procedures are described in the following section.

Admission Requirements. Minimum requirements for admission to the professional nursing major include:

1. Admission to Arizona State University and classification of good standing;

2. Attainment of a minimum grade point average of 2.75 in the prerequisite courses and 2.50 in the cumulative grade point average for the total number of credit hours earned;

3. Completion of all prescribed prerequisite courses with a grade of C or better in each;

4. Submission of all documents to the College of Nursing Office of Student Services.

Application Procedures

1. Eligibility

Applicants who have completed at least 45 of the 64 prerequisite credit hours with the necessary prerequisite and cumulative grade point averages and who are currently enrolled in the remaining prerequisite courses are eligible to submit the required documents for admission by the designated deadlines.

2. Deadlines

a. Applications for admission to the professional nursing major for fall semester must be submitted by January 31 of the same calendar year.

b. Applications for admission to the professional nursing major for spring semester must be submitted by August 31 of the preceding year.

3. Documents

The following documents must be on file in the College of Nursing Office of Student Services by the designated deadline in order for students to be considered for admission to the professional nursing major:

a. Certificate of Admission to Arizona State University.

b. Completed application to the professional nursing major. Obtain form in the College of Nursing Office of Student Services.

c. Official transcripts of completed course work from other colleges or universities. This is in addition to the transcripts on file in the Admissions Office, Arizona State University.

d. College of Nursing Health History Inventory and Record of Physical Examination completed within three months prior to deadline for application. Forms are available in the College of Nursing Office of Student Services.

e. Selected other health requirements as defined by the College of Nursing.

f. Registered Nurse students are required to provide evidence of current registration in Arizona.

Applicants may be requested to come for interview and/or submit additional documents in the event that further information is deemed necessary.

Selection and Notification of Admission.
The limited number of spaces available each semester will be awarded to those applicants who have met the minimum criteria for admission to the professional nursing major; however, admission to the major is not a guarantee of space availability in all of the introductory nursing courses. Admission is competitive: applicants with the highest GPA's will have priority for the spaces available. Regular admission status may be granted to applicants who have submitted the required documents by the designated deadline and have completed all prerequisite courses with the necessary prerequisite and cumulative grade point averages. Provisional admission may be granted to applicants who have completed at least 45 of the 64 prerequisite credit hours with the necessary prerequisite and cumulative grade point averages and are enrolled in the remaining prerequisite courses.

Notification of admission status for fall semester will be in March, June or August, depending on date of completion of the prerequisite courses and the availability of space. Notification of admission status for spring semester will be in October or January, depending on date of completion of prerequisite courses and the availability of space. Provisional admission to the professional nursing major will be *automatically* revoked if all prerequisite courses are not completed and the required cumulative and prerequisite grade point averages maintained.

State Board of Nursing Requirement. Students must have a high school diploma or GED certificate to be eligible to write the State Board Examination for licensure as a Registered Nurse.

Re-admission. Students who have not been in continuous enrollment in the professional nursing major at Arizona State University must submit an application for re-admission to the major. Re-admission is not automatic.

Student Health. Students enrolled in the professional nursing major are responsible for fulfilling the requirements of the current health policies of the College of Nursing, available from the Baccalaureate Program Office. All students enrolled in the profes-

sional nursing major must carry health and accident insurance.

Liability Insurance. Students are required to carry their own professional liability insurance.

Student Employment. Students intending to pursue the professional nursing major on a full-time basis should expect to spend approximately 45 hours per week in class and study. Thus any additional activities or employment should be kept at a minimum.

Comprehensive Assessment Tests. All students who will take the professional licensing examination are required to take a comprehensive assessment test prior to graduation. Arrangements for taking the test and payment of fee must be made during the student's final term.

CPR Certification. All students entering the professional nursing major must be certified in cardiopulmonary resuscitation (CPR) as evidenced by current CPR card. This certification must be maintained while in the program. CPR courses are available outside the College of Nursing.

Grading Policy for Nursing Courses. Within the baccalaureate program, grades are assigned to reflect levels of achievement in relation to course objectives. Students who do not complete a required nursing course satisfactorily, receiving a grade of D or E (failing) or a mark of W (withdrawal), are not eligible to progress in the professional nursing major. Receiving a grade of D or E necessitates repeating the course in its entirety. A required nursing course may be repeated only once.

Any petition for curriculum adjustment, course substitution, overload, readmission to a nursing course or readmission to the professional nursing major must be approved by the Baccalaureate Standards Committee.

Withdrawal is in accordance with the withdrawal policy of the University. Students who withdraw from required nursing courses must complete the form, "Withdrawal from Nursing Courses." This should be done in conjunction with the appropriate faculty member. In addition, students are responsible for completing the University withdrawal procedure. Two withdrawals from any single nursing course constitute ineligibility to continue in the nursing major without an approved petition from the Baccalaureate Standards Committee.

An *incomplete* in a required nursing course must be satisfactorily removed before progression in the nursing major is permitted. A grade of "I" is not allowed in clinical practice courses.

Audits are not permitted in required professional nursing courses.

Pass/Fail grades are not acceptable for courses in the minimum 126 credit hour requirement for graduation.

Retention. Retention in the professional nursing major is contingent upon maintaining sound physical and mental health. Students who appear to lack the degree of physical and mental health necessary to function successfully as a professional nurse may be required to have a medical examination and the results made available to the Baccalaureate Standards Committee of the College of Nursing. Qualifications of students whose behavior and/or performance has been questioned will be reviewed by the Baccalaureate Standards Committee. The student shall be informed of the results of the medical examination, and may appear in person before the committee and personally present information relevant to the committee's review. Such additional information may also be presented in writing without personal appearance. The decision of the committee to continue or discontinue the student's clinical nursing experience is final.

Appropriate professional behavior and appearance is required during all nursing course activities.

Academic dishonesty is not tolerated and will be subject to specific College of Nursing policies and procedures.

Comprehensive Examinations. The Registered Nurse student who has applied to the professional nursing major is eligible to take selected comprehensive examinations to establish credit in upper division nursing courses. For further information contact the College of Nursing Academic Advisor, College of Nursing, Room 108, (602) 965-2987.

Nursing

PROFESSORS:
KRUEGER (NUR 457), BRANSTETTER,
JOHNSON, LUDEMANN, MUHLENKAMP,
MURPHY, STEFFL, WOOD ZORNOW

ASSOCIATE PROFESSORS:
BRUNER, GRONSETH, KNUDSEN,
KOMNENICH, NORTH ROBERTS, THEOBALD

ASSISTANT PROFESSORS:
BAGWELL, FELLER, F NCH, GARRITY,
KATZMAN, KURTH, LaMONTAGNE, LUDLOW,
MELV N, MILLER, MOORE, OLSON,
RICHARDS, SEHESTED, SHERIDAN, SQU RES,
STENGEL, TOB ASON, UUSTAL, WURZELL,
ZSOHAR

INSTRUCTORS:
ADAMS, ANDERSEN, BECK, BELL, BLOSSER,
ENTZ, ESPARAZA, FRITZ, GALE, JOHNSON,
KASTENBAUM, KATZENBERGER KLEINER,
KRUSE, LUKES MacKENZIE, McNAMARA,
NELSON, PLUMER, SALETTA, STRANG,
THORNE

NURSING

*Fnrollment is restricted to students admitted
to the upper division nursing major.*

Prerequ s te course numbers marked w th a dagger (†)
have further prerequ s tes Each student is required to
take the indicated prerequ s te courses

**NUR 219 Health Promotion and Self Care
Competencies.** (2) F S, SS
Bas c nursing sk s and health promotion content as re
ated to se f care, home care and act v ties of dai y
l ving Prerequis tes Sophomore stand ng and approva
of nstructor One and one half hour lecture, one and
one ha f hour ab

303 Nursing Process, Roles and Functions. (2) F S
Soc a zat on into professiona role Nurs ng process for
dec s on making and action. Nursing funct ons and re-
spons b' t es n hea th and ness. Prerequ s tes NUR
219 and adm ss on to the profess onal nurs ng ma or or
Reg stered Nurses

304 Pharmacology for Nursing. (3) F, S
Drug c assif cat ons and prototypes. Psychophys o og c
pr nc p es of drug action Know edge bas c to safe ad
m n strat on n nurs ng practice. Prerequ s tes. NUR 219
and adm ss on to the profess onal nurs ng major.

305 Development of Professional Nursing. (2) F, S
H storical deve opment of nurs ng, education, and prac
tice ro es Professional va ues and norms, legal and
socio po lt cal processes Prerequ s te· NUR 303

313 Basic Competencies in Nursing Practice. (2) F, S
Sc ent f c principles and selected psychomotor ski ls for
beginning cl nical nurs ng pract ce. Prerequisites· NUR
219 and adm ssion into the professiona nursing major.
One hour ecture 3 hours aboratory.

314 Health Assessment. (3) F S
Introductory knowledge and sk l s for systematic
physica psychosocial and developmenta nursing as-
sessment over the ife span. Prerequisite or concurrent.

NUR 303, 313 or Reg stered Nurses or approval of in-
structor. Two hours lecture, 3 hours ab

323 Care of the Hospitalized Adult I. (5) F, S
Nursing concepts and practice n car'ng for the hosp -
ta ized adult with med cal-surg cal problems Theo-
retical bases, pathophysio ogy and related nurs ng
management Prerequ s'te· NUR 219 and concurrent
303, 304, 313, 314 Two hours ecture, 9 hours ab.

327 Care of the Well and Hospitalized Child. (3) F S
Nursing concepts and practice in caring for we l and
hosp tal zed ch ldren exper enc ng norma or excep-
t onal hea th stressors. Prerequis te NUR 323, 305 pre
requ s te or concurrent. One and one ha f hour ecture
four and one ha f hour lab

328 Parent Infant Nursing. (3) F, S
Nurs ng concepts and pract ce in the per nata per od.
Includes the impact on family members and the r rela-
tionships Prerequ s tes· NUR 323 305 prerequisite or
concurrent 1¹₂ hour lecture, 4¹₂ hour lab.

329 Mental Health Nursing. (5) F, S
Concepts and pract ces n psychiatric/menta hea th
nursing. Therapeut c commun cat on, relat onships, and
treatment approaches used n the nurs ng process
Prerequ s tes. NUR 323 305 prerequ s te or concurrent
2 hours ecture 9 hours lab

403 Nursing Research. (2) F, S
Components of the research process S gn f cance of
research to the improvement of nurs ng practice and
deve opment of the profess on Prerequisites. NUR 327
328, 329 or approval of nstructor Registered Nurses
who have completed 3 semester hours of stat st cs

406 Leadership and Management in Nursing. (2) F, S
Se ected theoret cal frameworks for organ zat on, man-
agement and eadersh p n nursing Prerequisites· NUR
403, 426 427 or Registered Nurses

407 Contemporary Issues in Nursing and Health. (2) F
S
Se ected contemporary ssues nf uenc ng nursing and
the hea th care system Prerequ sites. NUR 403, 426
427.

426 Care of the Hospitalized Adult II. (4) F, S
Nurs ng concepts and pract ce in caring for the hosp -
ta ized adult w th comp ex med cal surg cal prob ems
Theoret ca bases pathophysiology and re ated nursing
management Prerequ s tes· NUR 327, 328, 329 403
prerequ site or concurrent. 1¹₂ hours ecture, 7¹₂ hours
lab.

427 Community Health Nursing. (4) F, S
Nurs ng process and the fam y as the framework for
care n the community Emphas s on hea th promot on
and l ness prevention. Prerequ s tes. NUR 327 328,
329· NUR 403 prerequ s te or concurrent. 1¹₂ hours ec
ture, 7¹₂ hours ab

428 Management of Clients in Acute Care Settings. (4)
F, S
Appl cation of principles of nurs ng management and
leadership in acute care sett ngs Prerequisite or con
current· NUR 406, 407. One hour lecture, 9 hours lab.

429 Community Nursing of Populations at Risk. (4) F,
S
Applicat on of concepts of ep demiology, hea th educa-
tion and hea th screening to h gh r sk popu ations in the
community. Prerequisites or concurrent· NUR 406, 407
One hour lecture, 9 hours lab

431 Introduction to Cardiovascular Nursing. (3) F, S,
SS
Selected aspects of cardiovascular nursing D agnostic
evaluat on, h story and physical assessment, med cal
and surgical ntervent ons preventive and rehabi itat ve

management. Prerequisites: NUR 313, 323 or approval of instructor.

432 Cardiovascular Nursing Laboratory. (1) F, S, SS
Experiences to accompany NUR 431. Observation, direct care, decision-making and planning for clients in various stages of cardiac disease. Prerequisites: NUR 313, 323 or approval of instructor; NUR 431 concurrent. Three hours laboratory.

433 Abnormal Stress in the Maternity Cycle. (2-3) F, S
Clinical nursing in high risk obstetrics. Abnormal stresses for pregnant women, effects in newborns and appropriate nursing interventions. Prerequisite: NUR 328† or approval of instructor. Two hours lecture; 3 hours lab optional.

434 Cultural Variations of Health and Illness. (2-3) F, S
Health-illness beliefs, behaviors and interventions in selected ethnic cultures. Integrating scientific and folk medicine in nursing practice. Prerequisite: approval of instructor. Two hours lecture; 3 hours lab optional.

435 Nursing of Children with Developmental Disabilities (2-3) F, S
Congenital and acquired physical and mental developmental disorders. Evaluation of child and family. Clinical nursing in pediatric community settings. Prerequisite: NUR 327 or approval of instructor. Two hours lecture; 3 hours lab optional.

436 Prospective Health Care. (3) F, S
Analysis of factors influencing health and health care systems. Includes review of health risks, utilization of local and national resources and the performance of selected health screening techniques. Prerequisite: approval of instructor. Two hours lecture, 3 hours lab.

494 Special Topics. (1-4) F, S, SS
Advanced study and/or supervised practice in an area of nursing. Lecture and lab to be arranged. Prerequisite: 12 hours in the nursing major and/or approval of instructor.

500 Research Methods. (3) F, S
Research methods including research conceptualization and design. Prerequisite: graduate level inferential statistics course; may be taken concurrently.

580 Practicum. (1-4) N
Supervised clinical application of theoretical concepts. Prerequisite: Approval of instructor.

591 Seminar (Electives). (2-4) N
Advanced topics including curriculum development, teaching in nursing programs, leadership, gestalt therapy, cultural perspectives, computer applications, health promotion, etc.

598 Special Topics (Electives). (2-4) N
Special study including health promotion, health management, pathophysiology, advanced physiology, values, care of the acutely ill, etc. Prerequisite: approval of instructor in selected course.

599 Thesis. (1-6) F,S,SS
Research proposal development, data collection and analysis, thesis writing and thesis oral defense. Six hours required.

680 Practicum (Electives) (1-4) N
Clinical application of theories, concepts and principles such as health management, health maintenance, etc. Prerequisite: approval of instructor.

680 Advanced Nursing Practicum III-IV. (2-6) F, S
Clinical application of theories, concepts, and principles. Conferences included. Areas of concentration are:

1. Adult Health Nursing. 2. Community Health Nursing. 3. Community Mental Health/Psychiatric. 4. Nursing of Children. Prerequisites: admission to graduate program and approval of instructor.

681 Advanced Theory III. (2) F
Analysis of advanced nursing theory in area of concentration. Focus is on health, client, environment, and nursing practice. Prerequisite: admission to graduate program. Areas of concentration are:

1. Adult Health Nursing. 2. Community Health Nursing. 3. Community Mental Health/Psychiatric. 4. Nursing of Children.

682 Advanced Theory IV. (2) S
Analysis of advanced nursing theory in areas of concentration. Focus is on health, client, environment, and nursing practice. Prerequisite: admission to graduate program.

Special Courses. NUR 580, 590, 591, 592, 598, 680, 690, 691. (See pages 35-36.)

HUMAN DEVELOPMENT

HDE 586 Origins of Human Behavior. (3) F
Critical examination of theories, issues, and research to the developmental period of infancy through adolescence. Prerequisite: Course in child development or equivalent.

588 Development in Adulthood and Aging. (3) S
Critical examination of theories and research of adulthood and aging.

College of Public Programs

Nicholas L. Henry, Ph.D.
Dean

Purpose

The College of Public Programs offers a wide range of undergraduate and graduate course work, both on- and off-campus, to full-time students and as part of continuing education. Each academic unit of the College not only assumes responsibilities in preparing its own majors, but, in addition, the units provide a variety of service courses for the rest of the University. The College is committed to providing excellence in teaching, research, and public service. Consequently, the units work closely with numerous public, quasi-public, and private agencies at the national, regional, state and local levels.

Organization

The College of Public Programs is composed of five academic units: the Department of Communication, the Walter Cronkite School of Journalism and Telecommunication, the Department of Leisure Studies, the School of Public Affairs, and the School of Justice Studies. Each academic unit is administered by a Chair/Director.

The general administration of the College is the responsibility of the Dean, who is responsible to the University President through the Vice President for Academic Affairs.

Degrees

Baccalaureate Degrees. The College of Public Programs offers academic instruction in four areas. Successful completion of a four-year program of 126 semester hours as specified by the respective academic unit leads to the following bachelor's degrees:

Communication:
   Bachelor of Arts (B.A.)

   Bachelor of Science (B.S.)

Justice Studies:
   Bachelor of Science (B.S.)

Journalism and Telecommunication:
   Bachelor of Arts (Journalism) (B.A.)
   Bachelor of Arts (Broadcasting) (B.A.)
   Bachelor of Science (Journalism) (B.S.)
   Bachelor of Science (Broadcasting) (B.S.)
(The Bachelor of Science (B.S.) program is under review by the faculty and will not be available for students entering under this catalog).

Leisure Studies
   Bachelor of Science (Recreation) (B.S.)
   Specific degree requirements are explained in detail under the respective school or department program information section.

Graduate Degrees. Master's degree programs are offered by five academic units of the College of Public Programs. Specific requirements, as listed under the respective school or department section, lead to the following graduate degrees:

Communication:
   Master of Arts (M.A.)

Justice Studies:
   Master of Science (M.S.)

Journalism and Telecommunication:
   Master of Mass Communication (M.M.C)

Leisure Studies:
   Master of Science (Recreation) (M.S.)

Public Affairs:
   Master of Public Administration (M.P.A.)

College of Public Programs:

Doctor of Public Administration (D.P.A.)

The D.P.A. degree program is interdisciplinary in nature and is offered by faculty from various colleges. The program is administered by an executive committee appointed by and responsible to the Dean of the Graduate College. The purpose of the program is to prepare skilled professional public administrators for high-level positions in the public sector.

Information on all graduate degree programs in the College of Public Programs is detailed in the *Graduate College Catalog.*

Admission

Freshmen: Any incoming freshman (0-24 semester hours) who meets the minimum University admission requirements as detailed on pages 19-23 will be admitted to any chosen undergraduate academic unit of the College as a *pre-major* in that respective academic unit.

Major Status Admission. Entry to any undergraduate academic unit of the College with status as a major requires the completion of at least 56 semester hours with a minimum cumulative grade point average of 2.50, plus whatever additional requirements the respective school/department may impose. When a student has completed course work at Arizona State University, the grade point average is computed on Arizona State University courses only, and must be based on a *minimum* of nine (9) semester hours of courses with grade options of A, B, C, D, or E.

Students should refer to the information section of the catalog with reference to their preferred area of study for retention requirements and/or continued enrollment in their major courses.

Transfer Students: Any person applying for admission or transfer to an academic unit of the College will be admitted as a major of that unit if the student has met the specific requirements as listed in the information section for the respective department/school.

Transfer Credit. In most cases, course work successfully completed at a regionally accredited four-year institution of higher education will be accepted into the College of Public Programs respective academic unit.

Course work successfully completed at an accredited two-year institution of higher education (community or junior college) will transfer as lower division credit up to a maximum of 64 semester hours.

Successful completion is defined for purpose of transfer as having received a grade comparable to an A, B, or C at ASU. The acceptance of credits will be determined by the Director of Admissions and the utilization of credits toward degree requirements will be at the discretion of the individual academic unit.

Advisement. A student who has been admitted to the College of Public Programs will be assigned an academic advisor from the faculty of the academic unit that the student has selected as his/her major area of study. Questions on advisement should be directed to the student's academic advisor or to the Student Services Office of the College of Public Programs.

Course Load. A normal course load per semester is 15-16 credit hours. The maximum number of hours for which a student can register is 18 credit hours unless an overload petition has been filed and approved by the Department/School Standards Committee *and* the Undergraduate Programs Committee of the College.

Overload petitions are not ordinarily granted to students who have a cumulative grade point average of less than 3.0 and do not state valid reasons for the need to register for the credits. Students who register for credit hours in excess of 18 and do not have an approved overload petition on file will have courses randomly removed through an "administrative drop" action.

General Studies Requirements. All undergraduate students in the College of Public Programs are required to complete a minimum of 37 hours, plus the English Proficiency requirement, of General Studies courses in order to be eligible for graduation in any of the undergraduate curricula offered by the College. The following list includes the courses recognized by the College in each area. Students should refer to departmental/school checksheets for additional or stricter requirements. Any deviations or substitutions from the following will require the approval of the College Standards Committee.

Students presenting transfer course work, especially of a generalized or unusual description, should make sure that such courses are suitable for inclusion in one of these areas. The College follows the Course Equivalency Guide for transfer work from Arizona community colleges. Courses desig-

nated "E" (elective) in the Guide may not be used for General Studies credit.

English Proficiency. Students must demonstrate reasonable proficiency in written English by achieving a grade of "C" or better in both ENG 101 and ENG 102, or in ENG 105 or its equivalent. Should a student receive a grade lower than "C" in any of the courses, it must be repeated until specified proficiency is demonstrated. Transfer students from colleges outside Arizona should consult the College Student Services Office in Wilson Hall to assure completion of this requirement.

Writing Competence Requirement. In addition to English 101 and 102, or their equivalent, one of the following courses in written composition is required of all undergraduate majors: ENG 200, ENG 211, ENG 301, ADS 233, or JRN 201. This course may be included within the General Studies requirement of the department/school degree program where appropriate.

Computer Science Requirement. One of the following courses is required for all undergraduate majors: CSC 180, 181, or 183. It may be included within the General Studies distributional requirement or department/school degree program where appropriate.

Foreign Language Requirement. The School of Journalism and Telecommunication is the only academic unit of the College that has a foreign language requirement in order to successfully complete work for the Bachelor of Arts degree in either journalism or broadcasting. Refer to the degree requirement section of the School of Journalism and Telecommunication for detailed information.

Limitation on Physical Education Activity Hours. No more than eight hours of physical education activity courses may be counted within the minimum 126 hours required for graduation.

All students in the College of Public Programs must meet minimums as listed below.

The following list uses the prefixes as listed in the 1985-87 *General Catalog.* Students presenting course work from earlier catalogs should make sure it is accurately applied to requirements. It is the student's responsibility to make sure that graduation requirements are met.

General Studies Course List

Humanities and Fine Arts: Nine (9) semester hours minimum. Must include courses in at least two subject areas. Students may take up to three of the nine hours in performance or studio courses: ART, DAN, MUP, THP.

Architecture:
Architectural Philosophy and History, APH
Architectural Communication, AVC
Art:
Art History, ARH
Studio Art, ART
Communication:
COM 210, 222, 225, 241, 243, 271, 274, 341, 344, 420, 422, 441, 442, 443, 474
Dance:
Dance History, DAH
Dance Performance, DAN
English:
ENG (other than Freshman Composition). "Reading courses from community colleges *NOT* included.
Foreign Languages:
FLA, CHI, FRE, GER, GRK, ITA, JPN, LAT, RUS, SPA
Interdisciplinary Humanities:
Humanities, HUP, HUM
Music:
General Studies Electives, MUS
Music History and Literature, MHL
Music Theory and Composition, MTC
Music Performance, MUP
Philosophy: PHI, HPS
Religious Studies: REL
Theatre:
History, Literature, and Theory, THE
Theatre Performance and Production, THP

Social and Behavioral Sciences: Eighteen (18) semester hours minimum. Must include courses in at least three subject areas.
Anthropology (Cultural): ASB
Business:
Advertising, ADV
Decision and Information Systems, DIS
Economics, ECN
Finance, FIN
Management, MGT
Marketing, MKT
Quantitative Business Analysis, QBA
Transportation, TRA
Administrative Services, GNB
Communication:
All Communication courses *other* than

listed above under Humanities require-ments.

Design Sciences: DSC
Engineering:
Analysis and Systems, ASE
Industrial and Management Systems Engineering, IEE
Society, Values, and Technology, STE
Geography (Cultural): GCU
History: HIS
Journalism and Telecommunication:
JRN, MCO, TCM
Justice Studies: CRJ
Leisure Studies: REC
Planning: PUP
Political Science: POS
Psychology:
PGS (includes general introductory courses)
Sociology: SOC
Science and Mathematics: Ten (10) semester hours minimum. Must include at least two subject areas. A laboratory science course is required.
Anthropology (Physical): ASM
Botany: BIO, BOT, MIC
Chemistry: CHM
Computer Science: CSC
Engineering:
Civil Engineering, CEE
Chemical and Bio Engineering, CHE
Engineering Core, ECE
Electrical and Computer Engineering, EEE
Mechanical and Aerospace Engineering, MEE
Geography (Physical): GPH
Geology: GLG
Mathematics: MAT, STP
Physics: AST, PHS, PHY
Psychology: PSY
Zoology: ENT, ZOL
Students may not use courses from their major department/school to satisfy General Studies requirements.

Special Credit Options

Undergraduate Credit for Graduate Courses: In order to enable undergraduate students to enrich their academic development, the Graduate College and the individual academic units of the College of Public Programs will allow qualified students to take graduate level courses for undergraduate credit. In order to qualify for admission to a graduate level course, the student must have

senior status (87 or more semester hours successfully completed) and a cumulative grade point average of 3.0 or higher. In addition, permission to enroll must be given prior to registration and must be approved by the instructor of the course, the student's advisor, the department chair/school director, and the Dean of the College in which the course is offered.

Academic Standards and Retention

Good Standing: Any pre-major or major student of the respective academic units of the College will be considered in good standing if the student maintains a cumulative grade point average of 2.0 or higher in all courses taken at Arizona State University.

Probation: Any student who does not maintain good standing status as described above may be placed on probation. A student on academic probation is required to observe any limitations or rules the College may impose as a condition for retention.

Disqualification, Reinstatement, and Appeals: The terms of disqualification, reinstatement, and appeals are identical with those of the University as set forth on pages 38-39 of this catalog.

All academic discipline action is the function of the Student Services Office, Wilson Hall, Room 232, under the direction of the Dean of the College. Students who are having academic problems should contact this office for advisement.

Honors Program. The College of Public Programs provides an Honors Program for undergraduates of exceptional ability. This program includes special courses taught by outstanding faculty and limited in class size, special advisement, preferential preregistration, and the preparation of a senior Honors thesis.

Admission to the Honors Program. Entering freshmen in the top 5% of their high school graduating class and those who have a 27 or higher ACT composite score or a 1250 or higher SAT combined score are eligible to apply for admission to the program. Continuing and transfer students who have completed between 15 and 60 hours with at least a 3.25 GPA also may apply for admission to the program. However, only ASU course work is used to determine the GPA for Honors retention and graduation.

Accelerated Degree Programs. Selected academic units within the College of Public

Programs provide inter- and intradisciplinary programs leading to the completion of the baccalaureate degree and the master's degree within a five-year period. These are not new degree programs, but rather than articulation of required course work which will allow the student with exceptional ability to obtain both the undergraduate and graduate degree in a shorter than normal time frame. Completion of the master's degree should require two semesters and intermediate summer course work beyond the baccalaureate degree.

Admission Requirements: To be successful in this program, students must have graduated from a recognized high school and achieved one of the following: (1) graduated in the upper five percent of their high school graduating class; (2) attained an ACT composite score of 27 or higher; (3) a combined SAT score of 1250 or higher.

In addition, students are required to maintain a minimum cumulative grade point average of 3.25 in order to continue participation in an accelerated degree program option.

Students wishing to enter this program but not possessing the above requirements may choose to enter the program late during their undergraduate studies. Such students must have achieved and maintained a minimum grade point average of 3.40 at Arizona State University. These students must also recognize that they may require longer than the expected five years to complete both degrees.

Program options: *Interdisciplinary* Accelerated Degree Program options include but are not limited to:

Bachelor's Degree in Communication - Master of Mass Communication

Bachelor's Degree in Communication - Master of Public Administration

Bachelor's Degree in Journalism/TeleCommunication - Master of Arts in Communication

Bachelor's Degree in Journalism/Telecommunication - Master of Science in Justice Studies

Bachelor's Degree in Journalism/Telecommunication - Master of Public Administration

Bachelor's Degree in Justice Studies - Master of Public Administration

Bachelor's Degree in Leisure Studies - Master of Public Administration

Accelerated *Intradisciplinary* options are also available within the academic units of Communication, Journalism/Telecommunication, Justice Studies, and Leisure Studies.

Master's Degree Requirements. Participation in an Accelerated Degree Program option in no way implies a guarantee of admission into any graduate degree program. The student must make application and meet all requirements for regular admission to the selected Master's Program as defined in the Arizona State University *Graduate College Catalog* for the respective College of Public Programs discipline.

Interested students should consult the Arizona State University *General Catalog* and separate curriculum checksheets for individual department/school accelerated program requirements. For further information, students may call or write the College of Public Programs Student Services Office, Wilson Hall 203.

Graduate Requirements. Besides completing the regular University, College and departmental graduation requirements for the major, Honors students must complete at least 60 hours of resident course work at ASU with a 3.40 cumulative GPA; complete at least 18 hours of specially designated Honors course work, including 6 upper division hours out of the major; and write a senior Honors thesis under the supervision of a thesis committee, subject to oral defense and designated approvals.

For further information about the program, students should call or write the College Student Services Office, Wilson Hall 203.

Center for Urban Studies
John S. Hall, Ph.D., Director

The Center for Urban Studies (CUS) is an interdisciplinary research and service unit of the College of Public Programs which seeks to promote the analysis and understanding of urban systems. Center studies are directed at improving the effectiveness, efficiency, responsiveness and equity of urban decision making. To meet its goals, the center undertakes research, conducts workshops and provides technical assistance both for local governments and citizens. The center is a community resource.

The Center is organized to conduct high quality interdisciplinary research that is

useful for public problem solving. The divisions and major foci of the Center are the Advanced Public Executive Program (APEP), Adult Development and Aging Program; Division of Field Research; Division of Policy Analysis and Evaluation; and the Division of Public Opinion Research.

The demand for CUS services from state, local and community groups has been substantial. Past studies have included those on the evaluation of social service delivery; housing investment patterns; crime and police services; problems and programs of the elderly; community sentiment about governance; assessment of governmentally provided health systems; and evaluation of the impact of shifts in national domestic policy on local governments, non-profit organizations, and citizens.

Advanced Public Executive Program (APEP). APEP is designed to provide the public sector executive with analytical approaches and skills that will help mobilize ideas, people, and resources in support of public programs. To meet these objectives, APEP uses interdisciplinary faculty teams to provide a series of short-courses, seminars, and other training devices to help public managers become more effective and efficient.

Adult Development and Aging Program. This program is an interdisciplinary research unit which emphasizes the analysis and understanding of the distinctive problems of elderly populations. This unit places special emphasis on the aged in the Southwest. Besides its research activities, the program offers a Certificate in Gerontology and carries out many community service projects.

The College of Public Programs offers a Certificate in Gerontology through the Adult Development and Aging Program. Students who wish to work in gerontology-related professions or who are interested in issues which pertain to the elderly may earn the Certificate while pursuing degrees in various university departments. For further information, contact Director, Adult Development and Aging Program.

Division of Field Research. The Phoenix urban area is a virtual laboratory of public programs and issues. This division will apply techniques of field research to local public policy and organization issues. In addition to its own studies, the division assists other Center units in using field research techniques such as elite and specialized in-

terviewing, observational research and archival analysis.

Division of Policy Analysis and Evaluation. This unit focuses on the analysis of significant public policy problems and issues, with an emphasis of providing public sector decision makers with high quality decision-relevant information.

Part of the division's mission is to provide ongoing support to those agencies with which the division contracts to undertake research. The division is committed to the idea of making maximum use of data collected for public agencies beyond the demands of the initial grant or contract.

Division of Public Opinion Research. The Public Opinion Research Program provides a mechanism for assessing and reporting community sentiment and reactions to news events, public policy issues and problems of broad public interest. As such, it has established an ongoing relationship with a wide array of public and private agencies.

Morrison Institute for Public Policy. This research unit, located in the School of Public Affairs, was created by a grant from the Marvin Morrison family, and seeks to provide both citizens and public officials with objective information to make well-informed policy decisions.

The Institute's mission revolves around public service and research activities. These activities include the publication of occasional papers, policy reports, and the *Policy Studies Review.* The Institute also sponsors conferences on policy issues and engages in contract and grant research on public policy in support of state and local government agencies.
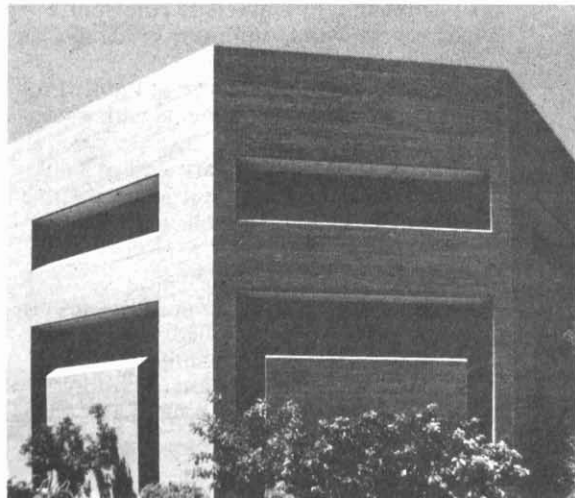
Communication

PROFESSORS:
GOYER (STAUF 412), ARNOLD, DAVIS, JAIN,
KASTENBAUM, McHUGHES, PERRILL,
RICHARDS, STITES, K. VALENTINE

ASSOCIATE PROFESSORS:
BOSTER, BULEY, DAVEY, GUDYKUNST,
MAYER, MERRILL, REINARD

ASSISTANT PROFESSORS:
CRAWFORD, HECHT, JOHNSON, ROBBINS,
C. VALENTINE

LECTURERS:
OLSON, WILLIAMS

General Information

The purpose of the Department of Commu-
nication is to demonstrate, encourage, and
facilitate systematic study of the theories,
processes, and skills of human communica-
tion. Courses of study are designed to pro-
vide relevant, integrated programs adapted
to the academic and professional goals of
students.

Communication Pre-Major Requirements.
All students admitted to the University are
eligible for acceptance to the Department of
Communication in a pre-major status.

Communication Major Requirements. Un-
dergraduate students may be admitted to
Communication major status after meeting
all of the following requirements:
(1) Completion of at least 56 semester
hours with a minimum cumulative grade
point average of 2.50. The grade point aver-
age is computed on ASU courses only, and
must be based on a *minimum* of nine se-
mester hours of courses with grade options
of A, B, C, D, or E.
(2) Completion of University core course
requirements with a minimum grade of C in
each.
(3) Completion of all College of Public Pro-
grams core course requirements with a min-
imum grade of C in each.
(4) Completion of all Department of Com-
munication core course requirements with a
minimum grade of C in each.

Degree Requirements

Bachelor of Arts and Bachelor of Science. In
addition to University, College, and Depart-
ment core course requirements, all majors
must complete a combination of required
and optional courses consisting of at least
45 hours in an emphasis area of the stu-
dent's choice. Current emphasis areas in-
clude General Communication, Inter-
cultural Communication, Rhetoric/Public
Communication, and Secondary Education/
Communication.

Of the minimum 45 hours, at least 24
hours must be in departmental and related
field upper division (300 and 400 level)
coursework, including at least two courses
numbered 400 or above. A minimum grade
of C in required in each course taken in the
major.

Specific Curriculum Check Sheets for
each emphasis area are available from the
Departmental Undergraduate Advisor in
Stauffer Hall.

In addition, the following General Studies
requirements for the Bachelor of Arts and
Bachelor of Science degrees must be satis-
fied.

	Bachelor of Arts	Bachelor of Science
Humanities/Fine Arts:	15	9
Social/Behavioral Sciences:	18	21
Science/Mathematics:	10	13
General Studies Electives:	12	12
Total:	55	55

Students may not use courses included in
the major to fulfill General Studies require-
ments. Consult the Departmental Academic
Advisor for current information concerning
College of Public Programs and Department
of Communication lists of courses applica-
ble to General Studies requirements.

Bachelor of Arts in Education: The Sec-
ondary Education curriculum *major* in
Communication consists of 60 semester
hours and is designed to provide prepara-
tion for teaching. Two options are available:
(1) The student may complete a minimum
of 24 hours in Communication and a mini-
mum of 18 hours in each of two additional
approved academic minors. (2) The student
may complete a minimum of 36 hours in
Communication and a minimum of 24
hours in a single additional approved
academic minor. The Communication ma-
jor must complete all University, College of
Public Programs and Department of Com-
munication core courses, and at least one
course in each of the designated areas in the
field of Communication. At least 18 hours
of the major must be in upper division
courses; an additional 6 hours of Communi-
cation activity courses (COM 381 or 382
which involve non-graded credit only) must
be completed, 3 hours of which may be

counted toward the major. Specific courses to complete the major are selected by the student in consultation with the student's advisor.

Students should refer to the College of Education to ascertain the General Studies requirements for this degree.

Secondary Education curriculum *minor* in Communication consists of 24 semester hours in Communication, including the departmental core courses, plus COM 480. At least 9 of the additional hours must be in upper division course work.

Communication Internships. Internships consist of supervised field experiences and are available to qualified upper-level undergraduate (COM 484) and graduate (COM 584) students. Internships must receive prior approval from the departmental Coordinator of Internship Programs *before* student registration for the course. Internships may be taken once or repeated for credit up to a total of 12 hours, but not more than 6 hours may be applied toward the major.

Departmental Graduate Programs

The Department of Communication offers programs leading to the degree of Master of Arts. Consult the *Graduate College Catalog* for requirements.

COMMUNICATION

COM 100 Introduction to Human Communication. (3) F, S, SS
Focus on the basic theory and dimensions of human interaction, including individual and group experiences in human communication.

110 Personal Relationship Communication. (3) F, S, SS
Demonstration and practice of communicative techniques in establishing and maintaining interpersonal relationships.

172 Introduction to Manual Communication. (3) F, S
American Sign Language (ASL): linguistic principles, expressive/receptive skills; terminology, cultural aspects, socio-educational trends, and sign systems.

200 Human Communication Systems. (3) N
Human communication processes and systems, major areas of theory and research, and the scientific bases of human communication behavior.

207 Introduction to Communication Inquiry. (3) F, S, SS
Bases of inquiry into human communication, including introduction to notions of theory, philosophy, problems, and approaches to the study of communication. Prerequisite: COM 100.

210 Issues in Personal Communication. (3) F, S
Exploration of theoretical, ethical, and philosophical approaches to communication in human relationships. Prerequisite: COM 110.

215 Listening. (3) F, S
Study of theory and practice of effective listening behaviors, including intensive skill exercises.

222 Argumentation. (3) A
Philosophical and theoretical foundations of argumentation, including a comparison of models of advocacy and evidence applied in the forensics environment.

225 Public Speaking. (3) F, S, SS
Verbal and nonverbal communication in platform speaking. Discussion and practice in vocal and physical delivery and in purposeful organization and development of public communication. Not open to freshmen.

230 Small Group Communication. (3) F, S, SS
Principles and processes of small group communication, attitudes and skills for effective participation and leadership in small groups, small group problem-solving and decision-making.

241 Introduction to Oral Interpretation. (3) F, S, SS
The communication of literary materials through the mode of performance. Verbal and nonverbal behavior, interface of interpreter with literature and audience, and rhetorical and dramatic analysis of literary modes.

243 Interpreters Theatre Workshop. (3) S
Students will create and practice ensemble interpretation of literature using a variety of media in diverse settings.

263 Elements of Intercultural Communication. (3) F, S
Basic concepts, principles and skills for improving communication between persons from different minority, racial, ethnic, and cultural backgrounds.

271 Voice Improvement. (3) F, S
Intensive personal and group experience to improve normal vocal usage, including articulation and pronunciation.

272 Intermediate Manual Communication. (3) F, S
Emphasis on increasing vocabulary and speed; development of greater fluency in ASL, including finger-spelling and non-verbal communication. Survey of deafness. Prerequisite: COM 172.

274 General Semantics. (3) A
Analysis of relationship to language to reality: nature of meaning, levels of abstraction, application of general semantics to everyday contexts.

275 Nonverbal Communication. (3) F, S, SS
The effects of space, time, body movement, environment, objects, and voice quality on human communication and interaction.

294 Special Topics. (3) F, S, SS
Prerequisite: approval of instructor.

308 Empirical Research Methods in Communication. (3) F, S
Review of empirical research methods in communication, including applications to experimental, survey, descriptive, and other quantitative approaches. Prerequisite: COM 207.

309 Rhetorical Research Methods in Communication. (3) F, S
Historical development of rhetorical theory and research methods in communication, and the modes of qualitative research in the field. Prerequisite: COM 207.

310 Interpersonal Communication Processes. (3) A
Survey and analysis of major research topics, paradigms, and theories dealing with message exchanges between and among social peers. Prerequisites: COM 100, 110, and 207, or approval of instructor.

312 Communication, Conflict and Negotiation. (3) A
Theories and strategies of communication relevant to the management of conflicts and the conduct of negotiations. Prerequisite: COM 100 or approval of instructor.

316 Women and Communication. (3) A
Introduction to gender-related communication. Verbal, nonverbal, and paralinguistic differences and similari-

ties are examined within social, psychological, and historic perspectives.

320 Communication and Consumerism. (3) F, S
Critical evaluation of messages designed for public consumption. Perceiving, evaluating, and responding to political, social, and commercial communication.

325 Advanced Public Speaking. (3) F, S
Social and pragmatic aspects of public speaking as a communicative system: strategies of rhetorical theory and the presentation of forms of public communication. Prerequisite: COM 225 or approval of instructor.

329 Persuasion. (3) A
Variables which influence and modify attitudes and behaviors of message receivers, including analysis of theories, research, and current problems. Prerequisite: COM 207 or approval of instructor.

331 Large Group Decision-Making. (3) F, S
Theory, methods, and individual communicative behaviors relevant to large group interaction systems. Public discussion and parliamentary procedure in various types of public and deliberative assemblies. Prerequisite: COM 230 or approval of instructor.

341 Interpretation in Social Contexts. (3) N
Adaptation and performance of literature in situations of crisis and conflict, notably in prisons, mental hospitals, and centers for the aged. Prerequisite: COM 241 or approval of instructor.

344 Oral Traditions in Literature. (3) N
Literary forms evolving from oral myths, legends, folk tales, and fables. Prerequisite: COM 241 or approval of instructor.

350 Communication in Business and the Professions. (3) F, S, SS
Interpersonal, group, and public communication methods and practices in business and professional organizations. Not open to freshmen, and may not be counted toward the major in Organizational Communication.

351 Interviewing. (3) F, S
Principles and techniques of interviewing, including practice through real and simulated interviews in informational, persuasive, and employee-related situations. Not open to freshmen.

355 Organizational Communication. (3) F, S
Analysis of theories and processes of communication in complex, formal organizational settings (government, industry, education, etc.). Prerequisite: COM 308 or approval of instructor.

363 Intercultural Communication Processes. (3) F, S
Processes and problems of communication between people from different racial, ethnic, and cultural backgrounds in both domestic and international settings. Prerequisite: COM 263 or approval of instructor.

371 Language, Culture, and Communication. (3) A
Cultural influences of language on communication, including social functions of language, bilingualism, biculturalism, and bidialectism.

372 Advanced Manual Communication. (3) F, S
ASL and English concepts and idiomatic expressions; emphasis on ASL principles. Practice in building fluency in Ameslan; preparation for interpreting. Prerequisite: COM 272.

381 Communication Activities. (1-3) F, S, SS
Non-graded participation in forensics or interpretation cocurricular activities, or for students enrolled in SED 433 (maximum 3 credits each semester). Prerequisite: approval of instructor.

382 Classroom Apprenticeship. (1-3) F, S, SS
Non-graded credit for students extending their experience with a content area by assisting with classroom

supervision and exercises in other COM courses (maximum 3 credits each semester). Prerequisite: approval of instructor.

394 Special Topics. (3) F, S, SS
Prerequisite: approval of instructor.

408 Quantitative Methods in Communication Research. (3) N
Advanced theory and practice in the formulation and conduct of empirical research using quantitative methodologies. Prerequisite: COM 308 or approval of instructor.

414 Crisis Communication. (3) N
Role of communication in crisis development and intervention. Prerequisite: approval of instructor.

417 Communication and Aging. (3) N
Dynamics of aging as it relates to communication. Prerequisite: approval of instructor.

420 Public Address. (3) N
Critical study of significant speakers and speeches of the past and present. Prerequisite: approval of instructor.

422 Advanced Argumentation. (3) N
Advanced study of argumentation theories and research as applied to public forum, adversary, scholarly, and legal settings. Prerequisite: COM 222 or approval of instructor.

425 Legal Communication. (3) N
The legal setting as a communicative event, featuring discussion of jury selection, legal interviewing, negotiations, and jury behavior. Prerequisite: approval of instructor.

430 Leadership in Group Communications. (3) N
Theory and process of leadership in group communication, emphasizing philosophical foundations, contemporary research, and applications to group situations. Prerequisite: COM 230 or 331 or approval of instructor.

441 Interpretation as Literary Criticism. (3) N
Communication of literature through the medium of performance. Problems of content, structure, and style in poetry, drama, and prose. Prerequisite: COM 241 or approval of instructor.

442 Interpretation and the Mass Media. (3) N
The relationship of modern media (radio, TV, and film) to oral interpretation and literature.

443 Interpreters Theatre: Theory and Practice. (3) N
Studies in visual perception, audience psychology, theory, and criticism; practice in directing, analyzing, scripting, and staging of literature. Prerequisite: COM 243 or approval of instructor.

444 Interpretation of Shakespeare. (3) N
Analysis and solo performance of scenes from Shakespeare. Emphasis on current trends in the cirticism and interpretive performance of Shakespearean literterure. Prerequisite: COM 241 or approval of instructor.

445 Chamber Theatre. (3) N
Theory and practice in analyzing, scripting, and staging prose fiction as group performance. Prerequisite: COM 241 or approval of instructor.

451 Quality Circles. (3) A
Analysis of "quality circles" theory, procedures, and facilitation techniques in human resources development and organizational problem-solving. Prerequisites: COM 230 and 355, or approval of instructor.

453 Communication Training and Development. (3) N
Examination of the procedures and types of communication training and development in business, industry and government. Prerequisite: COM 355 or approval of instructor.

456 Political Communication. (3) A
Theory and research related to political campaign communication. The persuasive process of political campaigning, the role of the media, the candidate and image creation. Prerequisite: approval of instructor.

457 Communication and Information Diffusion. (3) N
Role of communication in diffusion of innovations. Principles for effective use of communication for planned change in various social systems. Prerequisite: approval of instructor.

472 Development of Language as Communicative Behavior. (3) N
Development of language and interpersonal communicative behaviors of children through adolescence, including expressive and receptive competencies and interactions with others. Prerequisite: approval of instructor.

480 Methods of Teaching Communication. (3) N
Analysis, organization, and presentation of textual and other classroom materials. Prerequisite: approval of instructor.

484 Communication Internship. (1-12) F, S, SS

494 Special Topics. (1-3) F, S, SS
Prerequisite: approval of instructor.

500 Research Methods in Communication. (3) N
Definition and structure of the field of communication; identification and analysis of current research emphases, strategies, techniques and designs. Prerequisite: approval of instructor.

504 Theories and Models of Communication. (3) N
Critical survey and analysis of theories and models of communication viewed as process and event, including their respective research implications. Prerequisite: approval of instructor.

508 Quantitative Research Methods in Communication. (3) F
Empirical research designs, measurements, and statistical strategies and techniques employed in the analysis and evaluation of experimentive, descriptive, and related research problems in communication. Prerequisite: approval of instructor.

509 Qualitative Research Methods in Communication. (3) S
Qualitative research methods, including historical/critical/rhetorical and other non-quantitative techniques for analyzing communication. Prerequisite: approval of instructor.

520 Rhetorical Criticism of Oral Discourse. (3) N
History and significance of rhetorical theory and criticism in the analysis of oral discourse. Prerequisite: approval of instructor.

529 Theories of Persuasion. (3) N
Analysis of representative theories and models of persuasive processes and their implications for communicative behavior. Prerequisite: approval of instructor.

531 Theories of Small Group Communication. (3) N
Theory and research in small group interaction and decision-making, focusing on communicational variables which affect small group output. Prerequisite: approval of instructor.

541 Research Perspectives in Interpretation. (3) N
Supervised research in the historical and contemporary relationships between the interpreter, the text, and the audience. Prerequisite: approval of instructor.

555 Communicative Processes in Organizations. (3) N
Systematic analysis of communicative interactions between organizational structure, information flow, and human behaviors in the organizational setting. Prerequisite: approval of instructor.

563 Intercultural Communication. (3) N
Analysis of contemporary theory and research concerning the effects of a variety of cultural variables on communication between people. Prerequisite: approval of instructor.

575 Language and Message Systems. (3) N
Sign/symbol systems; personal, functional, and contextual aspects of message systems; measurement of "meaning." Prerequisite: approval of instructor.

584 Communication Internship. (1-12) F, S, SS

Special Courses: COM 298, 492, 493, 498, 499, 500, 580, 590, 591, 592, 594, 598, 599. (See pages 35-36.)

School of Justice Studies

John R. Hepburn, Ph.D., Director

Purpose and Philosophy

The School provides a interdisciplinary setting for studying justice from a social science perspective: the just distrubtion among people of benefits and burdens, including rights, desserts, and needs. The curriculum focuses on criminal, juvenile, civil and administrative regulations; and the individual and group behavior that these regulations are designed to influence. The study of justice includes diverse conceptions such as social justice, economic justice and the growing concern with victimology as well as the exploration of liberty and responsibility.

Degrees

Bachelor of Science. The curriculum for the Bachelor of Science degree in Justice Studies provides interdisciplinary, social science courses relevant to law and justice for students working in the justice field, those anticipating justice-related careers (including the legal profession), and interested non-majors.

Master of Science. The curriculum for the Master of Science degree with a major in Justice Studies is designed to prepare students for justice-related agencies, for teaching in community and four-year colleges, or for further study and research in the field of justice. Information on the Master of Science with a major in Justice Studies is detailed in the *Graduate College Catalog.*

Doctor of Public Administration. The D.P.A. degree program is interdisciplinary in nature and is offered by faculty from various colleges. The purpose of the Justice Studies area of concentration is to prepare

skilled professionals for high-level positions in justice agencies and to prepare other individuals for justice-related teaching positions in colleges/universities. The D.P.A. degree program is administered by an executive committee appointed by and responsible to the Dean of the Graduate College. For more details, see the description of the D.P.A. in the *Graduate College Catalog.*

Admission to Undergraduate Program

Undergraduate students at Arizona State University may become classified as justice studies majors in one of two ways: (1) Students who meet the minimum requirements (56 hours—2.50 grade point average—GPA) at the time of admission to the University will automatically be designated as justice studies majors by the Admissions Office. If students do not meet the minimum requirements, Admissions will designate them as pre-justice studies students. (2) At the point pre-justice studies students attain the minimum requirements, they will be designated as justice studies majors. In this case, the GPA will be calculated on hours earned at Arizona State University only. Students having achieved major status in the School are expected to maintain a minimum GPA of 2.50 until graduation; students failing to maintain at least a 2.25 GPA will be reviewed by the School and may be subject to reclassification as a pre-justice studies major.

Academic Advisement. Students admitted as pre-justice studies majors are advised by the School's academic advisor. All students are encouraged to seek advisement in order to plan an appropriate program of studies. Justice studies majors may also be advised by the School's faculty.

Degree Requirements

The School of Justice Studies awards a Bachelor of Science degree upon the successful completion of a curriculum of 126 semester hours consisting of:

	Semester Hours
General Studies Requirements	46
Justice Studies Major	48
Electives	32
Total	126

In addition, the student must fulfill the following requirements:

1. Have accumulated a minimum of 50 semester hours of upper division courses.

2. Have completed a minimum of 30 semester hours, including 24 in justice courses, at Arizona State University.

3. Have obtained a grade "C" or better for all justice courses taken at Arizona State University.

4. Have met the University's residency and scholarship requirements.

5. Have demonstrated a reasonable proficiency in written English by receiving a grade of "C" or better in both ENG 101 and 102, or in ENG 105.

General Studies Program. To meet the University's General Studies requirements, and to assure breadth and depth of the student's education, all justice studies undergraduate students must complete a total of 46 semester hours of General Studies courses, excluding all justice courses and the related courses counted toward the major, with the designated minimum semester hours in each of the following fields:

Humanities and Fine Arts ....9 sem. hrs.
  Must include courses in at least two subject areas. Courses may be chosen from the listing on the School's curriculum check sheet.

Social and Behavioral Sciences............18 sem. hrs.
  Must include courses in at least three subject areas. Courses may be chosen from the listing on the School's curriculum check sheet.

Sciences and Mathematics...................10 sem. hrs.
  Must include a science course with a laboratory section, at least one mathematics course at the level approved by the School, and one computer science course approved by the School. Courses may be chosen from the listing on the School's curriculum check sheet.

Other General Courses........................6-9 sem. hrs.
  All justice studies students must complete a course in Communication approved by the School, and ENG 105 or both ENG 101 and 102 as part of these 9 hours. Additional courses may be taken from the above fields as limited by the exceptions indicated, or other fields as approved by the student's advisor.

Justice Studies Program. A major consists of 48 semester hours credit, of which 9 must be taken in related fields approved by the School of Justice Studies. CRJ 100, 200, 301, 302, and 402 are required for all degree candidates. Additionally, all degree candidates must complete ENG 101 and 102 (*or* 105) with a grade of C or better as prerequisites for all upper-division justice courses. Finally, a group of justice courses may be recommended to ensure a comprehensive exposure to all aspects of justice studies.

Electives. Students are encouraged to utilize the unique opportunities afforded by the

University to pursue personal educational interests, whether in the form of a broad sampling of other disciplines, or the deeper probing of a single field.

Transfer of Community College Credits. Credits transferred from accredited community colleges will be accepted as lower division credits up to a maximum of 64 semester hours. The acceptance of credits will be determined by the Director of Admissions, and the applicability of credits toward degree requirements will be determined by the School of Justice Studies.

Special Program Option. Justice Studies participates in the accelerated degree program of the College of Public Programs, by which eligible students may complete a master's degree on an accelerated schedule. See the description provided by the College of Public Programs (page 341).

Justice Studies

PROFESSORS:
HEPBURN (WILSON 323), ALTHEIDE, HAYNES, JOHNSON, KENNEDY, LAUDERDALE, MUSHENO

ASSOCIATE PROFESSORS:
BRUNS, CAVENDER, DATESMAN, HERNANDEZ, SCHADE, SHUMAN

ASSISTANT PROFESSORS:
BORTNER, FERRARO, JURIK, MELICHAR, ZATZ

CRJ 100 The Justice System. (3) F, S, SS
Overview of the justice system. Roles of law enforcement personnel, the courts, and correctional agencies. Philosophical and theoretical views in historical perspective.

200 Concepts and Issues of Justice. (3) F, S, SS
Issues relating to justice policies, perspectives, techniques, roles, institutional arrangements, management, uses of research, innovative patterns. Prerequisite: CRJ 100 or approval of instructor.

301 Research in Justice Studies. (3) F, S, SS
Oriented toward an understanding of research elements: i.e., errors in reasoning, hypotheses, scales of measurement, variables, sampling and reliability. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

302 Basic Statistical Analysis in Justice Studies. (3) F, S, SS
Introduction to the fundamentals of statistics; a description of the purpose and process of evaluative research in justice studies. Prerequisites: CRJ 100, 200, 301; ENG 101 and 102 (or 105); MAT 106.

306 The Police Function. (3) F, S, SS
Alternative objectives, strategies, programs, institutional arrangements, roles, perspectives, and interagency relationships of the police. Prerequisites: CRJ

100, 200, ENG 101 and 102 (or 105), or approval of instructor.

308 The Adjudication Function. (3) S
Objectives, processes, settings, roles, and perspectives of the courts, prosecution, and defense. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

310 The Correctional Function. (3) F, S, SS
Alternative correctional objectives, strategies, programs, institutional arrangements, roles, perspectives and interagency relationships. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

311 Prevention of Delinquent and Criminal Behavior. (3) F, S
Theories of prevention, individual, group, and community approaches: intervention at appropriate stages; contemporary law enforcement and corrections practices. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

320 Community Relations in the Justice System. (3) F, S
Relationship between the justice system and the community served. Focus on social stratification, interest groups, and racial/ethnic minorities. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

340 Juvenile Justice. (3) F, S
A critical examination of the history and development of the juvenile court and the juvenile justice system. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

360 Law and Social Control. (3) F, S, SS
Resolution of social issues through the application of law as an agent of social control. Nature, sanctions, and limits of law. Categories of law and schools of jurisprudence. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

394 Special Topics in Justice Studies. (1-3) F, S, SS
Topics chosen from various fields of justice studies. Prerequisites: CRJ 100, 200, or approval of instructor.

402 Justice Theory. (3) F, S
A conceptual examination of the justice system. Integration of contemporary thought into an operational frame of reference. Prerequisites: CRJ 100, 200, ENG 101 and 102 (or 105), or approval of instructor.

404 Imperatives of Proof in the Justice System. (3) F, S
Problems and means of establishing identity and fact in relation to arrest, detention, adjudication, sentencing, and correctional case management. Prerequisites: CRJ 100, 200 and 402, ENG 101 and 102 (or 105), or approval of instructor.

422 Women and Crime. (3) F, S, SS
An in-depth analysis of the involvement of women in crime and in the criminal justice system. Prerequisites: ENG 101, 102, and CRJ 100, 200, 402.

440 Organization and Administration of the Justice System. (3) F, S, SS
System-wide analysis of organizational structures. Management and administrative policies of justice agencies—law enforcement, courts, and corrections. Prerequisites: CRJ 100, 200 and 402, ENG 101 and 102 (or 105), or approval of instructor.

461 Substantive Criminal Law. (3) F, S, SS
Criminal liability. Crimes against persons, property, and society. Governmental sanctions of individual conduct as formulated by legislatures and the courts. Prerequisites: CRJ 100, 200 and 402, ENG 101 and 102 (or 105), or approval of instructor.

462 Procedural Criminal Law. (3) F, S
The criminal process. Constitutional and legal problems associated with criminal procedures. Due process of law. Prerequisites: CRJ 100, 200 and 402, ENG 101 and 102 (or 105), or approval of instructor.

463 Discretionary Justice. (3) F, S, SS
Use of discretionary authority throughout all phases of the justice system. Cross-purpose effect of discretionary justice. Constitutional limitations on and judicial review of discretionary authority. Prerequisites: CRJ 100, 200 and 402, ENG 101 and 102 (or 105), or approval of instructor.

469 Political Deviance and the Law. (3) F, S, SS
An examination of the controversies created by political and deviant behavior; including a critical view of law as an agent of social control. Prerequisites: CRJ 402, ENG 102, or approval of instructor.

474 Legislation of Morality. (3) F, S
Understanding basic questions and contemporary issues related to law and morality. Process of creating and enforcing morality statutes (e.g., prostitution). Prerequisites: Junior status and completion of CRJ 360 or approval of instructor.

484 Internship in Justice Studies. (3 or 6) F, S, SS
Assignments in a justice agency designed to further the student's integration of theory and practice. Placements are arranged through consultation with students and agencies. May be taken for a total of up to 12 hours credit, of which a maximum of six shall be applied to the major. Prerequisites: Major status and completion of required courses (CRJ 100, 200, 402, ENG 101 and 102 (or 105), or approval of instructor.

494 Special Topics in Justice Studies. (1-3) F, S, SS
Topics chosen from various fields of justice studies. Prerequisites: CRJ 100, 200, 402, ENG 101 and 102 (or 105) or approval of instructor.

498 Pro-Seminar. (1-3) F, S
Small group study and research for advanced students. May be repeated for credit up to a maximum of nine hours, no more than three applied to the major. Prerequisites: Junior status, minimum cumulative GPA of 3.0, approval of instructor and completion of required courses: CRJ 100, 200, 402, ENG 101 and 102 (or 105).

499 Independent Study. (1-3) F, S, SS
Original study or investigation in the advanced student's field of interest under the supervision of a faculty member. May be repeated for credit up to a maximum of six hours, all applied to the major. Prerequisites: Senior status, minimum cumulative GPA of 3.0, approval of instructor and completion of required courses: CRJ 100, 200, 402, ENG 101 and 102 (or 105).

500 Justice Research Methods. (3) F, S, SS
Theories and methods of research with emphasis on development of designs most relevant to justice data and problems. Prerequisite: approval of instructor.

501 Justice System, Theory and Issues. (3) F, S
Analysis of the justice structure and process within various theoretical frameworks. Issues such as discretion, diversion and plea negotiations. Prerequisite: approval of instructor.

502 Primary Management in Justice Agencies. (3) S
Concepts of modern management and their application to justice-related agency supervision and management. Prerequisite: approval of instructor.

503 Crime and Social Causation. (3) S
Theories of deviance and crime as they relate to social policies and specific response of the justice complex. Prerequisite: approval of instructor.

509 Statistical Problems in Justice Research. (3) F, S
Methodological problems of research design and statistical methods specific to justice studies. Prerequisite: CRJ 500 or approval of instructor.

510 Understanding the Offender. (3) F
Survey of learning, personality, and biological theories of causation and their relevance to understanding criminal and delinquent behavior. Prerequisite: approval of instructor.

514 Justice Policy. (3) F
Assessment of the politics of justice policy as well as an understanding of the basic tools available to social scientists for analyzing the formulation, implementation and evaluation of justice policy. Prerequisite: approval of instructor.

520 Qualitative Theory and Data Collection. (3) F, S
The basic theoretical rationale and perspectives for justice related qualitative research, e. g., symbolic interactionism. Techniques for data collection, e.g., ethnography, depth interviewing. Prerequisite: approval of instructor.

521 Qualitative Data Analysis and Evaluation. (3) F, S
Analysis of a qualitative data, e.g., field notes, depth interview transcripts, document analysis, coding and retrieval with a microcomputer; qualitative evaluation. Prerequisite: CRJ 520 or approval of instructor.

530 Justice Education. (3) F
Development and philosophy of justice education and training. Problems of curriculum development and evaluation. Examination and evaluation of teaching methodologies and instructional aids. Prerequisite: approval of instructor.

540 Justice Administration. (3) S
Administrative policies and practices used in justice agencies, and their application to the various facets of the justice administrative process. Prerequisite: approval of instructor.

541 Justice Planning: Innovation and Change. (3) S
Normative factors in planning for standards and goals in the justice system. Application of innovation and change techniques in an interdependent system. Prerequisite: approval of instructor.

550 Survey Research in the Public Sector. (3) S
Design and implementation of survey research methods with an emphasis on public sector applications. Prerequisites: CRJ 500, 509 or PAF 500, 501, or equivalent, or approval of instructor.

560 Women and Crime. (3) F
Nature and extent of female crime, causation theories, and the treatment of females in the law and justice system. Prerequisite: approval of instructor.

570 Juvenile Delinquency. (3) F
Study of delinquency, including causation theories, alternative definitions of delinquency, official statistics and the critique and analysis of the interaction between social institutions and youth. Prerequisite: approval of instructor.

571 Juvenile Justice System. (3) S
Graduate-level introduction to juvenile justice system, including historical development, philosophical orientation, organizational structure, and contemporary controversies. Prerequisite: approval of instructor.

610 Law and the Social Sciences. (3)
Normative conceptualizations of law; law and the administrative state; impacts of law on society; discretion, street-level bureaucrats and the living law. Prerequisite: approval of instructor.

Special Courses. CRJ 584, 590, 591, 592, 593, 594, 598, 599. (See pages 35-36.)

Walter Cronkite School of Journalism and Telecommunication

Major Requirements

Freshmen enrolling in the Walter Cronkite School of Journalism and Telecommunication and students transferring from other departments within the University must complete a minimum of 30 semester hours with at least a 2.25 cumulative grade point average before they will be permitted to enroll in School courses beyond the 100 level. These 30 semester hours must include the following courses:

	Semester Hours
ENG 101 and 102, or ENG 105	3-6
POS 110 or POS 300	3
MCO 110	3
Laboratory Science (General Studies)	4
General Studies Electives	14-17
Total	30

A student who has completed 30 semester hours at another institution must remove any of the preceding course deficiencies during the first two semesters in the School. All students intending to take School courses beyond the 100-level must complete an English proficiency exam with a passing score. The exam will be administered by the School.

To become a major in either Journalism or Broadcasting, a student must complete at least 56 semester hours with a minimum cumulative grade point average of 2.50. A 2.25 cumulative grade point average must be maintained in order to continue to enroll in courses in the School. The student must become a major (2.50 GPA) by the time 86 semester hours is reached, otherwise the student is disqualified from taking courses in this School.

To ensure students receive a broad academic background, no more than 36 semester hours of courses in the major may apply to the 126 semester hours required for graduation. At least 18 hours of School courses, including one writing course, must be taken at Arizona State University. A student must make a "C" or higher grade in all courses taken in the major and in the required related field area. Specific area that may be used to fulfill the related field requirement are listed on the curriculum check sheets for each major available in the School. Courses elsewhere in the university which duplicate or are closely related to School subject matter may be restricted by the School.

The journalism news-editorial and broadcasting sequences are accredited by the American Council on Education for Journalism and Mass Communication.

Bachelor of Arts Degree Requirements

All students are required to complete 16 credit hours of a foreign language, or the equivalent to the 202 level.

Broadcasting—Consists of 42 semester hours of credit of which 30 must be in School courses and 12 in a related field. Students must take a required core of courses consisting of MCO 110 and 402 and TCM 200†, 201†, and 235†. In addition, the student must choose 12 credit hours in a major professional emphasis area. These include: Broadcast Journalism, Production Analysis, Broadcast Station Operations, Telecommunication Management and Telecommunication Promotion/Advertising.

These courses are in addition to other degree requirements. (See Degree Requirements, page 43.)

Journalism—Consists of 42 semester hours of credit of which 30 must be in School courses and 12 in a related field. Students must take a required basic core, consisting of MCO 110 and 402 and JRN 201†, 301†, 313† and one of the following: MCO 314, 412† or JRN 421†. In addition the student must choose 9 credit hours in a major professional emphasis area. These include; News-Editorial, Public Relations or Photojournalism.

These courses are in addition to other degree requirements. (See Degree Requirements, page 43)

Bachelor of Science Degree Requirements

(The Bachelor of Science program is under review by the faculty and will not be available as an option for students entering under this catalog.)

Broadcasting—Consists of 42 semester hours of credit, of which 30 must be in School courses and 12 in a related field. Students must take a required basic core consisting of MCO 110 and 402, and TCM 200†, 201†, 235† and 332†. In addition the student must choose 9 credit hours in a major professional emphasis area. These include Production, Management or Broadcast News.

Bachelor of Science majors are also required to complete 15 credit hours which shall consist of one course from each of the following areas: statistics, computer science, communication (applied speech), English composition and management/marketing. These courses are in addition to other degree requirements and may not be used to satisfy General Studies requirements. (See Degree Requirements, page 43).

Journalism—Consists of 42 semester hours of credit, of which 30 must be in School courses and 12 in a related field. Students must take a required basic core consisting of MCO 110 and 402, JRN 201†, 301†, 313† and one of the following: MCO 314, 421 or JRN 412†. In addition the student must choose 9 credit hours in a major professional emphasis area. These include: News-Editorial, Public Relations or Photojournalism.

Bachelor of Science majors are also required to complete 15 credit hours which shall consist of one course from each of the following areas: statistics, computer science, communication (applied speech), English composition and management/marketing. These courses are in addition to other degree requirements and may not be used to satisfy General Studies requirements. (See Degree Requirements, page 43).

Major Teaching Field Requirements

Bachelor of Arts in Education Degree Curriculum

Journalism—Consists of 45 semester hours of credit. Courses MCO 110, JRN 201†, 301†, 313†, 351† and 480† are required. An additional 27 hours, including 15 hours in School course offerings, must be taken on approval by the advisor in consultation with the student. The remaining courses may be in closely related fields.

Minor Teaching Field Requirements

Journalism—Consists of 24 semester hours of credit. Courses MCO 110, JRN 201†, 301†, 313†, 351† and 480† are required. The remaining courses are to be selected in consultation with a journalism advisor.

General Studies.

The General Studies program for the Journalism/Telecommunication majors consists of a total of 54 semester credit hours with 12 credit hours required in humanities and fine arts, 18 credit hours in social and behavioral sciences, and 12 credit hours in science and mathematics. Additional courses may be taken in each of the three groups and/or from General Studies electives to complete the 54 total required.

Each Broadcasting and Journalism major is required to take a minimum of 34 credit hours in background courses, within the General Studies requirements. Students will be required to take one course in each of the following: Political science (either 110 or 300), history, economics, communication, computer science, a natural (physical) science laboratory course, English composition (beyond Freshman English level), philosophy, psychology, statistics and one course in advertising.

Related Field—Each student is required to complete a 12 credit hour related field (or minor). This is to compliment the courses taken in the major emphasis areas.

See the curriculum check sheets for each major for the full details and suggested related field areas.

Graduate Program

Master of Mass Communication Degree.
The curriculum for the M.M.C. degree is designed to help students achieve intellectual and professional growth, to prepare students for positions in the mass media, and to provide a background to enable those currently in the media to advance their careers. Information on the Master of Mass Communication program is detailed in the *Graduate College Catalog.*

MASS COMMUNICATION

MCO 110 Introduction to Communication. (3) F, S, SS
Organization, function and responsibilities of the media and adjunct services. Primary emphasis on newspapers, radio, television and magazines. Not open to students with credit for MCO 120.

120 Media and Society. (3) F,S
Role of newspapers, magazines, radio, television and motion pictures in American society. Not open to students with credit for MCO 110.

314 History of Communications. (3) F,S
American journalism from its English and colonial origins to the present day. Development and influence of newspapers, magazines, radio, television and news gathering agencies.

402 Communications Law. (3) F,S,SS
Legal aspects of the rights, privileges and obligations of the press, radio and television.

421 News Problems. (3) S
Trends and problems of the news media, emphasizing editorial decisions in the processing of news. Prerequisite: nine hours of mass communication/journalism/telecommunication courses, or approval of instructor.

430 International Communication. (3) F,S
Comparative study of communication and media systems. Information gathering and dissemination under different political and cultural systems.

450 Visual Communication. (3) N
Theory and tradition of communication through the visual media with emphasis on the continuity of traditions common to modern visual media.

503 Press Freedom Theory. (3) S
Examination of philosophical and legal aspects of press freedom. Emphasis on First Amendment theory evolution from 1791 to present.

510 Research Methodology in Mass Communication. (3) F
Identification of research problems in mass communication. Overview of questionnaire constructions. Attention to survey, historical, legal research methods.

520 Mass Communication Theories and Process. (3) F, S
Analysis of various theoretic models of mass communication with emphasis on the applications of these theories to various professional communication needs.

522 Mass Media and Society. (3) F
Mass media as social institutions, particularly interaction with government and public. Emphasis on criticism, normative statements.

530 Media Ethics. (3) S
Ethical conventions and practices of print and electronic media as they relate to the government and private sectors of the society.

JOURNALISM

JRN 201 Journalism News Writing. (3) F,S,SS
Writing news for the print media. Prerequisites: MCO 110 or 120, successful completion of English proficiency requirement and demonstrated typing ability of 30 words per minute.

301 Reporting. (3) F,S
Fundamentals of news gathering, interviewing and in-depth reporting. Prerequisite: JRN 201†.

313 Introduction to Editing. (3) F,S
Copyediting and headline writing. Electronic editing on video display terminals. Prerequisite: JRN 301†.

340 Magazine Writing. (3) F,S
Writing and marketing magazine articles for publication. Prerequisite: JRN 301† or approval of instructor.

351 Photojournalism I. (3) F,S
Taking, developing and printing pictures for newspapers and magazine production on a media deadline basis. Students should have their own cameras. Prerequisite: JRN 201† or approval of instructor.

401 Public Relations Techniques. (3) F,S
Theory and practice of publicity, public relations and related techniques and procedures. Prerequisite: JRN 201† or approval of instructor.

412 Editorial Interpretation. (3) N
The press as an influence on public opinion. The role of the editorial in analyzing and interpreting current events. Prerequisite: JRN 301†.

413 Advanced Editing. (3) F,S
Theory and practice of newspaper editing, layout and design, picture and story selection. Prerequisite: JRN 313†.

414 Business and Industrial Publications. (3) S
Theory and practice of layout, typography and design for magazines, brochures and industrial publications.

415 Writing for Public Relations. (3) F, S
Development of specific writing techniques for the practitioner in public relations agencies and divisions of major organizations.

420 Reporting Public Affairs. (3) F,S
Instruction and assignments in reporting the courts, schools, government, city hall, social problems and other areas involving public issues. Prerequisite: JRN 301†.

422 Business Reporting. (3) N
Analyzing and reporting economic and consumer affairs. Prerequisites: three hours of economics, JRN 301†.

451 Photojournalism II. (3) F,S
Theory and practice of photojournalism with emphasis on shooting, lighting and layout for the media. Prerequisite: JRN 351†.

452 Photojournalism III. (3) F,S
Advanced theory and practice of photojournalism with emphasis on the photo essay and illustrations in black and white and color. Prerequisite: JRN 451†, 2 lectures, 2 hour lab.

460 Print Media Management. (3) F, S
Problems and functions involved in the management and marketing of a newspaper or magazine. Interaction of management with the organization and community. Prerequisite JRN 201 or approval of instructor.

480 Methods of Teaching Journalism. (3) F
Methods of instruction, organization and presentation of appropriate content in journalism. Prerequisite: six hours of journalism at 300 level and above or approval of instructor.

TELECOMMUNICATION

TCM 200 Fundamentals of Radio-Television. (3) F,S,SS
Structure of telecommunications in the U.S.: history, regulation, organization, with emphasis on broadcasting. Relationship to advertising, research and government agencies. Prerequisite: MCO 110 or 120.

201 Broadcast News Writing. (3) F,S,SS
Writing for electronic media, news and continuity. Prerequisites: MCO 110 or 120, successful completion of English proficiency requirement and demonstrated typing ability of 30 words per minute.

235 Studio Techniques. (3) F,S,SS
Introduction to the theory, techniques and operation of telecommunication production equipment, audio and video. Prerequisite: TCM 200†. One lecture, 4 hours studio.

300 Videography. (3) N
Basics of video continuity as used in telecommunication news and information. Prerequisites: TCM 201†, 235† and 315.

315 Broadcast News Reporting. (3) F,S
News and information practices of networks, stations and industry. Advanced practice in writing, reporting and editing. Prerequisites: TCM 201†, 235†.

332 Broadcast Programming. (3) F,S,SS
Programming theory and evaluation, regulation, ethics and responsibilities, and basics of audience psychographics and effects. Prerequisites: TCM 200†, 201† and junior standing.

336 Television Production. (3) F,S
Planning, and analyzing the television production process. Prerequisites: TCM 201†, 235†. One lecture, 4 hours studio.

343 Broadcast Announcing. (3) F,S
Techniques of radio and television announcing. Prerequisites: TCM 201†, 235†.

431 Advanced Writing for Telecommunication. (3) F,S
Technique and practice in non-news writing for telecommunication, including broadcast, industrial and educational areas. Prerequisite: TCM 201† and junior standing.

433 Broadcast Station Operations. (3) F
Operational procedures in the departments of a radio or television station. Prerequisites: TCM 201† and 332† or approval of instructor. May be repeated for credit.

435 Cable TV and Emerging Telecommunication Systems. (3) F, S
Structures and utilization of cable, industrial and instructional television and satellite and videocassettes. Prerequisite: TCM 200 and 201†.

437 Television Directing. (3) S
Aesthetics of video directing for broadcast, cable, industry, and education. Prerequisite: TCM 336†. One lecture, 4 hours studio.

472 Broadcast Station Management. (3) S
Management principles and practices, including organization, procedures, policies, personnel problems and financial aspects of station management. Prerequisite: TCM 200 and 201.†

Special Courses: MCO 394, 484, 492, 493, 494, 500, 580, 584, 590, 591, 592, 593, 598, JRN 484, 494, 499, 584, TCM 499, 584. (See pages 35-36.)

Leisure Studies

PROFESSORS:
CHEATHAM, GREEY

ASSOCIATE PROFESSORS:
HALEY (GHALL 204), ALLISON

ASSISTANT PROFESSORS:
ROBERTSON, TEYE

LECTURER:
VIRDEN

Departmental Major Requirements

Freshmen enrolling in the Department of Leisure Studies and students transferring from other departments within the University must complete a minimum of 56 semester hours with a minimum of 2.50 cumulative grade point average before being officially admitted to the Bachelor of Science program in Recreation with major status. As part of this minimum requirement, the students must successfully complete REC 160 and ENG 101-102 *or* ENG 105 (or the English Proficiency Examination) with a grade of "C" or better.

Transfer students who have completed 56 semester hours or more at another institution must remove any of the above course or scholastic deficiencies prior to being admitted with major status to the Bachelor of Science program in Recreation.

The student must maintain a minimum 2.50 cumulative GPA to continue to enroll in professional core courses in the Department.

The student must complete a minimum of 37 semester hours in upper and lower division General Studies courses as listed in the College of Public Programs requirements (page 339). General Studies courses may not be used concurrently toward the General Studies requirement and related requirements within the major core.

Bachelor of Science Degree Curriculum

Consists of 69-75 semester hours of course work including related studies. The following courses are core major courses required of all undergraduate majors:

			Semester Hours
REC	120	Dynamics of Play	3
REC	160	Leisure and Society	3
REC	210	Urban Leisure Systems	3
REC	330	Theory and Principles of Recreation Programming	3
REC	364	Recreation for Special Populations	3
REC	462	Administration of Leisure Services	3
REC	463	Senior Internship	12
		Total	24

REC 160, 210, 330, 462, and 463 are to be taken in sequence and may not be taken concurrently.

The remaining courses will be reflective of the professional emphasis area selected by the student in consultation with his/her assigned departmental advisor. The five (5) professional emphasis areas in the department follow:

Travel/Tourism. This emphasis provides a broad-based academic approach to the travel/tourism field that features administrative, environmental and planning con-

cerns. Partially funded by the Arizona Office of Tourism, this option brings to the student a wide variety of tourism concepts and information. Furthermore, by emphasizing applied and practical aspects of the tourism industry, this emphasis endeavors to familiarize the student with current professional problems and opportunities. National and international career placements and settings include tourism, travel and convention bureaus, commercial recreation agencies and resort and destination developments.

American Humanics. The Department of Leisure Studies prepares with professionals for the field of voluntary youth and human service agency management. Academic course work is supplemented with a cocurricular program of workshops, seminars, field trips, and cooperative education experiences. This emphasis is one of only 16 nationally select youth agency administration programs funded by and affiliated with American Humanics, Inc., the nation's largest non-profit, educational organization committed to the training and job placement of students within this career field. Career opportunities include positions with the American Red Cross, Big Brothers, Big Sisters, Boy Scouts of America, Boys' Clubs, Camp Fire, 4-H, Girl Scouts of the USA, Girls' Clubs, Junior Achievement, YMCA, YWCA and numerous other youth and human service agencies.

Outdoor Recreation and Education. This area of emphasis establishes a factual and information base that assists the student in his/her assumption of professional responsibilites in agencies which have the primary mission of administering and providing outdoor recreation opportunities. These include various state, county and regional recreation agencies such as the United States Forest Service, the Bureau of Land Management, the National Park Service as well as private organizations that provide outdoor recreation and education services.

Urban Recreation. This area of emphasis is designed to provide the student with competencies necessary to function in leadership, supervisory or administrative positions within a variety of community, leisure and human service agencies. Agency settings include park and recreation departments, public human service agencies, regional and county park and recreation departments and quasi-public service agencies.

Therapeutic Recreation. This area of emphasis is designed to prepare students for work with groups exhibiting special societal needs. These special populations include youth and adult criminal offenders, alcoholics, drug addicts, the mentally retarded, mentally ill, physically handicapped or other economically or physically disadvantaged groups. Career placements in this area typically include the following: hospital and school settings, urban park and recreation departments, correctional facilities, rehabilitation programs, and gerentological and adult development centers. Additionally, 200 cock hours of recreation leadership experience are required prior to doing Senior Internship (REC 463). Students are not permitted to take additional course work during the Senior Internship placement period.

A student must attain a grade of "C" or better in all courses within the major including the related area. Specific courses which may be used to fulfill the related requirements are listed in a brochure available in the Department.

LEISURE STUDIES

REC 120 Social Psychology of Play. (3) F,S
Theoretical bases of play. Factors influencing play choices and attitudes. Analysis of game structure and function.

150 Camping and Outdoor Skills. (3) F, S
Theories and practical skills for outdoor living. Wilderness philosophy, outdoor experience culminating in ACA certification (if desired). Overnight trips.

160 Leisure and Society. (3) F, S
Analysis of the human relationship to leisure. Historical survey of philosophical, psychological, and socioeconomic bases for development of systems that provide leisure programs.

210 Urban Leisure Systems. (3) F, S
Systematic overview of interrelated public, private and commercial urban leisure services. Prerequisite: REC 160. Leisure Studies majors only.

300 Fund Raising. (3) F
Methods, techniques and directed experience in fund raising for voluntary youth and human services agencies. Budget control and accountability.

310 Volunteerism. (3) F
Administration of volunteer service programs. Study and analysis of the volunteer personnel process.

320 Youth and Human Service Workshop. (1) F, S
Forum for exchange between students and professional agency personnel. Variable topics, guest speakers. Prerequisite: approval of instructor.

330 Theory and Principles of Recreation Programming. (3) F, S
Foundations for effective program planning. Theory and principles related to varied settings and types of activity. Formal planning process. Prerequisites: REC 160†, 210†. Leisure Studies majors only.

340 Outdoor Survival. (4) F, S
Skills for survival. Use of plant, animal life in short, long-term emergency survival in the Southwest. Off-campus weekend required.

350 Recreation Planning and Design. (4) F
Design and development of leisure and recreational resources with a focus upon man and his environment.

360 Resource Management. (3) S
Management and decision-making in recreation resource agencies. Policy, analysis and use conflicts. Prerequisite: Leisure Studies majors only.

364 Recreation for Special Populations. (3) F, S
Concepts, methods, settings involving recreational services as applied to special groups in American society; e.g., youthful and adult offenders, alcoholics, drug addicts, mentally retarded, mentally ill, and physically handicapped. May include field experience.

370 Environmental and Outdoor Recreation Issues. (3) F
Survey of outdoor recreation resource delivery in the public sector.

380 Outdoor Education. (3) F, S
Utilization of the outdoors to facilitate learning and enjoyment of the natural environment. Techniques of organizing outdoor education programs. Off-campus weekend required.

400 Therapeutic Recreation. (3) S
Principles, practices of program development, evaluations, professional roles and support services related to therapeutic recreation service. Off-campus labs. Leisure Studies majors only. Prerequisite: REC 364†.

410 Tourism and Commercial Recreation. (3) S
Survey and analysis of the role and impact of tourism and commercial recreation enterprise on the community, state and citizen. Prerequisite: Leisure Studies majors only.

420 American Humanics Institute. (1) F, S
Mini-intensive national management institute for voluntary youth and human service agency personnel. Out-of-state conference required. Prerequisite: approval of instructor.

430 Youth Agency Administration. (3) S
Analysis of administrative structure, decision-making and program delivery within voluntary youth and human service agencies.

440 Areas and Facilities. (3) S
Public, private and commercial recreation areas and facilities. Survey of design, function, aesthetics and relationships.

450 Recreation and Aging. (3) F
Organized recreation services and facilities for the aged. Socioeconomic considerations affecting delivery of comprehensive leisure services to the elderly. Off-campus laboratory. Prerequisite: approval of instructor.

460 Issues in Therapeutic Recreation. (3) S
Contemporary problems/issues confronting the therapeutic recreation field-professional development, programs and services, legislation, philosophical and research issues. Off-campus laboratories. Prerequisites: REC 364, Leisure Studies majors only.

462 Administration of Leisure Services. (3) F,S
Basic principles of administration and their application to successful administration practices. Analysis of administrative function, structure and policies. Prerequisite: REC 330†. Leisure Studies majors only.

463 Senior Internship. (6 or 12) F, S, SS
Supervised guided experience in selected agencies. Prerequisites: REC 330†, 462†, senior standing. Recreation majors only.

470 Camp Organization and Administration. (3) F
Organization and administration of camps. Preparation for camp management; consideration of budget, camp-site and personnel.

500 Research Methods. (3) S
Introduction to recreation research methods with emphasis on methodological questions, research issues and techniques relevant to contemporary social research.

540 Recreation Services for the Aged. (3) S
Recreational activities, special facilities, use of volunteers, public relations techniques, fund raising, and the dynamics of interpersonal relationships relative to the senior citizen.

552 Philosophical Foundations of Leisure. (3) F
Analysis of fundamental philosophical concepts as they relate to principles and practices of organized programs for leisure.

558 Current Issues in Recreation. (3) F
Contemporary issues and problems confronting the leisure services profession. Prerequisite: REC 552.

569 Commercial Recreation. (3) F'82
Procedures in determining public needs, initiating enterprise, promoting activity, and evaluating the total project in terms of both proprietor and public.

570 Outdoor Recreation Planning. (3) S'82
Planning for administrative duties in varied recreation settings. Prerequisites: REC 370 or equivalent.

Special Courses: REC 294, 298, 484, 492, 493, 494, 497, 498, 499, 500, 580, 584, 590, 591, 592, 593, 598, 599, 691. (See pages 35-36.)

School of Public Affairs

PROFESSORS:
HALL (WILSON 206), BECKER, CAYER, HENRY, KARNIG, KELLY, MUSHENO, PALUMBO, PERRY, WESCHLER, WIGAND

ASSOCIATE PROFESSORS:
BROWN, DANEKE, ERIBES, HALL, MANKIN, McCLAIN, MERRILL, MUSHKATEL, WILSON

ASSISTANT PROFESSORS:
NIGG, PIJAWKA

LECTURER:
DeBOLSKE

PROFESSOR EMERITUS:
SACKTON

The faculty in the School of Public Affairs offer a graduate program leading to the professional degree, Master of Public Administration (MPA). The MPA program has been recognized to be in conformity with standards developed by the National Association of Schools of Public Affairs and Administration. The faculty also participate in the interdisciplinary degree program leading to the Doctor of Public Administration. Consult the *Graduate College Catalog* for information about these programs. The ba-

sic aims of the School are: (1) to offer professional education programs leading to graduate degrees in public administration and to encourage mid-career education for public administrators by offering evening course work at the state government complex; (2) to maintain a research program designed to identify problems, disseminate information and propose solutions to major public problems; (3) to provide a high level of public service in meeting needs in Arizona and the nation.

PUBLIC AFFAIRS

PAF 500 Research Methods I. (3) F, S
Presentation of multivariate statistics, computer applications and introduction to major research design issues. Prerequisite: an approved course in statistics.

500 Research Methods II. (3) F, S
Advanced treatment of design and measurement issues with emphasis on applied research projects by students.

501 Statistics in Administration. (3) F, S
Application of statistical methods to problems in finance, personnel, survey and planning.

502 Computers in Administration. (3) N
Experience in use of computer technology for public administration problem solving.

503 Organization Theory. (3) N
Organization theories and current research emphasis with application to public administrative organizations.

504 Comparative Administration. (3) N
Literature on comparative public administration theory. Bureaucracies and their impact on the political development process. Selected nations will be studied.

505 Intergovernmental Relations. (3) N
Evolution, growth, present status and characteristics of the U.S. federal system of government. Federal-state relations, state-local relations, regionalism, councils of government, interstate cooperation, grants-in-aid, and revenue sharing.

506 Regional Cooperation, Programs and Associations. (3) N
Inter- and intrastate regional political and administrative cooperative devices and bodies.

507 Bureaucracy and Public Affairs I. (3) F, S
Analyses of the conceptual and contextual elements of public administration and policy.

508 Bureaucracy and Public Affairs II. (3) F, S
Analyses of public administration concepts applied to management situations including personnel, finance, budgeting, decision-making and implementation.

510 Governmental Budgeting. (3) F, S
Legal, social, economic, and political nature of governmental budgets and the budgetary process. Theories and social consequences of budget decision-making and practices of budget control.

511 Governmental Finance Management. (3) A
Sources of funding, management of funds and debts and general pattern of expenditures, in states, counties, cities and districts.

512 Public Affairs Economics. (3) A
Role of economics in public affairs with examples from transportation, urban form, Rio Salado project, housing land use, flood control, growth, aspects of energy economics.

520 Public Management. (3) A
The management process in government and public agencies, with emphasis on the executive leadership within the public sector.

521 Public Personnel Management. (3) A
History of the civil service, recruitment, selection, position and wage classification, motivational analysis, productivity, public unionism, and ethics in the public service.

522 Public Labor Relations. (3) A
Rise of public unionism, managerial policy toward unionism, conflict resolution, impact of unionism on budgets, personnel policies and public policy.

523 Public Information Systems. (3) N
Systems analysis concepts and theory as applied to administration. Alternative modes of information organization and their impact on public decision-making.

524 Community Conflict Resolution. (3) N
Interdisciplinary approach to understanding the dynamics of community conflict. Strategic considerations in policy design and advocacy; potential reaction to conflict. Relevant models and research findings generated by both case studies and comparative methods.

525 Public Program Management. (3) A
Governmental service programming: formulating, financing, operating, evaluating and reporting. Analysis of interagency relationships and the role and conduct of research in the programming process.

530 Management of Urban Government. (3) A
Administrative practices and behavior within the urban political administrative environment. Functional areas such as citizen participation, urban planning, urban transportation, and the conflicts between urban politics and administrative efficiency.

531 Comparative Urban Administration. (3) N
Development of urban governments within different cultural, social and political milieu. Cities within developing countries as well as in the developed countries of Europe and North America.

532 Urban Planning Administration. (3) A
Historical and present day uses of urban planning and procedures for its implementation. Basic principles and practices.

533 Politics of Urban Planning. (3) A
Urban planning policy issues frequently faced by local, state and federal government. Consideration of the relationships between the political leader, the professional planner and the citizen.

535 The City and County Manager. (3) A
The manager's role and resources in the differing forms of administrative, legislative and community sectors.

540 Public Policy Analysis. (3) A
Theories which attempt to explain public policy formulation. Application of social science to policy issues.

541 Topics in Public Policy Analysis. (3) A
May be repeated for credit. Topics may be offered from the following: (a) Aging, (b) Art, (c) Education Policy, (d) Environmental Public Policy, (e) Health, (f) National Public Policy, (g) Public Safety, (h) Recreation, (i) Transportation, (j) Welfare.

542 Science, Technology and Public Affairs. (3) N
The influence of science and technology on governmental policy-making; scientists as administrators and advisors; governmental policy-making for science and technology; government as a sponsor of research and development.

543 Public Management of Land. (3) N
Extent, basis, procedures, and consequences of land management by agencies of federal, state and local governments.

544 Preparation of Reports in Public Administration. (3) N
Intensive practice in written and oral presentation of reports to conferences covered with problems in public administration. Visual aid techniques.

545 Research Data Management. (3) N
Techniques and problems associated with data management in a research environment. Data base management systems, security and integrity, accessibility and cost.

546 Data Base Management Systems in Public Administration. (3) N
Concept and use of modern data base management systems in an administrative organization. Advantages and disadvantages of this approach.

547 Program Evaluation. (3) N
Various methodologies available for the evaluation of public policies and programs.

550 Survey Research in the Public Sector. (3) N
Design and implementation of survey research methods with an emphasis on public sector applications. Same course as CRJ 550. Prerequisites: PAF 500 and 501, or CRJ 500 and 509, or equivalent, or approval of instructor.

551 Urban Planning Evaluation. (3) N
Concepts, principles and methods employed by public planners in the analysis of urban problems involving multiple criteria decisions. Prerequisite: Formal graduate level course work in statistics and planning.

552 Urban Housing Policy. (3) N
Comprehensive consideration of the revitalization of American cities with major emphasis upon the housing process and related institutions and services.

553 Social Impacts of Planning. (3) N
Analyzes the planning needs of various social groups in urban settings and the appropriate mechanisms of public sector planning for multiple publics.

554 Urban Growth Administration. (3) N
Examines the process of urban growth and change. Partnership roles played by public and private sectors in management is emphasized.

555 Environmental Policy and Management. (3) N
Analysis of environmental policy and planning issues and principles related to the analysis and management of natural and urban/regional resources.

556 Urban Policy Making. (3) N
Analysis of the opportunities and costs of influencing public policy and the roles of officials and bureaucracies in decision making.

591 Seminar. (3) F, S
Topics may be selected from the following: (a) General Public Administration, (b) Public Finance Administration, (c) Public Management, (d) Urban Affairs and Urban Planning, (e) Public Policy Analysis, (f) Information Management.

593 Planning Workshop. (3) N
Practical team research and field experience. Emphasis on the synthesis of public sector planning methodologies, concepts and techniques applied to a local planning problem.

600 Research Design and Methods. (3) F
Advanced methods of research design and analysis. Prerequisites: Formal graduate level course work in statistics and in research methods.

601 Seminar: Policy Analysis and Program Evaluation. (3) S
Normative and conceptual issues of policy formulation, implementation, and evaluation; empirical approaches and methods of program evaluation and policy analysis.

602 Seminar: Foundation of Public Administration. (3) F
Ethical, social, legal and philosophical foundations of public administration.

603 Seminar: Organization and Behavior in the Public Sector. (3) S
Structure, organization, conduct, and performance of public sector institutions in the administration of public policy. Prerequisite: PAF 602.

Special Graduate Courses: PAF 580, 584, 590, 592, 594, 598, 599, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

School of Social Work

Jesse F. McClure, Ph. D.
Dean

The School of Social Work offers three degree programs: Doctor of Social Work (D.S.W.), a two-year program leading to the degree of Master of Social Work (M.S.W.) and a Bachelor of Social Work (B.S.W.). The M.S.W. and B.S.W. programs are accredited by the Council on Social Work Education for the preparation of M.S.W. and B.S.W. level Social Work practitioners.

Degrees
Bachelor of Social Work

The School's undergraduate curriculum leads to a Bachelor of Social Work degree (B.S.W.). During the freshman and sophomore years, students concentrate on obtaining a strong background in Liberal Arts and are classified as pre-majors until they are officially admitted to the major. Entrance into the social work major from the pre-major is *not* automatic (see section on Admissions).

Junior and senior social work majors focus on social work courses in: social policy and services, human behavior in the social environment, social work direct practice, social work research, and field instruction in community agencies. In addition, majors take additional courses in related areas and electives.

Objectives

The undergraduate curriculum is designed to prepare students for beginning level social work practice, and to provide preparation for graduate training in social work. It also offers social welfare content in General Studies courses for Liberal Arts students.

In consideration of the varied cultural and ethnic composition of Arizona and the Southwest, the program prepares students for trans-ethnic social work and actively recruits from ethnic minority groups.

Degree Requirements

All candidates for graduation in the Bachelor of Social Work curriculum are required to present at least 126 hours of credit, of which at least 50 hours must consist of upper division courses. A cumulative grade point index of 2.00 is required for graduation.

Requirements for the Bachelor of Social Work degree:

		Semester Hours
I.	Communications Requirement	6
II.	General Studies Requirement	51
III.	Social Work Core Requirement	42
IV.	Related Social Work Requirement	15
V.	Electives	12
	Total	126

I. Communication Requirement.

ENG 101—3 credit hours

ENG 102—3 credit hours
  or
ENG 105*—3 credit hours (see page 29, "University English Proficiency Requirement").

*Those students taking ENG 105 must complete 3 additional hours in any subject to total 126 semester hours for graduation.

II. General Studies Requirement. To meet University General Studies requirements and to assure breadth and depth to the student's education, all social work students must complete a total of 51 semester hours of General Studies courses with the designated minimum semester hours in each of the following fields. Students may choose the requirements for the catalog under which they entered the University or the following:

Humanities and Fine Arts..........11 semester hours
Required: Philosophy 101 or 103 (3 hrs.)

Elective: Spanish 101, 102 (8 hrs.)* or: Architecture (APH and DSC 100, 101, 200, 201, 313, 314 courses only); Art History (ARH courses only); Dance History (DAH courses only); English (except ENG 101, 102, 105, 107, 108); Foreign Language (Spanish recommended); Humanities (HUP courses only); Music (MUS courses only); Philosophy; Religious Studies; Theatre (THE courses only).

*Highly recommended

Social and Behavioral Sciences..21 semester hours
Required: SOC 101 Intro. to Soc. (or SOC 301 Principles of Soc.) (3 hrs.); POS 110 Government and Politics (3 hrs.) or POS 300 American National Government (3 hrs.); ECN 200; or 111; or 112 (3 hrs.); PGS 100 Intro. to Psychology (3 hrs.); SOC 341 Modern Social Problems (3 hrs.); HIS (topical, indigenous series) (3 hrs.) e.g., 362, 364, 367, 368, 370, 380, 422, 424, 425, 428, 430

Sciences and Mathematics...................10 sem. hrs.
Required: A lab science (4 hrs.)

Elective: BIO 300 Natural History of Arizona (3 hrs.) *or* GLG 300 Geology of Arizona (3 hrs.) *or* Anthropology (ASM courses only) (3 hrs.)

Additional Courses.................................9 sem. hrs.
Required: FAS 331 Family Relationships (3 hrs.); Statistics.

III. Social Work Core Requirements

		Semester Hours
SWU 271	Introduction to Social Work	3
SWU 291	Community Resources	3
SWU 301	Human Behavior in the Social Environment I	3
SWU 310	SW Practice I - Skills	3
SWU 331	Social Policy and Services I	3
SWU 402	Human Behavior in the Social Environment II	3
*SWU 410	SW Practice II - Systems	3
*SWU 411	SW Practice III - Settings	3
*SWU 412	Field Instruction I	6
*SWU 414	Field Instruction II	6
SWU 420	Practice Oriented Research	3
SWU 432	Social Policy and Services II	3

SWU 412 and 414 each require 16 hours weekly per semester in the field. Students must file an application for field work before registering for the courses.

*Majors Only

No credit will be granted toward fulfilling major core requirements in any course in the student's major unless the grade in that course is at least a "C".

IV. Related Areas. (15 hours) Although the practice model of the program is a social work generalist, related areas and electives offer students opportunities to pursue their interests in special areas of service. Students are urged to consult their advisors for specific course suggestions.

V. Electives. (12 hours) In order to fulfill the University requirement of 126 credit hours for graduation, the student may take the 12 credit hours of electives at the School of Social Work or other departments within the University. Students are encouraged, in consultation with their advisor, to use these elective courses to supplement their particular area of concentration suggested under related areas. Economics, education, management, political science, psychology, decision and information systems, and sociology are only a few of the academic units offering a specialized knowledge of value to the professional social work practitioner.

Admissions

The Bachelor of Social Work degree program at Arizona State University is divided into the pre-social work major and the social work major.

Pre-social work major consists of freshman and sophomore students who have been admitted to the University and have declared social work as their major, as well as students transferring to the School of Social Work from other colleges within the University and other universities or junior colleges who have not successfully completed the admission process to the program. Students transferring from other universities or community colleges as pre-majors should follow the procedure outlined on pages 19 and 21 of this catalog. Students transferring from another college within the University must obtain a "Change of College" form from the Undergraduate Social Work office.

Admission Procedure for Social Work Majors. (Students having 45 credit hours or more). In order to meet accreditation standards, the Undergraduate Program of the School of Social Work has had to place a limitation on the number of social work majors enrolled. Students wishing to enter the social work major are required to apply for admission to the program in addition to obtaining an official certificate of admission to the University. A student is eligible to apply for admission to the social work major during the last semester of his/her sophomore year. It is expected that applicants will have completed 55 semester hours by the end of the semester in which they are

applying. Students are admitted to the major at the beginning of the term following the semester during which they applied.

Students who have been pre-majors will automatically be sent social work major application packets at the end of the semester in which they successfully completed 45 hours. Upon notification of formal acceptance at ASU, the Undergraduate Social Work office will mail the social work major application packet to the address listed on the official certificate of admission of transfer students having completed 45 hours during the previous semester or before. For this reason, students are urged to notify the Undergraduate Social Work office of any change in address. Students also may pick up social work major application packets at the Undergraduate Social Work office in West Hall 137 or request that they be mailed to their home address by calling 965-6081.

Applicants are reviewed for admission for the fall and spring semester. Students applying must have a certificate of admission to the University in their files by: November 1 for spring admission and February 1 for fall admission. Students should allow at least four additional weeks to process their ASU application to recveive their acceptance. All other application material (i.e., application form, additional statement and two letters of reference) must be returned to the Admissions Office, School of Social Work, Undergraduate Program, Arizona State University, Tempe, AZ 85287 by November 15 for spring admission or February 15 for fall admission. Failure to meet these deadlines may result in the applicant having to wait for the next admissions process. Applicants will be notified by mail of the committee's decision within five weeks following the application deadline. Those applicants who have been denied admission may request a conference to discuss the decision and obtain guidance in the development of alternative plans.

Criteria for Admission. Admissions are based on the following criteria: (1) Overall GPA (Grade Point Average). Generally, a 2.5 cumulative grade point average is required, but consideration is given to applicants whose grades reflect a recent or constant trend of improvement. (2) A 2.5 Cumulative GPA in core social work courses. (3) Applicant's educational and career goal's compatibility with the educational objectives of the School. (4) Volunteer and/or

work experience in human services. Personal life experience may be considered. (5) References. Two references are required for each applicant. These references should be from two persons who have known the applicant in a professional capacity.

Social Work

PROFESSORS:
McCLURE (WEST HALL), ALDRIDGE, COUDROGLOU, DALEY, LEWIS, MacEACHRON, MONTIEL, MORONEY, WONG

ASSOCIATE PROFESSORS:
BRAND, ENGELHARDT, FAUSEL, KETTNER, LEYBA, MAGEL, MONTERO, NICHOLS, RED HORSE, WOODMAN

ASSISTANT PROFESSORS:
ANGULO, ASHFORD, JORQUEZ, LeCROY, NETTING, SCHILIT

PROFESSORS EMERITUS:
CRANMER, HARWARD, LUNDBERG, POLENZ

SOCIAL WORK (SWU)

SWU 271 Introduction to Social Work. (3) F, S
Analysis of contemporary social welfare services and professional social work. Designed for freshmen/sophomores considering this major. Prerequisite for all other social work courses.

291 Community Resources. (3) F,S
Purpose, structure and delivery system of community welfare agencies. Includes 40 hours observational experience in local agencies. Prerequisite: SWU 271 or concurrent enrollment.

301 Human Behavior in the Social Environment I. (3) F, S
Introduction to interrelation of bio-psycho-sociocultural systems and their effect on behavior focused on Southwestern ethnic and cultural groups. Prerequisites: SWU 271, 291, SOC 101, PGS 100.

310 Social Work Practice I - Skills. (3) F, S
Introduction to social work methods, emphasizing communicative skills: role-playing, video training, cross-cultural interviewing, communication patterns. Prerequisites: SWU 271, 291, 301.

331 Social Policy and Services I. (3) F, S
History, philosophy and values of social welfare; function and role of social welfare in society; development of the social work, profession and practice. Prerequisites: Junior standing and POS 110; 3 hours ECN; SWU 271, 291.

402 Human Behavior in the Social Environment II. (3) F, S
Sequel completing study of life span development and behavior which forms base for social work practice. Prerequisites: senior standing and SWU 271, 291, 301.

410 Social Work Practice II - Systems. (3) F, S
Emphasizes interventive problem solving from systems perspective, incorporating traditional methodologies used with individuals, small groups and community. Prerequisites: Social Work major and SWU 271, 291, 301, 310.

411 Social Work Practice III - Settings. (3) F, S
Content focused on student's field placement (public welfare, rural, medical, etc.). Prerequisites: Social Work major and SWU 271, 291, 301, 310, 410.

412 Field Instruction I. (6) F, S
Sixteen hours a week of supervised practice in an approved placement and 1½ hours a week field seminar. Prerequisites: Social Work major and SWU 271, 291, 301, 310, 410, concurrent enrollment in 411, 412.

414 Field Instruction II. (6) F, S
Sixteen hours a week of supervised practice in an approved placement and 1½ hours a week field seminar. Prerequisites: Social Work major and SWU 271, 291, 301, 310, 410, 412 concurrent enrollment in 411.

420 Practice-Oriented Research. (3) F, S
Application of scientific principles to field practice, problem formulation, intervention procedures and impact assessment. Prerequisite: an approved course in data analysis techniques or equivalent.

432 Social Policy and Services II. (3) F, S
Contemporary social, political, and economic issues. Special emphasis on poverty and inequality in the Southwest. Analysis and developent of social welfare policies and programs. Prerequisites: Senior standing and SWU 271, 291, 331.

474 Ethnic/Cultural Variables in Social Work. (3) F, S
A basic conceptual approach to understanding ethnic/ cultural variables of Southwestern ethnic minorities and how these factors intervene in social work practice.

Special Courses: SWU 484, 494, 498, 499, 590. (See pages 35-36.)

Master of Social Work

The Master of Social Work program prepares professional social workers for advanced direct practice, administration, and community practice. The program puts major emphasis on preparing social workers capable of responding effectively to the needs of special populations in the Southwest - the ethnic minority groups of the region, the aged, and rural populations - in its curriculum and its practicum assignments. The M.S.W. program is accredited by the Council on Social Work Education.

Program of Study

The standard program consists of 60 hours including both classroom instruction and field practicum. It is divided into a foundation year (Core Curriculum) and a concentration year. During both years, students spend two days a week in a practicum setting. The foundation curriculum is the same for all students and must be completed prior to entering the concentration year. Major conceptual frameworks used include systems theory, the dual perspective (an approach to understanding the cultural components of human behavior), the problem-solving process, and eclectic approach to intervention theories and strategies. The following are the required foundation courses:

SWG	501, 502	Human Behavior in the Social Environment I, II	6
SWG	510, 511	Direct Practice I, II	6
SWG	520	Practice Oriented Research	3
SWG	531	Social Policy and Services I	3
SWG	580, 581	Initiating Community and Organizational Change	6
SWG	541, 542	Field Practicum I, II	8
			30

In the second year students concentrate in either Direct Practice or Planning, Administration and Community Practice. Nine hours of elective are available for students to either take additional hours in their concentration or increase their substantive knowledge and skills in such areas as health and mental health, family and child welfare, rural social work, or social work with the aged. The following are the required concentration courses:

Semester Hours

SWG	610	Direct Practice III	6
		and select one of the following: SWG 611 Social Work Treatment With Individual SWG 612 Social Work Treatment With Families SWG 619 Social Work With Groups **or**	
SWG	680	Program Planning in Social Services	6
		and select one of the following: SWG 681 Social Work Administration SWG 682 Community Practice	
SWG	620, 621	Field Research I, II	6
SWG	632	Social Policy and Services II	3
SWG	641, 642	Advanced Practicum/Direct Practice I, II **or**	6
SWG	643, 644	Advanced Practicum/SW Administration & Community Development	6
		Electives selected from offerings at the School of Social Work or courses offered through other departments with the approval of student's advisor	9
			30

Comprehensive Examinations. Arizona State University requires a comprehensive examination for graduation in all professional master's programs that do not have a thesis requirement. All social work students must pass a comprehensive examination, administered by the School, prior to graduation.

Academic Standing and Curriculum Sequencing. In order to remain in good

academic standing, the student must maintain an overall GPA of 3.00 at the end of each semester. Most courses in the program are sequential; successful completion of the prior course in the sequence is required to enroll in the following course. Students may not enroll in any second year required courses until all foundation courses have been successfully completed.

Southern Arizona Component. All foundation year courses, as well as the second field practicum are available in Tucson to a limited number of students. For application to the Southern Arizona Component, follow the admissions procedures outlined below.

Part-Time Program. A limited number of students are admitted each year to a planned part-time program. Students interested in this option must specifically apply to the part-time program. This program is completed in three academic years, with the first two on a part-time basis, and the final year on a full-time basis.

Admissions Requirements

Admission to the graduate program in social work requires completion of all admission requirements and procedures set forth by the Graduate College (see *Graduate College Catalog*), and the following additional requirements: 1) test scores from the Graduate Record Examination or the Miller Analogies Test, 2) motivation to pursue professional social work education, and 3) evidence of successful work experience in human services. Successful experience in working with persons from the culture of the Southwest is desirable. All students are expected to complete a course in statistics prior to enrollment in the graduate program.

Applications to the M.S.W. program are accepted from November 1 to May 1 preceding the fall semester to which the applicant is seeking admission. All applicants are reviewed for admission for the fall semester only.

Application Procedure. The following should be submitted to the Admissions Office, Graduate College, Arizona State University, Tempe, AZ 85287: The application for admissions to the Graduate College, two transcripts from each institution where the applicant has attended previously, test scores from either the Graduate Record Examination or the Miller Analogies Test.

The following should be submitted to the Admissions Committee, Graduate Program, School of Social Work, Arizona State University, Tempe, AZ 85287: 1) application to the Graduate Social Work Program, 2) statement of educational and career goals in sufficient detail to indicate compatibility with the educational objectives and capabilities of the School of Social Work, and 3) three letters of reference. The reference letter forms provided by the School of Social Work must be used.

Transfer Credit. Upon recommendation of the Admissions Committee, the first year of graduate study (up to 30 graduate semester hours) earned at another CSWE-accredited school of social work may be transferred toward the M.S.W. degree. A full report from the school at which the credit was obtained is required.

A maximum of 9 graduate semester hours earned as an unclassified student in the ASU School of Social Work may be transferred. Up to six semesters hours of prior graduate work in another ASU program or another university may transfer as elective credit. A combination of credit earned as an unclassified student in other programs or universities may not exceed 9 semester hours.

Consideration for acceptance of prior graduate credits must be applied for at the time of admission. The grades for all transfer credit must be a B or better.

Waiver Exams. The number of hours required to complete the M.S.W. degree ranges from 40 to 60 semester hours, with 60 credits representing the standard program. Admitted students may acquire credits toward the degree by: a) transferring in credit (see policy on transfer credit) or b) waiving up to 20 hours of foundation course work as a result of successfully passing examinations offered in April and August of the year of the student's initial entry in the Graduate Program. Waiver examinations are available for all foundation level courses.

With the exception of students transferring in the first year of graduate study from an accredited graduate program in social work, no student may be exempted from more than 20 credits of course work by either examination or a combination of transfer credit and examination. In the event that the student passes examinations in more than 20 credits of course work, the student will replace waived required courses with elective course work to complete the requisite 40 hours.

Financial Aid. University scholarships, fellowships, and financial aids are available as outlined in the *Graduate Catalog*. In addition a limited number of Trainee Stipends are available through the School of Social Work. The funding sources of these awards require interest and commitment to practice with specific populations such as mental health services to Chicanos, Indians and rural residents. These stipends are awarded on the basis of academic scholarship, financial need and career goals. Application for the Trainee Stipends should be submitted to the School of Social Work by March 1.

SOCIAL WORK (SWG)

SWG 501 Human Behavior in the Social Environment I. (3) F
A study of the major theoretical approaches to the understanding of individual and family development within a diverse socio-cultural environment.

502 Human Behavior in the Social Environment II. (3) S
Continuation of SWG 501. Prerequisite: 501.

510 Direct Practice I. (3) F
Basic social work methods with an emphasis on the problem-solving process as it pertains to individuals, families and small groups.

511 Direct Practice II. (3) S
Continuation of interventive techniques with individuals, families and small groups. Prerequisite: SWG 510.

520 Practice-Oriented Research. (3) S
Accelerated course in application of scientific principles to field practice, problem formulation, intervention procedures and impact assessment. Prerequisites: Social Work major and an approved course in statistics.

531 Social Policy and Services I. (3) F
Conceptual, analytical, and historical perspectives on the social welfare institution. Emphasis on poverty and inequality. Principles of policy analysis.

541, 542 Field Practicum I, II. (3,3) F,S
Two consecutive semesters (480 hours) of supervised social work practice in an approved placement. Prerequisites: Concurrent or prior enrollment in SWG 510, 511.

580 Initiating Community Change. (3) F
Understanding communities as social systems. Experiences of special populations as community participants. Strategies for introducing planned change in communities.

581 Initiating Organizational Change. (3) S
Examines human service organizations and the extent to which they are structured and designed to meet consumer needs. Introduces strategies for initiating planned change. Prerequisite: SWG 580.

591 Seminar. (1-3) F, S
Courses offered in specialized areas.

605 Substance Abuse. (3) N
Psychological and socio-cultural determinants of substance abuse. Overview of social policies and treatment approaches. Prerequisites: SWG 501, 502, or approval of instructor.

606 Psychopathology. (3) N
Theories and concepts of mental health and illness. Attention to the development of environmental, interpersonal, psycho-social, stress factors in human behavioral dynamics. Prerequisites: SWG 501 or approval of instructor.

607 Social Work and Women's Development. (3) N
Impact of sexism on growth and development process, possible outcomes. Human Pathology/interpersonal/intrapersonal dynamics. Systems supporting mental health and/or contributing to mental illness. Prerequisite: SWG 501 or approval of instructor.

608 Cross Cultural Aspects of Aging. (3) N
Aging in context of culture and ethnicity; comparative analysis selected modern and traditional populations. Implications for practice with minority aged. Prerequisites: SWG 501, 502 or approval of instructor.

609 Health Aspects of Aging. (3) N
The aging process and health of the aged; chronic illness and adaptation, prevention, control of chronic disease, disability, assessment, intervention. Prerequisites: SWG 501, 502 or approval of instructor.

610 Direct Practice III. (3) F
Refine and integrate knowledge, skills and attitudes provided in basic social work methods. Prerequisites: SWG 510, 511.

611 Social Work Treatment With Individuals. (3) S
Advanced theory and practice of use of social work intervention with individuals. Prerequisites: SWG 510, 511, 610.

612 Social Work Family Treatment. (3) S
Theory and practice of social work treatment with families. Prerequisites: SWG 510, 511, 610.

614 Social Work With Reconstituted Families. (3) N
Analyzes the psycho-social dynamics of families disrupted by divorce, separation, or death of a parent. Offers differential social work interventions. Prerequisite: SWG 510, 511 or approval of instructor.

615 Group Process in Social Work. (3) N
Applicaiton of small group theory/group dynamics knowledge to social work practice. Understanding and application of small group theory in worker/group member roles. Prerequisite: SWG 510, 511, or approval of instructor.

619 Social Work With Groups. (3) S
Advanced course using social work groups as a direct practice intervention in social work. Prerequisites: SWG 510, 511, 610.

620, 621 Field Research I, II. (3,3) F, S
Individual or group projects in such areas as policy oriented research; knowledge assessment for practice; knowledge building-empirical research on a human services problem; program evaluation. Prerequisite: SWG 520.

624 Program Evaluation in the Human Services. (3) N
Development of understanding and skill in the conduct of program and project evaluation. Prerequisite: SWG 620 or approval of instructor.

632 Social Policy and Services II. (3) S
Development of advanced knowledge and skills in social welfare policy analysis, policy formulation, and advocacy and intervention for policy change.

633 Ethical Dilemmas in Social Work. (3) N
Ethical dilemmas in social work practice. Philosophical aspects of critical social welfare issues and the ethics guiding professional action. Prerequisite: SWG 531, or approval of instructor.

634 Child Welfare Law. (3) N
Provides social workers with knowledge of basic legal principles and procedures with emphasis on family related issues and children's rights. Prerequisites: SWG 531 or approval of instructor.

635 Community Mental Health. (3) N
The seminar examines theory development in community mental health practice with individuals, groups and communities as well as the linkages among these elements. Prerequisites: SWG 531 or approval of instructor.

641, 642 Advanced Practicum/Direct Practice I, II (3, 3) F, S
Two consecutive semesters (480 hours) of supervised social work practice in an approved placement related to the student's career goal. Prerequisites: SWG 510, 511, 541, 542, and concurrent or prior enrollment in SWG 610 and either 611, 612, or 619.

643, 644 Advanced Practicum/Planning/Social Work Administration and Community Practice, I, II. (3, 3) F, S
Two consecutive semesters (480 hours) in social work practice in an approved placement related to the student's career goal. Prerequisites: SWG 580, 581, 541, 542, and concurrent or prior enrollment in SWG 680 and either 681 or 682.

680 Program Planning in Social Services. (3) F
The social services planning process includes needs assessment, goals and objectives, program design, budgeting, management information systems and program evaluation. Prerequisites: SWG 580, 581.

681 Social Work Administration. (3) S
Administrative skill building and theory application within human service non-profit social work settings. Prerequisites: SWG 580, 581, 680.

682 Community Practice. (3) S
Community practice entails specific skill areas including program evaluation, task oriented group technology, citizen/consumer participation and bargaining/negotiating. Prerequisites: SWG 580, 581, 680.

683 Grantsmanship/Proposal Development. (3) N
Student groups develop proposals in collaboration with human service agencies or community groups. Identification of potential funding sources; technical and interpersonal/political aspects of proposal development. Prerequisites: SWG 580, 581, or approval of instructor.

684 Contract Administration in Social Work. (3) N
Fundamentals of contracting from initial conceptualization of the service need through development, negotiation, administration and monitoring of contracts.

Doctor of Social Work

The Doctor of Social Work program is designed to prepare a limited number of experienced social workers for leadership roles in social welfare as administrators and as social policy analysts, with an applied research orientation.

Policies developed by legislative bodies, administrative regulations and judicial decisions, establish the basic programs and services with which social workers are concerned. D.S.W. graduates should be prepared to contribute to the assessment and formulation of such policies, based on sophisticated analysis and understanding of the social problems for which the policies are designed. They should also be prepared to engage in leadership roles in the development of viable social work programs of in-

tervention on behalf of populations at risk, and to contribute to the efficient and effective operation and administration of such programs.

Program of Study

Completion of the program will require at least 39 credit hours of course work beyond the master's degree and a minimum of 15 credit hours for the dissertation. Each student will complete all core requirements: Research (9 hours); Social Work Administration (9 hours); Social Policy (9 hours); Comprehensive Examinations (written and oral); Dissertation (15 hours), and 12 hours of electives. In addition, based on an educational assessment by the Supervisory Committee, a number of "leveling" courses may be required to bring the student to an acceptable level of specific knowledge.

The following are the core requirements:

			Semester Hours
SWG	720	Research Methods in Social Policy and Administration...	3
SWG	721	Survey Research and Selected Research Issues in Social Policy and Administration...	3
SWG	722	Organizational and Evaluative Research in Social Policy and Administration	3
SWG	730	Social Policy Issues in Social Welfare	3
SWG	731	Social Welfare Policy Analysis and Development	3
SWG	732	Social Welfare Policy: Economic and Political Analyses	3
SWG	740	Theory and Practice of Social Work Administration	3
SWG	741	Social Work Administration in a Systems Context	3
SWG	742	System Redesign for Social Change	3

The remaining 12 semester hours will be negotiated by the student and his/her advisory committee and will reflect the student's short and long term career interests. It is expected that in most instances these courses will be taken in other schools or departments within the University.

Admission to the D.S.W. Program

In general, an applicant to the program should hold a Master of Social Work degree from an accredited school of social work and have demonstrated professional growth in the practice of social work, particularly in the administration of social services. Excep-

tions to this general requirement may be made for applicants with an advanced degree in a related field and exceptional practice or research experience in social work.

Admission to the D.S.W. program requires completion of all admission requirements and procedures set forth by the Graduate College and test scores from the Graduate Record Examination (verbal and quantitative). Applications are accepted up to March 1 preceding the fall semester to which the applicant is seeking admission. Students are admitted only in the fall semester.

Application Procedure. The following should be submitted to the Admissions Office, Graduate College, Arizona State University, Tempe, AZ 85287: The application for admissions to the Graduate College, two transcripts from each institution where the applicant has attended previously, test scores from the Graduate Record Examination.

The following should be submitted to the Admissions Committee, Graduate Program, School of Social Work, Arizona State University, Tempe, AZ 85287: 1) application to the Doctor of Social Work Program, 2) statement of educational and career goals in sufficient detail to indicate compatibility with the educational objectives and capabilities of the School of Social Work, 3) examples of written work or published materials, and 4) four letters of reference. The reference letter forms provided by the School of Social Work must be used.

SOCIAL WORK

SWG 720 Research Methods in Social Policy and Administration. (3) F
Research methodology, statistical methods and social data applied to social welfare problems and administrative decisions, emphasizing southwestern populations.

721 Survey Research and Selected Research Issues in Social Policy and Administration. (3) S
Sampling data collection; forecasting methodology; research and development programs in southwestern settings; computer methods. Prerequisite: SWG 720.

722 Organizational and Evaluative Research in Social Policy and Administration. (3) F
Evaluating social welfare organizations, policies, practices; measuring program results; impact on target populations; research methods to fit social welfare problems. Prerequisite: SWG 721.

730 Social Policy Issues in Social Welfare. (3) F
Historical backgrounds of current policy issues; law as expression of social policy; legislative, executive and judicial roles in formulating policy.

731 Social Welfare Policy Analysis and Development. (3) F
Methods of policy analysis; critique of social welfare policies against proposed models; case studies of policy development emphasizing southwestern populations. Prerequisite: SWG 730.

732 Social Welfare Policy: Economic and Political Analyses. (3) S
Economic and political factors influencing national social welfare policies; taxes, financial resources and civil rights as affecting social welfare programs. Prerequisite: SWG 731.

740 Theory and Practice of Social Work Administration. (3) F
Organizational theory and administrative principles applied to social work administration; distinctive features of social work administration; serving populations at risk.

741 Social Work Administration in a Systems Context. (3) S
Case studies of social work administration from initial conceptualization of policy through implementation at national, state and local levels. Prerequisite: SWG 740.

742 System Redesign for Social Change. (3) F
Redesigning/improving administrative structures; relation of administrative organization to service delivery; organization change procedures; case studies emphasizing minorities and women. Prerequisite: SWG 741.

Special Courses: SWG 700, 780, 783, 784, 790, 791, 792, 799. (See pages 35-36.)

Graduate College

Charles M. Woolf, Ph.D.
Dean

The functions of the Graduate College at Arizona State University are to provide the student with opportunities for study beyond the bachelor's degree and to foster a spirit of scholarship and research. Graduate programs are offered through the Graduate College by faculty who are affiliated with departments, centers, schools, colleges, and committees.

Graduate Council

The Graduate Council is responsible for establishing general policies for the development, maintenance, and review of graduate programs and for the admission of students to these graduate programs. The members of the Graduate Council are appointed by the president of the University but are elected for consideration of appointment by a process at the college or school level. The members represent faculty who offer graduate degree programs. The dean of the Graduate College administers Graduate Council policies and promotes quality training in all graduate programs. The dean of the Graduate College does this in concert with deans, chairpersons, and directors of all academic units.

Graduate Degrees

Graduate degrees obtained through the Graduate College are awarded upon the recommendation of the faculty offering the graduate degree programs.

A graduate degree program is defined as a specific degree title (such as M.B.A., M.S., or Ph.D.) and a major (such as Business Administration, Geology, or Mechanical Engineering). A major may consist of more than one concentration. A graduate degree program must be approved by the Arizona Board of Regents before it can be offered by the faculty at Arizona State University. Following the policy statements of the Council of Graduate Schools in the United States, graduate programs are characterized as being primarily research-oriented or professionally-oriented.

The following research-oriented graduate degrees can be obtained through the Graduate College:

Master of Arts (M.A.)
Master of Science (M.S.)
Doctor of Philosophy (Ph.D.)

Programs leading to the M.A. and M.S. degrees should give at least an introduction to research. These programs are often preparatory to Ph.D. degree programs. The Ph.D. degree is the highest university award given to candidates who have proven their ability by scholarship and original research in their chosen fields.

A major requirement for the Ph.D. degree is the submission of a dissertation. The Ph.D. dissertation should be a valuable educational experience which demonstrates the candidate's mastery of research methods, theory, and tools of the discipline. It should demonstrate the candidate's ability to address a major intellectual problem and to propose meaningful questions and hypotheses. It should be a contribution to knowledge that is worthy of publication by an established press as a book or monograph, or as one or more articles in a reputable journal.

Professional graduate programs emphasize training leading to professional practice. The degrees are awarded upon evidence that the candidate has command of a comprehensive body of knowledge and has the ability to organize and carry out significant investigations in the professional field. Professional master's degrees are usually named "Master of (Professional Field)." Profession-

al doctor's degrees are named "Doctor of (Professional Field)." An additional graduate professional degree available through the Graduate College is Education Specialist. The professional doctor's degree is the highest university award given in recognition of the completion of academic preparation for professional practice. The following professional graduate degrees can be obtained through the Graduate College:

Master of Accountancy
Master of Architecture
Master of Business Administration
Master of Counseling
Master of Education
Master of Environmental Planning
Master of Fine Arts
Master of Health Services Administration
Master of Mass Communication
Master of Music
Master of Natural Science
Master of Public Administration
Master of Quantitative Systems
Master of Science in Engineering
Master of Social Work
Master of Technology
Education Specialist
Doctor of Education
Doctor of Musical Arts
Doctor of Public Administration
Doctor of Social Work

The faculty offering a specific graduate degree program may be affiliated with a single academic unit, such as a department, center, school, college, or a committee consisting of faculty from different academic units. An interdisciplinary graduate degree program may be offered by committee.

For information concerning graduate degree programs offered at Arizona State University, please refer to the *Graduate Catalog.*

Admission to the Graduate College

A student who has earned a baccalaureate or graduate degree recognized by Arizona State University may apply for admission to the Graduate College. Recognition of a degree is acknowledgment that the program leading to the degree is equivalent to a program offered by Arizona State University or is an acceptable program for the proposed graduate major at Arizona State University. A student who enters a graduate degree program at Arizona State University is expected to have undergraduate educational experiences, including general education

studies, that are appropriate for the program.

The Arizona Board of Regents has defined (May 26, 1979) a unit of credit for the institutions under its jurisdiction. A minimum of 45 hours of work by each student is required for each unit of credit. An hour of work is the equivalent of 50 minutes of class time (often called a "contact hour") or 60 minutes of independent study work. For lecture-discussion courses, this requirement equates to at least 15 contact hours and a minimum of 30 hours of work outside of the classroom for each unit of credit. Even though the values of 15 and 30 may vary for different modes of instruction, the minimum total of 45 hours of work for each unit of credit is a constant. Since the unit of credit as defined by the Arizona Board of Regents is the cornerstone of academic degree programs at Arizona State University, degrees that are recognized should be based on a similar unit of credit.

A degree cannot ordinarily be recognized if it is based on any of the following types of credits: (1) credits awarded by postsecondary institutions in the United States that lack candidate status or accreditation by a regional accrediting association; (2) credits awarded by postsecondary institutions for life experience unless validated by the institution awarding the credits through the use of standardized examinations (such as CLEP) or comprehensive examinations; (3) credits awarded by postsecondary institutions for courses taken at non-collegiate institutions (e.g. governmental agencies, corporations, industrial firms, etc.); (4) credits awarded by postsecondary institutions for non-credit courses, workshops, and seminars offered by other postsecondary institutions as part of continuing education programs.

Applications are reviewed on an individual basis by designated faculty committees following policies established by the Graduate Council and the faculty who offer each graduate degree program.

In all instances, the academic unit must indicate its willingness to admit the student. All applications for admission must be approved by the dean of the Graduate College. An academic unit may set standards higher than those established by the Graduate College and may recommend denial of a student whose academic record is superior to the minimum requirements described below.

All decisions on admission are made without regard to sex, creed or ethnic origin.

Applicants may be admitted to a graduate program under two classifications:

Regular Admission. Applicants must be acceptable to both the Graduate College and the academic unit in which the applicant plans to study. Among other considerations for acceptance by the Graduate College, the applicant must have a grade point average of 3.0 (4 point scale) or the equivalent in the last two years of work leading to the bachelor's degree. The applicant's score on an aptitude examination, such as the Graduate Record Examination, Miller Analogies Test, the Graduate Management Admission Test, or the Test of English as a Foreign Language (for international students only), may also be considered in making decisions regarding admission. Applicants should check with the academic unit of their intended study to determine specific requirements.

Provisional Admission. Applicants may be granted provisional admission to the Graduate College if the Graduate College or academic unit in which they plan to study requires additional evidence of their qualifications for admission with regular status. No student may maintain provisional status indefinitely. Normally, final determination of status will be made by the time the student has completed 12 hours of approved graduate study. If applicants have extensive deficiencies, they may be advised to enroll in selected undergraduate courses.

Application Procedures. At least two months before the first enrollment, the Graduate College should have received the application for admission and two transcripts of all undergraduate and graduate work. The faculty of the academic units (department, center, school, college, or committees) offering specific graduate degree programs may have earlier application deadlines than the Graduate College and additional admission requirements. Applicants are advised to check with individual academic units regarding application deadlines and admission requirements.

The submission of a score or scores on an academic aptitude test is strongly recommended for all applicants and is required for admission to some graduate programs. An applicant should refer to the admission requirements of a specific graduate program

to determine which academic aptitude test, if any, should be taken.

The application for admission, the applicable test scores, and the transcripts are all to be sent directly to the Admissions Office, Graduate College. The transcripts are to be sent to the Admissions Office by the registrar of each college or university which the applicant previously attended. The applicant should write to the registrars concerned and then allow them time to process and mail the transcripts. A qualified applicant whose application has been filed later than the deadline may be permitted to enroll in graduate classes as a nondegree student. The student will maintain that status until all required forms and transcripts have been received and a decision regarding admission to a program has been reached by the Graduate College.

A student's official status for a semester is determined by his/her status at the end of that semester.

All documents received by the University in connection with such applications for admission become the property of Arizona State University. Admission documents of applicants who do not enroll in the University may be destroyed after one year.

Letters of recommendation should be sent directly to the academic unit in which the student wishes to study.

International Student Applications. An international applicant is one who is a citizen of a country other than the United States. International applicants who are not currently attending a university in the United States are urged to apply one year prior to the date they plan to enroll. The application for admission, official transcripts, results of the Test of English as a Foreign Language (TOEFL), and a financial guarantee should be received in the Graduate College International Admissions Office by March 30 for admission for fall semester and by September 30 for admission for spring semester. Applicants should contact the individual academic units regarding additional admission requirements, application deadlines and test scores.

Transcripts cannot be submitted directly by the student. To be official, transcripts must be received by the Graduate College International Admissions Office directly from the institution that issues them. Alternate methods have been established for students whose previous academic institutions are unable to issue the documents di-

rectly to the Graduate College International Admissions Office. Those methods are outlined on the application for admission.

To be eligible to apply to the Graduate College, an applicant must have received a degree equivalent to a U.S. bachelor's degree. (See page 368, Admission to the Graduate College)

The Graduate College is required by the Immigration and Naturalization Service to verify that a person with a student visa has been admitted to a degree program and has financial support for the entire proposed period of study. An applicant must have assured financial resources in an amount not less than the one specified on the application for admission for each year of study. In addition, all international students must carry health insurance. An international student on a student visa may not enroll as a non-degree student.

Change in Graduate Degree Program. A change from one graduate degree program to another requires reapplication. After students have notified the Graduate College that they wish to apply for a new graduate degree program, the usual admission procedures will be followed.

Re-entry to the Graduate College. Any former graduate student who has not been in attendance at Arizona State University for one or more semesters must obtain an application for re-entry from the Admissions Office, Graduate College. This application should be submitted at least one month prior to the beginning of the semester in which the student plans to re-enter. Official transcripts of any additional work taken elsewhere that will be used on a program of study must be sent directly to the Admissions Office, Graduate College, at Arizona State University, from the Office of the Registrar at the institution where such credit was earned. It is recommended that the returning graduate student contact the Graduate College for a review of his or her status.

Nondegree Status. An applicant with an undergraduate degree who is not pursuing a graduate degree program may apply for non-degree status in the Graduate College. Before enrolling, he/she must submit an application for registration to the Graduate Admissions Office. A maximum of nine (9) credit hours completed prior to admission to a degree program at Arizona State University may appear on a master's program of study. (See Credit Completed Prior to Admission, *Graduate Catalog*.)

Student Responsibility. It is the responsibility of the graduate student to become conversant with and to observe all procedures and requirements of the Graduate College as defined in the *Graduate Catalog*. Students should also be informed about the requirements concerning the degree program they are enrolled in and any special requirements within the academic unit. Special attention should be given to the scholarship requirements of the academic unit and the Graduate College (see page 372, Scholarship.) Students are expected, as part of their obligations, to be familiar with the *Code of Conduct*. Violations of this *Code of Conduct* or instances of academic dishonesty, specifically cheating in examinations, laboratory work, written work (plagiarism), forging, or altering University records—that is attempting to gain credit for work which the student has not actually performed—will be subject to University discipline whether committed by individuals or groups.

Policies and Procedures of the Graduate Council Appeals Board. The Appeals Board of the Graduate Council acts as the appeals body for graduate students seeking redress on academic decisions regarding their graduate program. The Board is composed of five members of the Graduate Council, excluding ex-officio Council members who hold administrative positions in the Graduate College. The membership and chair of the Board are appointed by the dean of the Graduate College.

An appeal by a student previously admitted to a graduate degree program may result from an academic decision considered by the student to be adverse. Decisions involving Graduate College policy as stated in the *Graduate Catalog* are within the jurisdiction of the Appeals Board. Decisions involving policies of the academic unit (center, department, school, college) are not normally heard by the Graduate Council Appeals Board.

A student may seek redress by writing a letter to the dean of the Graduate College or to the chair of the Appeals Board of the Graduate Council. Upon receipt of the letter, the dean or chair will inform the student as to whether the appeal concerns a Graduate College policy, and is therefore within the jurisdiction of the Board, or is a policy of the academic unit.

A student may request an opportunity to appear before the Appeals Board or waive this right. The Board may choose to in-

terview faculty members and administrators involved in the case and review the student's complete academic record and all documents pertaining to the case. Such reviews are primarily concerned with the observance of stated procedures and policies, but may consider extenuating circumstances as related to policy.

In the event a member of the Appeals Board has been involved in a case as a member of the student's committee or as a member of the faculty offering the graduate program, he/she will be temporarily replaced on the Appeals Board for the duration of the case, and the dean of the Graduate College or chair of the Appeals Board may select an alternate member from the remaining membership of the Graduate Council. A member of the Appeals Board may request to be excused from a case, or may be temporarily replaced, whenever there is a potential for conflict of interest. The presence of three members of the Board at a meeting is considered a quorum.

Verbatim transcripts are not kept of the Board's proceedings. Only summary notes are kept. All written documentation presented in each case is retained in the Board's files for a period of one year. Such files are available only to the complainant and respondent in the hearing and do not become part of the student's official University file. The decision of the Appeals Board is reported to the Graduate Council for their information. The decision is then communicated to the student in writing by the dean of the Graduate College, with a copy to each member of the Appeals Board.

Graduate Supervisory Committees. Upon the recommendation of the head of the academic unit the dean of the Graduate College appoints a graduate student's supervisory committee, consisting of a chairperson and other resident faculty members. The number of members serving on this committee is a function of the degree program. See the specific degree program for additional information.

In some cases, individuals who are not members of the resident faculty may be appointed to a supervisory committee as a main or extra member. Such appointments must be consistent with quality graduate training, and be strongly recommended by the head of the academic unit. A vita for this individual should be submitted to the Graduate College with the recommendation.

Registration. Graduate students register during the intervals indicated in the *Schedule of Classes* . Details regarding registration and course drop-add procedures are given in the *Schedule of Classes*. Day and evening graduate classes, offered on or off campus, during the two regular semesters and the summer sessions are considered part of the regular program.

Reserving of Course Credit by Undergraduates. Undergraduate students at Arizona State University may enroll in graduate courses with the approval of their advisor, the course instructor, the chairperson of the department, and the dean of the college offering the course. If the course is not used to meet an undergraduate requirement, a procedure is available by which it may be reserved for possible use in a future graduate program.

Seniors at Arizona State University within twelve (12) credit hours of graduation who enroll in a 400 level or graduate course that is not used to meet a graduation requirement may petition to reserve the credit for possible use in a future graduate program. The course must be approved for reserve status by the student's advisor, departmental chair and the dean of the Graduate College prior to registration in the course. Permission to reserve a course in no way guarantees subsequent admission to a graduate degree program or that the course may be used toward graduate degree requirements. A maximum of nine hours of credit may be reserved and only courses with an "A" or "B" grade are applicable. Reserved credit earned prior to admission to a graduate degree program is classified as non-degree credit. (See Credit Completed Prior to Admission, *Graduate Catalog.*) The maximum course load for a student enrolled in a reserved course is 15 semester hours during a regular semester and six hours during a summer session. Petition forms to reserve credit are available in the Graduate College.

Course Load. The course load is determined by the supervisory committee but is not to exceed 15 semester hours of credit during each of the two regular semesters, 6 semester hours of credit during each five-week summer session, or 9 semester hours of credit during an eight-week summer session. Graduate assistants/associates working 50% time may not enroll for less than 6 hours or more than 12 hours during a regular semester. At the graduate level, course

work, whether or not formal in nature, serves mainly as a guide for independent study. Students are expected to exceed minimum requirements and to master subjects rather than simply to pass courses. All graduate students doing research, or working on theses or dissertations, taking comprehensive or final examinations, or who are using university facilities or faculty time, must be registered for a minimum of one hour of appropriate graduate level credit in the department in which they are pursuing their degree program.

Scholarship. Academic excellence is expected of students doing graduate work. A student who is not progressing satisfactorily may be withdrawn from the degree program by the dean of the Graduate College upon the recommendation of the head of the academic unit concerned.

The grading system applicable to graduate courses is as follows:

A—Excellent (4.0)   W—Withdrawal
B—Good (3.0)   I—Incomplete
C—Passing (2.0)   X—Audit
D—No Graduate   Z—Course in
    Credit (1.0)*   Progress**
Y—Satisfactory   E—Failure (0.0)*

*Cannot be applied toward a graduate degree but is included in calculation of grade point average.

**This grade is given pending completion of courses such as thesis, dissertation and practicum.

To be eligible for a degree in the Graduate College, a student must achieve a grade point average of "B" (3.0) or better in all work taken for graduate credit, exclusive of deficiencies, and in all work specifically included in the program of study. Two different grade point averages are computed: 1) the overall graduate grade point average in all courses numbered 500 or higher that appear on the transcript, except those that were listed as deficiencies in the original letter of admission, and 2) the grade point average in all courses that appear on the program of study. A grade of "Pass" in a 400-level course may not appear on a program of study. Grades below "C" cannot be used to meet the requirements for a graduate degree, although they are used to compute the grade point average. Grades on transfer work will not be included in computing grade point averages. Graduate course work reported "Incomplete", other than research applied project, thesis and dissertation, must be completed within one

year of the official ending of the course. If a grade of "Incomplete" ("I") is not removed within one year, it will automatically be changed to an "E".

Students receiving a grade of "D" or "E" must repeat the course in regular class if they wish to include it in their program of study.

The mark of "W" is given in a course whenever a student officially withdraws from a course. (See page 37, Withdrawal.)

Graduate Credit Courses. Courses at the 500, 600, and 700 level are graduate credit courses; however, courses at the 400 level will apply to graduate degree requirements when appearing on an approved program of study.

Correspondence Courses. Correspondence courses cannot be used to meet the requirements for a graduate degree.

Transfer Credit. Transfer of credit is the acceptance of credit from another institution for inclusion in a program of study leading to a degree awarded by Arizona State University. The number of hours transferred from other institutions may not exceed 20% of the total minimum semester hours required for a master's degree unless stated otherwise for a specific degree program. Refer to the specific degree programs for additional information. Transfer credit taken prior to admission to a degree program at Arizona State University is non-degree credit. Non-degree credit taken at Arizona State University combined with non-degree credit taken at another institution may not exceed nine (9) hours in the master's degree program of study (see Credit Completed Prior to Admission, *Graduate Catalog*.)

In the Education Specialist and doctoral programs, credits from recognized institutions may be transferred provided they are recommended by the supervisory committee and approved by the dean of the Graduate College.

Transferred credits must be acceptable toward graduate degrees at the institution where the courses were completed. Certain types of graduate credits cannot be transferred to Arizona State University, including: (1) credits awarded by postsecondary institutions in the United States that lack candidate status or accreditation by a regional accrediting association; (2) credits awarded by postsecondary institutions for life experience; (3) credits awarded by postsecondary institutions for courses taken at non-collegiate institutions (e.g. govern-

mental agencies, corporations, industrial firms, etc.); (4) credits awarded by postsecondary institutions for non-credit courses, workshops, and seminars offered by other postsecondary institutions as part of continuing education programs; (5) credits given for extension courses.

Acceptable academic credits earned at other institutions that are based on a different unit of credit than the one prescribed by the Arizona Board of Regents (see page 368, Admission to the Graduate College) are subject to conversion before being transferred to Arizona State University.

Only resident graduate courses with an "A" or "B" grade may be transferred. Transfer credit will not be given for courses in which a grade of Pass, Credit, or Satisfactory was received. Grades on transferred credit cannot be included in the grade point average.

Foreign Language Requirement. A specific graduate degree program may have a foreign language requirement. If a foreign language is required, students must demonstrate at least a reading knowledge in their area of study of a language which is recommended by their supervisory committee and consistent with the requirements for the graduate degree program. Normally these will be selected from French, German, Russian, or Spanish, although other languages may be recommended when there is adequate justification.

Language competency is certified by the Department of Foreign Languages only upon satisfactory performance on a foreign language examination specific to the particular graduate program in which the student is enrolled. The examinations are administered three times each year by the Department of Foreign Languages. Students planning to take the examination must register at least one month in advance of the examination date in the Graduate College. The chairperson of the supervisory committee has the responsibility to provide the Department of Foreign Languages with materials from which the examination will be prepared. The chairperson of the supervisory committee should submit or recommend relevant books and/or journals of approximately 200 pages in length in the desired foreign language. The student must pass the examination in no more than three attempts.

Format for Theses and Dissertations. Copies of the *Guide to Preparation of the Master's Thesis, Applied Project, or Doctoral Dissertation* are available in the Graduate College. A careful review of this document well in advance of the preparation of the manuscript is strongly recommended. Format evaluation of the final copy must be obtained prior to its submission to the Graduate College for the oral defense. Graduate students and their supervisory committees are encouraged to select a style manual or journal format representative of the field of study. The Graduate College prefers to allow maximum flexibility in the format of the manuscript, but certain Graduate College and library regulations must be followed. Format evaluation is not required of master's students submitting thesis substitutes in fulfillment of their research requirement.

Graduation. Students should apply for graduation no later than the date specified in the *Graduate Catalog* calendar. All fees are payable at that time. Students applying for graduation after the deadline listed in the *Graduate Catalog* calendar will be required to pay a late fee. At the end of the semester in which they apply for graduation, students will be officially notified of any requirements for their degree which they have not yet completed. Students who do not complete all degree requirements by their anticipated graduation date will be required to pay a refiling fee.

Summer Session. Work taken during the Summer Sessions carries the same scholastic recognition as that taken during the regular semester. A complete schedule of offerings is available in the summer bulletins, which may be obtained from the office of the Director of Summer Sessions.

Dates and Deadlines. The University calendar found in the current *Graduate Catalog* lists deadlines for the submission of theses and dissertations to the Graduate College, the last day to apply for graduation, and the last day to hold an oral defense of a thesis or dissertation.

Off-Campus Academic Services

John L. Edwards, Ed.D.
Executive Director

The office of Off-Campus Academic Services is the academic service arm of the University in providing the opportunity for off-campus credit and non-credit courses. The following services and programs are available: off-campus courses for academic credit, correspondence study, non-credit courses, instructional television, American Language and Culture Program (English as a Second Language), and assistance in the development and administration of conferences.

Off-Campus Courses

As a convenience to students, off-campus courses are organized and scheduled in locations conducive to enrollment in the metropolitan area and various locations in the eastern half of Maricopa County.

Credits earned off campus will be recorded on a student's permanent record in the same manner as those earned on campus and both will be equivalent in all academic considerations. Admission to and prerequisite requirements for a credit course must be the same whether the course is taught on or off the University campus. Identification of course content, method of instruction and evaluation, and selection and appointment of instructors for off-campus courses remain the prerogative of the appropriate academic department with subsequent approval of the Dean of the College.

The fee for off-campus courses is $53.00 per semester hour. Full-time students (students registered for 7 or more hours through on-campus registration) may register for *off-campus resident credit* courses without incurring the payment of additional fees. Any combination of *on-campus and off-campus resident credit courses* resulting in a combined registration of 7 or more semester hours requires that the student pay full-time, in-state regis-

tration fees, or full-time out-of-state registration fees and the appropriate tuition (see page 29). Full-time students who have paid registration fees and tuition (7 or more semester hours) *must also pay additional fees if they enroll in off-campus credit courses* that commence after the 21st calendar day of the start of each semester.

Correspondence Study

College credit correspondence courses offered by Arizona State University are specifically designed for the student unable to attend classes in person. They are offered for those who are seeking to fulfill degree objectives as well as for those who wish to increase their occupational, professional and intellectual skills.

Persons desiring to enroll in correspondence study should write to the Correspondence Study Office, Off-Campus Academic Services, for an enrollment form and a brochure listing the courses available. Students intending to register for a correspondence course, who are already enrolled for six hours or more in residence, must first obtain approval of the Dean of the College in which they are enrolled. Correspondence study courses may not be utilized for repeating courses in which the student previously received a grade of D,E,W, or I.

A correspondence course generally consists of eight lesson assignments for each semester hour of credit concluding with a final examination. Eight to ten hours are normally required preparing each assignment.

A student will not be permitted to take the final examination for a course in less than 7 days from date of registration for a one-unit course, 14 days for a two-unit course, and 21 days for a three-unit course.

Students are limited to one correspondence study course initially, with the expectation of completing that course within a

calendar year. However, when one-half the lessons are completed in the initial enrollment, enrollment in a second course is possible. Students are limited to a maximum of two correspondence courses at any one time.

A maximum of 30 semester hours of credit earned in correspondence and/or by comprehensive examination may be applied toward the baccalaureate degree at Arizona State University. Correspondence courses are not applicable as graduate credit toward advanced degrees.

The fee for correspondence courses is $33.00 per semester hour of credit and is payable at the time of registration. This is an additional fee required of full-time students who have paid registration fees and tuition. Tuition waivers do not apply to correspondence study fees.

Admission to Off-Campus and Correspondence Course Programs. A student
may enroll in an off-campus or correspondence course without making formal application for admittance to the University or to degree candidacy. High school seniors may enroll in off-campus or correspondence courses under the provisions as stated for Conditional Admission Prior to Graduation from High School. (See page 21.)

Instructional Television Services

Television is a convenient, effective and efficient educational delivery system. Through television, it is possible to deliver selected educational opportunities to the adult population of Arizona. Instructional Television Services uses television as an educational delivery system capable of turning homes, businesses and schools in rural and urban communities into learning environments.

Non-Credit Continuing Education

Arizona State University recognizes its responsibility for providing effective continuing education activities. These activities, coordinated through the Office of Off-Campus Academic Services, are educational in nature and in conformance with established University regulations and policies. All non-credit continuing education activities are sponsored by an academic department, college, or other approved agency of the University. Activities may be co-sponsored or conducted in cooperation with outside agencies or groups when there is internal University involvement and control and the purpose of the activity is educational.

The Office of Off-Campus Academic Services provides operating assistance, encourages program development, and coordinates all continuing education activities sponsored by University administrative units and departments.

Arizona State University Computer Institute

The Arizona State University Computer Institute located within the Computer Showcase at 3883 E. Thomas Road in Phoenix, Arizona, represents a new approach in providing computer education to residents in the metropolitan Phoenix area and throughout the state. The first of its kind in the United States, the Institute offers a wide variety of microcomputer training classes applicable to business and industry needs as well as personal use in the home.

The ASU Computer Institute's faculty is drawn largely from Arizona State University's main campus, giving the Institute what may be the most highly qualified computer training staff in the country. The Institute's faculty and staff team together and teach credit and non-credit courses, seminars and workshops in computer education.

The Computer Institute offers introductory to advanced level classes from computer awareness, programming, information management, graphics, business applications, word processing, education, technical and special applications. More than 40 classes are offered which teach popular microcomputer business applications including Lotus 1-2-3, WordStar, Multimate, Multiplan, and dBase II. The Institute also works closely with business and industry to provide tailored classes developed specifically for a client and his or her employees. In addition, special seminars for professionals in the fields of medicine, law, accounting and others are scheduled throughout the academic year.

The Institute presently has six microcomputer training classrooms fully equipped with "state-of-the-art" hardware and software. The classrooms contain Macintosh, PC compatible Zenith, Apple IIc, IBM PC, portable micro, NCR, KayPro, and PC compatible Televideo microcomputers.

For additional information, contact the ASU Computer Institute.

American Language and Culture Program

The American Language and Culture Program (ALCP) features an intensive, non-credit course of study designed for adult international students who desire to become

proficient in English as a second language for academic, professional, and/or personal reasons. Applicants must be 18 years of age and must possess a high school diploma or its equivalent. All conditions of the United States Immigration and Naturalization laws pertaining to full-time study in the United States must be met by all applicants. Beginning students are required to take an English placement test prior to the beginning of classes. Certificates of achievement are awarded on completion of the course. Admission to the program does not constitute regular admission to Arizona State University.

Beginning, intermediate, and advanced level courses provide instruction in grammar, pronunciation and speaking, listening comprehension, writing and composition, and reading and vocabulary. Academic advising and orientation to Arizona and the United States are integral parts of the program.

Program-wide social activities each term include a major field trip, a dinner, a picnic, and a cultural activity, visits to museums, historical places, and musical presentations.

Advanced level ALCP students may be permitted to concurrently enroll in up to two ASU credit classes with the approval of the Director. Several special classes are offered through the ALCP. Classes in conversation and the Test of English as a Foreign Language (TOEFL) are offered alternate terms. The ALCP teaches a seminar for foreign teaching assistants. Also, the ALCP offers a credit bearing class in the second cycle of each semester.

The fall and spring semesters are divided into two 8 week cycles. Students may enroll for one or more cycles. An 8 week summer session of study is also offered. Inquiries concerning admission requirements, enrollment and fee schedules should be sent to the ALCP, Academic Services Building 110, Arizona State University, Tempe, Arizona 85287.

University Conference Services.
The Office of University Conference Services coordinates on- and-off campus conferences, seminars and workshops sponsored by any administrative unit or academic department within the university. Working closely with each of the University's colleges, complete conference services and assistance to any campus group desirous of conducting an educational program or professional meeting are offered. Services include, but are not limited to, general conference planning, budgeting, site selection, promotion and publicity, hotel/motel liaison, and overall logistical support for any and all phases of the conference. The office also aids in the development of guidelines, checklists, and general operating procedures which serve to ensure coordination and smooth operation of continuing education activities sponsored by the various campus departments.

Summer Sessions

Denis J. Kigin, Ed.D.
Director

Summer Sessions

The Summer Sessions provide an opportunity for students to pursue academic work on a year-round basis. Course offerings are much the same as those of the academic year. Degree candidates, both graduate and undergraduate, as well as those seeking to enhance or to refresh their subject matter interests, will find a broad selection of courses available. All campus classes are held in air-conditioned classrooms and laboratories. Limited offerings are available in off-campus locations during the summer sessions.

The opportunity for international travel and study is available during the summer through selected study tours. These programs are directed by regular faculty members and allow students to earn graduate or undergraduate credit. The international study programs carry University credit with the approval of the academic department and college involved.

Terms. There are three Summer Sessions: one of eight weeks and two of five weeks. The eight-week session and the first five-week session run concurrently.

Admission to Summer Sessions. Admission to the University is a requirement for enrollment in summer sessions. However, transient students--those already admitted to other colleges and universities--are allowed to be admitted as unclassified undergraduates or non-degree graduates. The submission of transcripts or test scores are not required for this status. Conditional admission prior to graduation from high school may be granted under the conditions as stipulated on page 22 of this catalog.

Summer session courses are equivalent to the regular semester courses in content, credit awarded and expected standard of performance. As a general rule, summer session courses are taught by regular members of the Arizona State University faculty. The *Summer Session Bulletin,* a schedule of courses, is published well in advance of the start of classes and may be obtained by writing or calling the Office of Summer Sessions.

Credit and Residence Requirements. Students are permitted to earn a maximum of 6 semester hours of credit each five-week session or 9 semester hours of credit in the eight-week session. Hours of enrollment in any other institution or correspondence course is included in the maximum allowable course load during any given session. Students entering the University as freshmen are invited to begin their university work in the summer. They should, however, seek academic advisement before registering (see pages 18-21).

Undergraduate Enrollment. In general, applicants for admission are expected to present evidence of graduation from an approved four-year high school, or evidence of good standing in an accredited college. Students, 19 years of age or over, may be admitted as unclassified students without the above qualifications, but with the understanding that all University admission requirements must be satisfied before they can be admitted for a degree program (see page 21).

Graduate Study. Summer Sessions offer an excellent opportunity for baccalaureate degree holders to continue their professional development. Candidates for graduate degrees should pay particular attention to the requirements for graduate admission and study (see page 367 and the *Graduate College Catalog*).

Fees and Expenses. Summer sessions students pay only for the number of hours of actual enrollment. The per credit hour fee is set by the Arizona Board of Regents and is

consistent with the fee assessed unclassified student enrollments during the academic year for students enrolled for 1-6 hours. The summer sessions credit hour fee includes the student activity fee. Out-of-state tuition is waived for all students during the summer sessions. Textbooks and supplies may be purchased at the ASU Bookstore. Room and board for the summer are available on campus at the prevailing rates. For information, contact the Office of Residence Life at Arizona State University.

Information. Requests for the Summer Sessions *Schedule of Classes* or for other information should be addressed to the Office of Summer Sessions at Arizona State University, Tempe, AZ 85287.

ASU West

ASU West is an upper-level university serving the upper division and graduate educational needs of west valley residents. ASU West was created by the 1984 Arizona Legislature with the passage of Senate Bill 1245. The legislation states that the Board of Regents "shall maintain a westside branch campus" of Arizona State University.

ASU West should be a fully operating campus serving 5,000 students by 1990. The first ASU West building could be in use by the 1988-89 school year on the 300 acre campus bounded by Thunderbird and Sweetwater and 43rd and 51st avenues.

During the period before the new campus is built, ASU West offers a wide variety of courses at ASU West Alhambra, 4510 N. 37th Avenue, and various other westside locations, including the American Graduate School of International Management. In addition, library services, a microcomputer laboratory, reception of Instructional Tele-vision Fixed Service courses from ASU Main, limited food service and on-site student services are already available at ASU West Alhambra.

Students may register for ASU West classes during specific registration periods by mail, by telephone, at ASU West Alhambra or on the main Tempe campus. Students registering by mail, phone or at ASU West Alhambra will be admitted automatically to the University as unclassified (non-degree) students. Students registering at ASU in Tempe and those wishing to pursue degrees or to take more than six hours of credit in one semester should file an undergraduate or graduate application prior to the registration period. Applications are available at ASU West Alhambra. Credits and degrees earned at ASU West are ASU credits and degrees.

Call 279-5484, ASU West Alhambra, for more information.

Faculty, University Offices and Services

The faculty listed are involved in both graduate and undergraduate instruction. Year following name indicates first appointment. Emeriti are included.

Arizona Board of Regents

Ex Officio

Bruce E. Babbitt, B.A., M.S., J.D...*Governor of Arizona*
Carolyn Warner ....*Superintendent of Public Instruction*

Appointed

To January 1986	To January 1988
Esther N. Capin, B.A., M.Ed.	William P. Reilly
Donald Pitt, B.S., LL.B.	Tio A. Tachias

To January 1990	To January 1992	Student Regent
A. J. Pfister, B.S., LL.B.	Edith S. Auslander, B.A., M.A.	To May 1985
Donald G. Shropshire	Herman Chanen	Paul D. Julien, Ph.D.

Glenn A. Brockman J.D. ....*Acting Counsel to the Board*
_____ ....*Executive Director*

General Administration

J. Russell Nelson ....*President of the University; Professor of Finance*
    B.A., Pacific Union College; M.B.A., Ph.D., University of California, Los Angeles
Paige E. Mulhollan...*Executive Vice President; Professor of History*
    B.S., B.A., M.A., University of Arkansas; Ph.D., University of Texas, Austin
Jack B. Kinsinger...*Vice President for Academic Affairs; Professor of Chemistry*
    B.S., Hiram College; M.S., Cornell University; Ph.D., University of Pennsylvania
Betty Turner Asher............*Vice President for Student Affairs; Associate Professor of Counselor Education*
    B.A., Eastern Kentucky University; M.A., Western Kentucky University; Ed.D., University of Cincinnati
Victor M. Zafra ....*Vice President for Business Affairs*
    B.S. F.S., Georgetown University; M.P.A., Woodrow Wilson School, Princeton University
Troy F. Crowder...*Special Assistant to the President;*
    B.A., University of South Dakota   *Associate Professor of Journalism and Telecommunication*
    M.A., University of Iowa
Lawrence D. Mankin ....*Assistant to President for Administration;*
    B.B.A., City College of New York;   *Associate Professor for Public Affairs*
    Ph.D., University of Illinois
Jacqueline Weatherby...*Assistant to the President for Equal Employment*
    B.S., Arizona State University   *Opportunity in Affirmative Action*
Samuel A. Kirkpatrick ....*Dean, College of Liberal Arts; Professor of Political Science*
    B.S., Shippensburg State College; M.A., Ph.D., Pennsylvania State University
Gerald R. McSheffrey ....*Dean, College of Architecture; Professor of Architecture*
    Dipl. Arch., University College, London; Dip. C.D., Edinburgh University

L. William Seidman ....*Dean, College of Business Administration; Professor of Accounting*
    A.B., Dartmouth College; LL.B., Harvard University Law School; M.B.A., University of Michigan
_____ ....*Dean, College of Education*

C. R. Haden ....*Dean, College of Engineering and Applied Sciences;*
    B.S., Arlington State College;   *Director, School of Engineering; Director, Engineering Research Center;*
    M.S., California Institute of Technology; Ph.D., University of Texas   *Professor of Engineering*
_____ ....*Dean, College of Fine Arts*

Paul Bender ....*Dean, College of Law; Professor of Law*
    A.B., LL.B., Harvard University
Janelle Krueger ....*Dean, College of Nursing; Professor of Nursing*
    B.S., M.S., Ph.D., University of Colorado
Nicholas A. Henry...*Dean, College of Public Programs; Professor of Public Affairs*
    B.A. Centre College; M.A., Pennsylvania State University; M.P.A., Ph.D., Indiana University
Jesse F. McClure ....*Dean, School of Social Work; Professor of Social Work*
    A.B., M.S.E., University of Michigan; Ph.D., Brandeis University
Charles M. Woolf..*Dean, Graduate College; Professor of Zoology*
    B.S., M.S., University of Utah; Ph.D., University of California, Berkeley

Resident Faculty

Aannestad, Per (1975)...*Associate Professor of Astronomy/Physics*
    B.S., University of Oslo; Ph.D., University of California, Berkeley
Abraham, Willard (1953)..*Professor of Education*
    B.S., Illinois Institute of Technology; M.Ed., Chicago Teachers College; Ph.D., Northwestern University
Acevedo, Roberto M. (1964) ....*Assistant Professor Emeritus of Spanish*
    B.A., University of California, Berkeley; M.A., Ph.D., University of Arizona
Acharya, Raghunath (1976)..*Associate Professor of Physics*
    M.Sc., University of Delhi; Ph.D., University of Rochester
Acker, William J. (1970)..*Associate Professor of Geography*
    B.S., Purdue University; M.S., University of Kansas; M.A., Ph.D., Syracuse University
Adams, Donna (1983) ....*Instructor of Nursing*
    B.S.N., University of Missouri; M.S.N., Arizona State University
Adams, Karen L. (1984) ....*Assistant Professor of English*
    B.A., M.A., Ph.D., University of Michigan
Adams, Sheila (1979)..*Assistant Professor of Management*
    B.S., M.B.A., University of Nevada, Reno; Ph.D., University of Washington
Adelson, Roger D. (1974)..*Associate Professor of History*
    B.A., George Washington University; M.A., Washington University;
    B.Litt., Oxford University; Ph.D., Washington University
Aguilar, John L. (1976)..*Associate Professor of Anthropology*
    B.A., University of California at Los Angeles; M.A., California State University at Los Angeles;
    Ph.D., University of California, San Diego
Ahern, Maureen V. (1972) ....*Associate Professor of Spanish*
    B.A., University of New Hampshire; Bachiller, Doctor en Letras, Universidad Nacional Mayor
    de San Marcos (Peru)
Ahmadzadeh, Akbar (1966) ....*Associate Professor of Physics*
    B.A., Ph.D., University of California, Berkeley
Akers, Lex A. (1980)...*Associate Professor of Engineering*
    B.S.E.E., M.S.E.E., Ph.D., Texas Tech University
Akins, William H. (1975)...*Professor of Theatre*
    B.A., Duke University; M.A., Ph.D., University of Denver
Alarcón, Justo S. (1968)...*Professor of Spanish*
    B.A., M.A. (Theol.), Serafica (Spain); M.A. (Sociology), Laval University (Canada);
    M.A. (Spanish). Arizona State University; Ph.D., University of Arizona
Alcock, John (1972)...*Professor of Zoology*
    B.A., Amherst College; Ph.D., Harvard University
Aldrich, Frank T. (1969)...*Associate Professor of Geography*
    B.A., University of Texas; M.S., Ph.D., Oregon State University
Aldridge, Gordon (1978) ....*Professor of Social Work*
    B.A., M.A., M.S.W., University of Toronto; Ph.D., University of Michigan

Alexander, Robert J. (1975)..*Associate Professor of German*
    B.A., Macalester College; M.A., Ph.D., University of Wisconsin, Madison
Alisky, Marvin (1957)..*Professor of Political Science*
    B.A., M.J., Ph.D., University of Texas
Allen, Theodore Jr. (1959) ....*Professor Emeritus of Engineering*
    B.S.M.E., M.S.M.E., Texas A & M University
Allison, Maria T. (1984)..*Associate Professor of Leisure Studies*
    B.S., M.S., University of New Mexico; Ph.D., University of Illinois
Alquist, Lewis R. (1984)..*Associate Professor of Art*
    B.F.A., Florida Atlantic University; M.F.A., Cranbrook Academy of Art
Altheide, David L. (1973)..*Professor, School of Justice Studies*
    B.A., Central Washington State College; M.A., University of Washington;
    Ph.D., University of California, San Diego
Altman, Michael L. (1972) ....*Professor of Law*
    A.B., Bowdoin College; LL.B., Boston College; LL.M., Harvard University
Alvarado, Ronald H. (1974)..*Professor of Zoology*
    B.A., University of California, Riverside; M.S., Ph.D., Washington State University
Anderson, Bruce A. (1966)...*Professor of Mathematics*
    B.A., M.S., Ph.D., University of Iowa
Anderson, Douglas A. (1979) ....*Associate Professor of Journalism and Telecommunication*
    B.A., Hastings College (Neb.); M.S., Kearney State College (Neb.); Ph.D., Southern Illinois University
Anderson, Gary (1975) ....*Associate Professor of Education*
    B.S., M.Ed., Edinboro State College; Ph.D., University of Pittsburgh
Anderson, Mary R. (1974)...*Associate Professor of Engineering*
    B.A., Hope College; M.S., Ph.D., University of Iowa
Anderson, Melvin S. (1967) ....*Associate Professor Emeritus of Real Estate*
    B.S., M.S., Oklahoma State University; Ed.D., University of Arkansas
Anderson, Paul M. (1980) ....*Professor of Engineering*
    B.S., M.S., Ph.D.; Iowa State University
Anderson, Sylvia (1983) ....*Instructor of Nursing*
    A.A., B.S., M.S.N., Brigham Young University
Andress, Barbara L. (1972)..*Professor of Music*
    B.A., M.A., Arizona State University
Andrews, Al (1984)...*Assistant Professor of Technology*
    B.S., M.S., Southern Illinois University, Department of Industrial Technology
Angulo, Julio (1981) ....*Assistant Professor of Social Work*
    B.A., University of Houston, Texas; M.S.W., University of California, Los Angeles;
    Ph.D., Kansas State University
Apostol, Constantin (1983) ....*Professor of Mathematics*
    Ph.D., University of Bucharest
Appleton, Nicholas R. (1972)..*Professor of Education*
    B.A., San Francisco State College; M.A., San Fernando Valley State College; Ed.D., University of Massachusetts
Aranda, Luis (1975)...*Associate Professor of General Business*
    B.M., M.Ed., University of Arizona; J.D., Arizona State University
Arciniega, G. Miguel (1979) ....*Associate Professor of Counselor Education*
    B.S., M.A., New Mexico State University; Ph.D., University of Arizona
Argulewicz, Edward N. (1980)..*Assistant Professor of Education*
    B.A., Fordham University; M.Ed., Edinboro State College; Ph.D., University of Georgia
Armstrong, Robert L. (1967) ....*Professor of Education*
    B.A., State Teachers College of Iowa; M.S., University of Iowa; Ed.D., University of Arizona
Arner, Douglas G. (1959)...*Professor of Philosophy*
    B.S., Creighton University; M.A., Ph.D., University of Michigan
Arnold, William E. (1973) ....*Professor of Communication*
    B.S., M.A., Northern Illinois University; Ph.D., Pennsylvania State University;
    Post Doctoral Fellow in Psychology, Florida State University
Aronson, Jerome M. (1966)..*Professor of Botany*
    B.A., Ph.D., University of California, Berkeley
Arterian Furnish, Hannah (1979) ....*Professor of Law*
    B.A., Elmira College; J.D., University of Iowa

Ashe, Robert W. (1955)...*Professor Emeritus of Education*
    A.B., M.A. in Ed., Arizona State University: Ed.D., University of Southern California

Asher, Betty Turner (1982)..*Associate Professor of Counselor Education;*
    B.A., Eastern Kentucky University;   *Vice President for Student Affairs*
    M.A., Western Kentucky University; Ed.D., University of Cincinnati

Ashford, Jose (1984)...*Assistant Professor of Social Work*
    B.A., Loyola University; M.S.W., Ohio State University, Ph.D., Bowling Green State University

Ashley, Richard (1977)..*Associate Professor of Political Science*
    B.A., University of California, Santa Barbara; M.A., Ph.D., Massachusetts Institute of Technology

Ashoor, Samy H. (1980)..*Professor of Agriculture*
    B.S., University of Cairo; M.S., University of California, Davis; Ph.D., University of Wisconsin

Atsumi, Takayori P. (1968)..*Professor of Music*
    B.F.A., Kunitachi Music College (Japan); M.M., New England Conservatory of Music

Autenrieth, Bertha (1946)...*Professor Emeritus of Music*
    B.M., New England Conservatory; M.M., University of Michigan

Autore, Donald D. (1959)..*Associate Professor of Technology*
    B.S.E., University of Michigan; M.S.E., Arizona State University

Avery, James P. (1960)...*Professor of Engineering*
    B.S.M.E., M.S.E.M., University of Michigan; Ph.D., Purdue University

Ax, Leland S. (1959)...*Associate Professor Emeritus of Engineering*
    B.S.E., B.S.R.E., Tri-State College; M.S., Kansas State College

Axelrod, Morris (1972)..*Professor of Sociology*
    B.A., Ph.D., University of Michigan

Axford, Roger W. (1975)...*Associate Professor of Education*
    B.A., Nebraska Wesleyan University; M.A., Ph.D., University of Chicago

Backhaus, Ralph A. (1977)..*Associate Professor of Agriculture*
    B.S., Rutgers, The State University; M.S., Ph.D., University of California

Backus, Charles E. (1968)...*Professor of Engineering; Assistant Dean,*
    B.S.M.E., Ohio University; M.S., Ph.D., University of Arizona *College of Engineering and Applied Sciences*

Bagwell, Marilyn (1972)...*Assistant Professor of Nursing*
    B.S.N., University of California, Los Angeles; M.A., Arizona State University;
    M.C.H., University of California

Bahr, Donald M. (1967)..*Professor of Anthropology*
    A.B., M.A., Ph.D., Harvard University

Bailey, James E. (1974)..*Associate Professor of Engineering*
    B.S.I.E., M.S.I.E., Ph.D., Wayne State University

Baker, Georgianne R. (1971)..*Associate Professor of Home Economics*
    B.S., Marygrove College; M.S., Ohio State University; Ph.D., Michigan State University

Baker, Virgil R. (1966)...*Professor Emeritus of Geography*
    B.S., M.S., University of Nebraska; Ph.D., University of Utah

Balanis, Constantine (1983)..*Professor of Engineering*
    B.S.E.E., Virginia Polytechnic Institute; M.S.E., University of Virginia; Ph.D., Ohio State University

Balasubramanian, Krishnan (1980)..*Assistant Professor of Chemistry*
    M.Sc., Birla Institute of Technology Science, India; M.A., Ph.D., Johns Hopkins University

Baldini, Pier Raimondo (1978)..*Associate Professor of Italian*
    B.A., San Francisco State University; M.A., University of British Columbia;
    Ph.D., University of California, Los Angeles

Baldwin, Bruce A. (1980)..*Assistant Professor of Accounting*
    B.A., M.B.A., Michigan State University; D.B.A., Arizona State University

Banuelos, Rodrigo (1984)...*Assistant Professor of Mathematics*
    B.S., University of California, Santa Cruz; M.A., University of California, Davis; Ph.D., University of California,
    Los Angeles

Bardewyck, Loretta A. (1957)...*Professor Emeritus of Nursing*
    P.H.N., B.S., University of Minnesota; M.S., Cornell University

Bardrick, Richard A. (1956)...*Associate Professor Emeritus of Psychology*
    A.B., Ph.D., University of California, Los Angeles

Barker, David (1983)..*Assistant Professor of Theatre*
    B.S.E., Duquesne University; M.F.A., Rutgers, The State University

Barkley, Margaret V. (1963)..*Professor Emeritus of Home Economics*
   B.S., Millikin University; M.S., Ed.D., University of Illinois
Barkson, Joseph A. (1958)..*Professor Emeritus of Engineering*
   B.S.E.E., University of Michigan; M.S., Ph.D., University of Illinois
Barlow, Richard B. (1964)...*Professor of History*
   B.A., M.A., Ph.D., University of Pennsylvania
Baroody, Wilson G. (1957)...*Assistant Professor of English*
   B.A., Grand Canyon College; M.A., University of Arizona
Barrera, Manuel (1977)..*Associate Professor of Psychology*
   B.S., Wisconsin State University; M.A., Ph.D., University of Oregon
Barrett, Thomas W. (1950) ....*Professor Emeritus of Agriculture*
   B.S., Brigham Young University; M.S., Ph.D., Cornell University
Bartels, Robert D. (1981)..*Professor of Law*
   B.A., University of Michigan; J.D., Stanford University
Barroll, Rayna (1980)..*Assistant Professor of Music*
   B.M., University of Texas; D.M.A. University of Maryland
Bartz, Donna R. (1968)...*Associate Professor of Theatre*
   B.F.A., M.A., University of Colorado
Bassford, Gerald (1969) ....*Associate Professor of Management*
   B.S., M.S., University of Wyoming; D.B.A., Indiana University
Batalden, Stephen K. (1976) ....*Associate Professor of History*
   B.A., Augsburg College; M.A., Ph.D., University of Minnesota
Batchelor, Harold W. (1943) ....*Professor Emeritus of Library Science*
   B.A., University of Oregon; B.S. in L.S., M.S., University of Illinois
Baty, Wayne M. (1962)..*Professor of General Business*
   B.S. in Ed., Southwest Missouri State College; M.A., Northwestern University;
   Ph.D., University of Southern California
Baumann, Victor H. (1964)..*Professor Emeritus of Education*
   B.A., Grinnell College; M.A., Northwestern University; Ed.D., University of Southern California
Baxter, Harry R. (1984)..*Assistant Professor of Technology*
   B.A., New York University; M.B.A., Fairleigh Dickinson University; M.Tech., Arizona State University
Baxter, John C. (1984) ....*Assistant Professor of Agriculture*
   B.S., M.S., University of Maryland; Ph.D., Colorado State University
Beakley, George C. Jr. (1956)..*Professor of Engineering; Associate Dean,*
   B.S.M.E., Texas Tech University;   *College of Engineering and Applied Sciences*
   M.S.M.E., University of Texas; Ph.D., Oklahoma State University; P.E.
Beatty, John (1982)..*Associate Professor of Philosophy*
   B.S., Tulane University; M.A., Ph.D., Indiana University
Beck, Lasca (1984) ....*Instructor of Nursing*
   B.S.N., Texas Woman's University; M.Ed., East Texas State University
Becker, R. James (1965) ....*Professor of Public Affairs*
   B.S., M.A., Bradley University; Ph.D., University of Illinois
Beckman, James R. (1980)..*Associate Professor of Engineering*
   B.S., M.S., University of Wisconsin; Ph.D., University of Arizona
Bedient, Jack D. (1963)...*Associate Professor of Mathematics*
   A.B., Albion College; M.B.S., Ed.D., University of Colorado
Bedworth, David D. (1963) ....*Professor of Engineering*
   B.S.I.E., Lamar College of Technology; M.S.I.E., Ph.D., Purdue University
Bell, James W. (1966) ....*Professor of Education*
   A.B., Washburn University; M.Ed., Ed.D., University of Kansas
Bell, John E. (1965) ....*Professor of Education; Chair, Department of Secondary Education*
   B.S., University of Nebraska; M.A., Ed.D., University of Wyoming
Bell, LoAnn (1980) ....*Instructor of Nursing*
   B.S., University of Wisconsin; M.S., University of Minnesota
Bell, Mary E. (1970)...*Associate Professor Emeritus of Education*
   B.S., Indiana State Teachers College; M.S., Butler University; Ed.D., Indiana University
Bellamy, Lynn (1976) ....*Associate Professor of Engineering*
   B.S., Texas A & M; M.S., Ph.D., Tulane University

Belok, Michael V. (1959) ....*Professor of Education*
  B.S., Indiana University; M.A., Arizona State University; Ph.D., University of Southern California
Beltramini, Richard H. (1980)..*Assistant Professor of Marketing and Advertising*
  B.S., M.B.A., University of Illinois; Ph.D., University of Texas, Austin
Bender, Bert A. (1971) ....*Associate Professor of English*
  B.A., University of Washington; Ph.D., University of California, Irvine
Bender, Gordon L. (1953)...*Professor Emeritus of Zoology*
  B.S., Iowa State College; M.S., University of Wisconsin; Ph.D., University of Illinois
Bender, Paul (1984)...*Professor of Law; Dean, College of Law*
  A.B., LL.B., Harvard University
Benedict, Joel A. (1946)..*Professor Emeritus of Education*
  B.A., M.A., Arizona State University; Ed.D., Stanford University
Benin, David B. (1970)...*Associate Professor of Physics*
  A.B., Cornell University; M.A., Ph.D., University of Rochester
Benin, Mary B. (1979)...*Assistant Professor of Sociology*
  B.A., Vanderbilt University; M.A., Ph.D., University of Nebraska
Bennett, ElDean (1970) ....*Professor of Journalism and Telecommunication; Director,*
  B.A., Brigham Young University;   *Walter Cronkite School of Journalism and Telecommunication*
  M.A., Ph.D., Michigan State University
Bennett, Peter A. (1984)..*Assistant Professor of Physics*
  B.A., University of Minnesota; Ph.D., University of Wisconsin
Benzinger, Robert P. (1970)...............................*Associate Professor Emeritus of Design Sciences*
  B.S.M.E., University of Wisconsin; M.A.E., Chrysler Institute of Engineering
Berch, Michael A. (1969)...*Professor of Law*
  B.A., J.D., Columbia University
Berman, David R. (1966) ....*Professor of Political Science*
  B.A. Rockford College; M.A., Ph.D., American University
Berman, Neil S. (1964) ....*Professor of Engineering*
  B.S., University of Wisconsin; M.S., M.A., Ph.D., University of Texas
Bertelsen, Wendle R. (1964) ....*Assistant Professor of Architecture*
  B. Arch., University of Michigan
Bessom, Richard M. (1968) ....*Associate Professor Emeritus of Marketing*
  A.B., Cornell University; M.B.A., Stanford University; Ph.D., University of Washington
Betz, M. Austin (1974)..*Associate Professor of Education*
  B.S., Lock Haven State College; M.Ed., Pennsylvania State University;
  M.A.T., Brown University; M.A., Ph.D., University of Illinois
Betz, Mathew J. III (1961) ....*Professor of Engineering; Director,*
  B.S., M.S., Ph.D., Northwestern University   *Center of Advanced Research in Transportation*
Beyard-Tyler, Karen C. (1975).............................*Associate Professor of Education; Chair, Department of*
  A.B., Wellesley College; M.A.L.S., University of Denver;   *Educational Technology and Library Science*
  Ph.D., Arizona State University
Bezanson, Llewellyn W. (1983) ....*Assistant Professor of Engineering*
  B.S., University of Florida; M.S., Clarkson College of Technology; Ph.D., Clarkson University
Bickford, William B. (1966) ....*Professor of Engineering*
  B.S., M.S., Kansas State University; Ph.D., University of Illinois
Bieber, Allan L. (1963)...*Professor of Chemistry*
  B.S., M.S., North Dakota State University; Ph.D., Oregon State University
Bininger, Robert J. (1962) ....*Professor of Spanish*
  B.A., M.A., Ph.D., Ohio State University
Birge, Edward A. (1972)...*Associate Professor of Microbiology*
  B.A., Ph.D., University of Wisconsin, Madison
Birk, James P. (1973)...*Professor of Chemistry*
  B.A., St. John's University; Ph.D., Iowa State University
Bitter, Gary G. (1970) ....*Professor of Education*
  B.S., Kansas State University; M.A., Kansas State Teachers College; Ph.D., University of Denver
Bjork, Robert E. (1983) ....*Assistant Professor of English*
  B.A., Pomona College; M.A., Ph.D., University of California, Los Angeles
Blackburn, Jack B. (1972)...*Professor of Engineering*
  B.S.C.E., Oklahoma University; MNS.C.E, Ph.D., Purdue University

Blackham, Garth J. (1962) ....*Professor of Counselor Education*
    B.S., M.S., Utah State University; Ph.D., Cornell University
Blackledge, Vernon O. (1969) ....*Professor of Computer Science*
    B.S.E.E., University of Illinois; M.S.E.E., University of Santa Clara; Ph.D., Arizona State University
Blaesser, Willard W. (1968) ....*Professor Emeritus of Counselor Education*
    B.S., M.A., University of Wisconsin, Madison; Ed.D., George Washington University
Blakemore, Arthur E. (1979) ....*Associate Professor of Economics*
    B.A., M.A., University of Detroit; Ph.D., Southern Illinois University
Blakey, Peter A. (1984) ....*Associate Professor of Engineering*
    B.A., Hertford College (Oxford); Ph.D., University College (London)
Blasko, Vincent J. (1980) ....*Assistant Professor of Advertising*
    B.S., M.B.A., Arizona State University; Ph.D., University of Texas, Austin
Blosser, Janlee (1984) ....*Instructor of Nursing*
    B.S.N., Goshen College; M.N., Wichita State University
Boetto, Laurel B. (1956) ....*Assistant Professor Emeritus of Education*
    B.A. in Ed., M.A. in Ed., Arizona State University
Bogart, Quentin J. (1970) ....*Associate Professor of Education*
    B.A., M.S., Fort Hays State College; Ph.D., University of Texas, Austin
Boggs, Lohnie J. (1959-65;1966) ....*Professor of General Business;*
    B.S., M.A., Ph.D., Ohio State University   *Chair, Department of General Business*
Bohlander, George W. (1977) ....*Associate Professor of Management*
    B.A., San Francisco State College; M.B.A., University of Southern California;
    Ph.D., University of California, Los Angeles
Bohlman, Herbert M. (1964) ....*Associate Professor of General Business*
    B.S., B.A., Drake University; M.B.A., J.D., Indiana University
Boissoneau, Robert (1980) ....*Professor of Health Services Administration*
    B.A., Eastern Michigan University; M.H.A., Medical College of Virginia; Ph.D., Ohio State University
Bongarts, Monty D. (1983) ....*Assistant Professor of Aerospace Studies*
    B.S., University of Tampa; M.P.A., Golden Gate University; M.S., Air Force Institute of Technology
Bontrager, O. R. (1962) ....*Professor Emeritus of Education*
    B.S., M.A., Ph.D., State University of Iowa
Booth, James R. (1980) ....*Assistant Professor of Finance*
    B.S., M.A., Ph.D., University of Alabama
Borgo, Philip E. (1967) ....*Associate Professor Emeritus of Engineering*
    B.S.C.E., University of Cincinnati; M.S., Ohio State University
Bortner, M.A. (1979) ....*Assistant Professor of Justice Studies*
    B.A., Edinboro State College; M.A., Ohio University; Ph.D., Washington University, St. Louis
Bose, Anjan (1981) ....*Associate Professor of Engineering*
    B. Tech., Indiana Institute of Technology; M.S.E.E., University of California; Ph.D.E.E., Iowa State University
Boster, Franklin (1977) ....*Associate Professor of Communication*
    B.A., M.A., Southern Illinois University; Ph.D., Michigan State University
Boswell, Jacquelyn (1982) ....*Professor of Music*
    B.M.E., Murray State University; M.M.E., Louisiana State University; Ed.D., University of Illinois
Bowers, Charles O. (1948) ....*Professor Emeritus of Music*
    B.S. in Ed., Southeast Missouri State College; M.M., D.M.A., Eastman School of Music
Bowers, Deloss H. (1984) ....*Assistant Professor of Technology*
    B.A., Ohio State University; M.S., Purdue University
Bowman, Russell K. (1956) ....*Professor Emeritus of Romance Languages*
    A.B., A.M., Ph.D., Columbia University
Boyd, Gertrude A. (1958) ....*Professor Emeritus of Education*
    A.B., M.S., Florida State University; Ed.D., Colorado State College
Boyd, James H. (1976) ....*Associate Professor of Accounting*
    B.B.A., Texas Christian University; M.S., Northeastern University; Ph.D., University of Texas, Austin; C.P.A., Texas
Boyer, Jay M. (1976) ....*Associate Professor of English*
    B.A., St. Louis University; M.A., Ph.D., State University of New York, Buffalo
Boyes, William J. (1974) ....*Professor of Economics; Chair, Department of Economics*
    B.S., Idaho State University; Ph.D., Claremont Graduate School

Boyle, Bernard M. (1969) ....*Professor of Planning*
    B. Arch., University of Sydney (Australia); M.Arch., M.A., Ph.D., Yale University

Brack, O M. Jr. (1973)..*Professor of English*
    B.A., M.A., Baylor University; Ph.D., University of Texas, Austin

Bracker, Jeffrey S. (1982)..*Assistant Professor of Management*
    B.S., M.B.A., University of Dayton; Ph.D., Georgia State University

Brada, Josef C. (1978) ....*Professor of Economics*
    B.S., M.A., Tufts University; Ph.D., University of Minnesota

Brady, Ward W. (1973) ....*Associate Professor of Agriculture*
    B.S., M.S., Ph.D., Colorado State University

Brand, Mark (1968)..*Associate Professor of Social Work*
    B.A., M.A., University of Arizona; M.S.W., University of California, Berkeley

Brandt, Elizabeth A. (1974)..*Associate Professor of Anthropology*
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Branstetter, Ellamae (1967) ....*Professor of Nursing*
    B.S., St. Louis University; M.P.H., University of Minnesota; Ph.D., University of Chicago

Braun, Joseph J. (1973) ....*Professor of Psychology*
    B.A., University of Oregon; M.A., Ph.D., Ohio State University

Braver, Sanford L. (1970)...*Associate Professor of Psychology*
    B.A., Wayne State University; Ph.D., University of Michigan

Brazel, Anthony J. (1974) ....*Professor of Geography*
    B.A., M.A., Rutgers, The State University; Ph.D., University of Michigan

Breckenridge, Jack D. (1962)...*Professor of Art*
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Bremner, Andrew (1984)...*Associate Professor of Mathematics*
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Brenenstuhl, Daniel C. (1978)...*Associate Professor of Management*
    B.S., M.B.A., Ohio University; M.S., St. Bonaventure University; D.B.A., Indiana University ,

Bresina, Bertha M. (1960) ....*Professor Emeritus of Home Economics*
    B.S., M.S., Stout State University; Ph.D., Iowa State University

Brink, Daniel T. (1976)..*Associate Professor of English*
    B.A., Lawrence University; M.A., Ph.D., University of Wisconsin

Brink, Jeanie R. (1974)..*Professor of English;*
    B.A., Northwestern University;   *Director, Arizona Center for Medieval and Renaissance Studies*
    M.A., Harvard University; Ph.D., University of Wisconsin, Madison

Britney, Robert R. (1984)..*Professor of Production/Operations Management*
    B. Eng. Sc., University of Western Ontario; M.B.A., Bowling Green State University; D.B.A., Indiana University

Britton, Daniel D. (1976) ....*Associate Professor of Art*
    B.F.A., M.F.A., University of Colorado

Britton, Mervin W. (1956)...*Professor of Music*
    B.S., M.S., University of Illinois

Broadley, Hugh T. (1969) ....*Professor of Art*
    A.B., Park College; M.A., Yale University; Ph.D., New York University

Brock, John H. (1977) ....*Associate Professor of Agriculture*
    B.S., M.S., Fort Hays State University; Ph.D., Texas A&M University

Brook, Weston L. (1966)..*Associate Professor of Education; Director,*
    B.A., M.A., Ed.D., University of Wyoming   *Professional Field Experiences*

Brooks, Daniel G. (1977)..*Associate Professor of Statistics*
    B.S., M.S., Colorado School of Mines; M.B.A., D.B.A., Indiana University

Brose, Marianna F. (1963)...*Assistant Professor of English*
    B.A., College of William and Mary; M.A., Arizona State University

Brown, Alan R. (1968)...*Associate Professor of Education*
    B.A., M.A., Los Angeles State College; Ph.D., University of Texas, Austin

Brown, Brent W. (1972) ....*Associate Professor of Public Affairs;*
    B.A., Brigham Young University;   *Assistant Vice President for Community Relations*
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Brown, Donald E. (1963)..*Professor Emeritus of Journalism and Telecommunication*
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Brown, Duane (1950)..*Professor of Chemistry*
   B.S., Brigham Young University; Ph.D., Cornell University
Brown, Stephen W. (1974) ....*Professor of Marketing*
   B.S., M.B.A., D.B.A., Arizona State University
Brown, Theodore M. (1963) ....*Professor of Chemistry*
   B.S., M.S., University of Toledo; Ph.D., Iowa State University
Brown, Walter C. (1966)..*Professor of Technology*
   B.S., Northwest Missouri State University; M.Ed., Ed.D., University of Missouri, Columbia
Bruner, May I. (1961)...*Associate Professor of Nursing*
   B.S., University of Hawaii; M.S., University of Colorado
Bruns, Gilbert H. (1974) ....*Associate Professor of Justice Studies*
   B.S., M.Ed., South Dakota State University; Ed.D., Arizona State University
Bryant, Fred O. (1950)..*Associate Professor of Physical Education*
   B.S., Springfield College; M.S., University of Illinois; Ed.D., Arizona State University
Buckingham, Willis J. (1969)...*Associate Professor of English*
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Buley, Jerry L. (1973) ....*Associate Professor of Communication*
   B.A., University of Colorado; M.A., Michigan State University; Ph.D., Florida State University
Burdette, Walter E. (1956)..*Professor Emeritus of Technology*
   B.S., M.S., Kansas State College of Pittsburg; Ed.D., University of Missouri, Columbia
Burdick, Richard K. (1976) ....*Associate Professor of Decision and Information*
   B.S., University of Wyoming; M.S., Texas A&M University
Burg, B. Richard (1967)...*Professor of History*
   B.A., University of Colorado; M.A., Western State College of Colorado; Ph.D., University of Colorado
Burgess, Hugh (1974) ....*Professor of Planning*
   B.S., University of Idaho; M.S. Arch., Col,umbia University; Arch. D., Rice University
Burgess, Paul L. (1969) ....*Professor of Economics*
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Burgoyne, Edward E. (1951)...*Professor Emeritus of Chemistry*
   B.S., Utah State University; M.S., Ph.D., University of Wisconsin, Madison
Burk, Karl W. (1949)...*Associate Professor Emeritus of Technology*
   B.A. in Ed., M.A. in Ed., Arizona State University; Ed.D., Bradley University
Burke, Joy Patricia (1981)...*Assistant Professor of Education*
   B.A., San Jose State University; M.Ed., Ed.D., Rutgers, The State University
Burke, William F. Jr. (1977)...*Associate Professor of Microbiology*
   B.A., University of Dallas, Irving; M.A., North Texas State University; Ph.D., Arizona State University
Burke, William J. (1962) ....*Professor Emeritus of Chemistry*
   A.B., Ohio University; Ph.D., Ohio State University
Burkett, Lee N. (1974) ....*Associate Professor of Physical Education*
   B.A., M.A., San Diego State University; Ph.D., Washington State University
Burns, Elizabeth K. (1983)..*Professor of Planning; Chair, Department of Planning*
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Burstein, David (1982)..*Assistant Professor of Physics*
   B.A., Wesleyan University; Ph.D., University of California, Santa Cruz
Burt, Donald M. (1974)..*Professor of Geology*
   A.B., Princeton University; A.M., Ph.D., Harvard University
Burton, Dora (1976)..*Assistant Professor of Russian*
   M.D., First Leningrad and Kazan' Medical Institute (Russia); M.A., Ph.D., University of Washington
Burton, Foster M. (1969)...*Associate Professor of Construction*
   B.S.C.E., B.S., (Industrial Management), Carnegie Institute of Technology;
   M.B.A., New York University; Ph.D., University of Pittsburgh
Buseck, Peter R. (1963) ....*Professor of Geology*
   B.A., Antioch College; M.A., Ph.D., Columbia University
Bush, Donald J. (1975)..*Associate Professor of Design Sciences*
   B.S., Arizona State University; M.A., University of Notre Dame; Ph.D., University of New Mexico
Bustoz, Joaquin (1975)..............................*Professor of Mathematics; Chair, Department of Mathematics*
   B.A., M.A., Ph.D., Arizona State University
Butler, Jay Q. (1972)...*Associate Professor of Real Estate*
   B.B.A., M.B.A., University of New Mexico; Ph.D., University of Washington

Byrnes, Christopher (1984) ....*Professor of Mathematics; Research Professor of Electrical Engineering*
   B.S., Manhattan College; M.A., Ph.D., University of Massachusetts

Cabianca, William A. (1967) ....*Professor of Counselor Education;*
   B.Ed., Gonzaga University;   *Associate Vice President for Student Development*
   M.Ed., Ph.D., Washington State University
Cady, Linell E. (1983)..*Assistant Professor of Religious Studies*
   B.A., Newton College; M.T.S., Th.D., Harvard University, The Divinity School
Cadzow, James A. (1981)..............................*Professor of Research; Electrical and Computer Engineering*
   B.S.E.E., University of Buffalo; M.S.E.E., State University of New York at Buffalo; Ph.D., Cornell University
Cale, Timothy S. (1981)..*Assistant Professor of Engineering*
   B.S., Arizona State University; Ph.D., University of Houston
Callarman, Thomas E. (1980) ....*Assistant Professor of Production/Operations Management*
   B.B.A., West Texas State University; M.B.A., Arizona State University; Ph.D., Purdue University
Calleros, Charles R. (1980)..*Professor of Law*
   B.A., University of California, Santa Cruz; J.D., University of California, Davis
Canright, James E. (1964)...*Professor Emeritus of Botany*
   B.A., Miami University; A.M., Ph.D., Harvard University
Capco, David G. (1984)...*Assistant Professor of Zoology*
   B.S., Edinboro State College; M.S., University of Houston; Ph.D., University of Texas at Austin
Carleton, Andrew M. (1982)..*Assistant Professor of Geography*
   B.A., M.A., University of Adelaide, Australia; Ph.D., University of Colorado, Boulder
Carlsen, Paul A. (1978) ....*Assistant Professor of Technology*
   B.A.E., M.N.S., Ed.D., Arizona State University
Carlson, Ingeborg L. (1964)..*Professor of German*
   Abitur, Hölderlinschule, Heidelberg; Vorsemester and
   cand.phil., University of Heidelberg; Dr. phil., University of Erlangen-Nuremberg
Carney, James D. (1967)...*Professor of Philosophy*
   M.A., Roosevelt University; Ph.D., University of Nebraska, Lincoln
Carpenter, R. W. (1980) ....*Professor, Center for Solid State Science/Engineering*
   B.S., M.S., Ph.D., University of California, Berkeley
Carr, Benny M. (1982)..*Associate Professor of Construction*
   B.S.E., United States Military Academy; M.S.E.E., Purdue University
Carrasco, Robert (1980) ....*Assistant Professor of Education*
   B.S., M.A.T., California State University; Ed.M., Harvard University
Carroll, Christina (1966)..*Professor of Music*
Carroll, James L. (1976) ....*Associate Professor of Education*
   B.A., Bethel College; Ph.D., University of Minnesota
Carroll, Kevin K. (1975)...*Assistant Professor of History*
   B.A., Canisius College; M.A., Ph.D., Harvard University
Carver, George L. (1965)...*Associate Professor of Classical Languages*
   B.A., M.A., University of Texas; S.T.B., St. Mary's Seminary, Baltimore; Ph.D., St. Louis University
Case, James L. (1969) ....*Associate Professor of Speech and Hearing Science*
   B.S., Weber State College; M.S., Ph.D., University of Utah
Castelazo, Ismael (1984)..*Assistant Professor of Engineering*
   Ing. Mec., Instituto Politecnico Nacionál, Mexico City; M.S., Ph.D., Massachusetts Institute of Technology
Cavalliere, William A. (1946)...*Assistant Professor Emeritus of Technology*
   B.A. in Ed., M.A. in Ed., Arizona State University
Cavender, Gray (1977) ....*Associate Professor of Justice Studies*
   B.S., J.D., University of Tennessee; M.S., Middle Tennessee State University; Ph.D., Florida State University
Cayer, Joseph N. (1980)...*Professor of Public Affairs*
   B.A., M.P.A., University of Colorado; Ph.D., University of Massachusetts
Cazier, Mont A. (1962)..*Professor Emeritus of Zoology*
   B.S., Ph.D., University of California, Berkeley
Cesta, John R. (1975) ....*Associate Professor of Finance*
   B.S., Capital University, Columbus, Ohio; M.B.A., Ph.D., Florida State University
Chalquest, Richard R. (1971)..*Professor of Agriculture*
   B.S., D.V.M., Washington State University; M.S., Ph.D., Cornell University

Chandler, Douglas E. (1980) ....*Assistant Professor of Zoology*
    B.S., University of Rochester; M.A., Johns Hopkins School of Medicine;
    Ph.D., University of California, San Francisco

Chang, Fu-Kuo (1984) ....*Assistant Professor of Engineering*
    M.S., National Tsing-Hwa University, Taiwan; Ph.D., University of Michigan

Chartier, George M. (1971) ....*Associate Professor of Psychology*
    B.S., University of Illinois; M.A., Ph.D., University of Oregon

Chasey, Eugene F. (1965) ....*Associate Professor Emeritus of Education*
    B.S., Northwestern State College; M.A., Colorado State College; Ed.D., University of Wyoming

Chassin, Laurie (1979)...*Associate Professor of Psychology*
    B.A., Brown University; M.A., Ph.D., Columbia University

Cheatham, Glenn W. (1975)...............................*Professor of Leisure Studies; Associate Dean, College of*
    B.S., M.S., San Francisco State University; Ph.D., University of Minnesota   *Public Programs*

Chen, Stanley S. (1967)..*Professor of Engineering*
    Diploma, Taipei Institute of Technology (China); M.S., Ohio University; Ph.D., University of Wisconsin,
    Madison

Chewning, Gene (1984) ....*Assistant Professor of Accounting*
    B.S.B.A., University of North Carolina, Chapel Hill; M.B.A., East Carolina University; Ph.D., University of South
    Carolina; C.P.A., North Carolina

Childers, Bruce K. (1974)..*Associate Professor of General Business*
    B.B.A., North Texas State University; M.B.A., J.D., Texas Tech University

Chlistowa, Xenia (1980) ....*Assistant Professor of Dance*

Chou, Ju-Hsi (1975)..*Professor of Art*
    B.A., University of Kentucky; M.A., Ph.D., Princeton University

Christensen, George (1975) ....*Assistant Professor of Architecture*
    B. Arch., Illinois Institute of Technology

Christiansen, Kent M (1966) ....*Associate Professor of Education; Director of Student Services*
    B.S., M.S., Brigham Young University; Ph.D., Michigan State University

Christine, Ray O. (1958)..*Associate Professor of Education*
    A.B., A.M., Northern Colorado University; Ed.D., Arizona State University

Chubrich, Robert E. (1971)..*Associate Professor of Speech and Hearing Science*
    B.A., Grinnell College; M.A., Indiana University; Ph.D., State University of New York, Buffalo

Church, Kathleen K. (1969) ....*Professor of Zoology; Chair, Department of Zoology*
    B.S., M.A., University of Utah; Ph.D., University of California, Berkeley

Churchill, William D. (1966) ....*Associate Professor of Education;*
    A.B., Colgate University;   *Counselor, University Counseling Service*
    M.Ed., Alfred University; Ed.D., University of Rochester

Chyu, Mingking (1984) ....*Assistant Professor of Engineering*
    B.S., National Tsing Hwa University, Taiwan; M.S., University of Cincinnati; Ph.D., University of Minnesota

Cialdini, Robert B. (1971) ....*Professor of Psychology*
    B.S., University of Wisconsin; M.A., Ph.D., University of North Carolina

Clark, Geoffrey A. (1971)...*Professor of Anthropology*
    B.A., M.A., University of Arizona; Ph.D., University of Chicago

Clark, Robert C. (1981) ....*Professor of Music*
    B.Mus., Central Methodist College; S.M.M., Union Theological Seminary

Clark, William Dennis (1976) ....*Associate Professor of Botany*
    B.A., Sacramento State College; Ph.D., University of Texas

Cleary, Edward W. (1967)..*Professor Emeritus of Law*
    A.B., Illinois College; J.D., University of Illinois; J.S.D., Yale University

Clothier, Ronald R. (1955) ....*Associate Professor Emeritus of Zoology*
    A.B., Fresno State College; M.A., Montana State University; Ph.D., University of New Mexico

Cluff, Gordon L. (1963)..*Professor of Speech and Hearing Science*
    B.A., Arizona State University; M.S., Ph.D., Southern Illinois University

Cmich, Dianne E. (1981)...*Assistant Professor of Health Science*
    B.S., Kent State University; M.A., Ph.D., Ohio State University

Cobas, José A. (1975)..*Associate Professor of Sociology*
    B.A., Maryville College; M.A., University of Tennessee, Knoxville; Ph.D., University of Texas, Austin

Cochran, Douglas L. (1968) ....*Associate Professor Emeritus of Management*
    B.S., Ohio State University; M.B.A., Harvard University; Ph.D., University of Oregon

Cochran, Jeffery K. (1984) ....*Assistant Professor of Engineering*
    B.S.E., M.S.N.E., M.S.I.E., Ph.D., Purdue University
Cochran, John A. (1962) ....*Professor of Economics*
    A.B., Drake University; A.M., Ph.D., Harvard University
Coghlan, William A. (1982) ....*Associate Professor of Engineering*
    B.S., Montana School of Mines; M.S., Ph.D., Stanford University
Cohen, David (1967)..*Professor of Music*
    B.S., M.S., Juilliard School of Music; D.M.A., University of Southern California
Cohen, Herbert G. (1977)..*Associate Professor of Education*
    B.S., Muhlenberg College; M.A., Hofstra University; Ph.D., University of Iowa
Cohn, Sanford J. (1979)...*Associate Professor of Education*
    B.A., M.Ed., Ph.D., Johns Hopkins University
Colby, Arthur L. (1965) ....*Assistant Professor of English*
    B.A., University of Massachusetts; M.A., Ph.D., University of North Carolina
Cole, Gerald A. (1958) ....*Professor Emeritus of Zoology*
    A.B., Middlebury College; M.S., St. Lawrence University; Ph.D., University of Minnesota
Collins, James P. (1975)..*Associate Professor of Zoology*
    B.S., Manhattan College; M.S., Ph.D., University of Michigan
Collofello, James S. (1979)...*Assistant Professor of Computer Science*
    A.A., Joliet Junior College; B.S., M.S., Northern Illinois University; Ph.D., Northwestern University
Comeaux, Malcolm L. (1969)..*Professor of Geography*
    B.A., University of Southwestern Louisiana; M.A., Southern Illinois University; Ph.D., Louisiana State University
Comfort, Joseph R. (1981) ....*Professor of Physics*
    A.B., Ripon College; M.S., Ph.D., Yale University
Conlin, David A. (1948)..*Professor Emeritus of English*
    A.B., Syracuse University; Ph.D., Yale University
Cook, Jeffrey (1961) ....*Professor of Architecture*
    B. Arch., University of Manitoba (Canada); M. Arch., Pratt Institute
Cook, Phil A. (1963) ....*Professor of Education*
    B.A., Southwestern State College; M.A., Colorado State College of Education; Ed.D., University of Kansas
Cook, Suzanne M. (1974) ....*Associate Professor of Management*
    B.B.A., M.B.A., D.B.A., Texas Tech University
Cooperrider, Neil K. (1973)..*Professor of Engineering*
    B.S.M.E., M.S.M.E., Ph.D., Stanford University
Corbin, Charles B. (1982) ....*Professor of Physical Education*
    B.S., University of New Mexico; M.S., University of Illinois; Ph.D., University of New Mexico
Corder, Brice W. (1971)..*Professor of Health Science; Assistant Dean,*
    B.A., Lynchburg College; M.Ed., Ed.D., Temple University   *Pre-Health Professions, College of Liberal Arts*
Cosand, Walter A. (1976) ....*Associate Professor of Music*
    B.M., M.M., University of Rochester
Cota-Cardenas, Margarita (1981) ....*Assistant Professor of Spanish*
    B.A., California State University, Turlock; M.A., University of California, Davis; Ph.D., University of Arizona
Couch, Sanford C. (1962) ....*Professor of Russian*
    B.A., M.A., Ph.D., University of Wisconsin, Madison
Coudroglou, Aliki (1971)..*Professor of Social Work*
    B.A., College of St. Benedict; M.S.W., University of Minnesota; D.S.W., Columbia University
Covey, Carlin R. (1984) ....*Assistant Professor of Computer Science*
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Cowley, Anne P. (1983) ....*Professor of Astronomy-Physics*
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Cowley, John M. (1969)..*Galvin Professor of Physics*
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Cox, Frank E. (1972)...*Professor Emeritus of Technology*
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Cox, Steven R. (1970)..*Associate Professor of Economics*
    B.S., University of Wisconsin, Madison; M.A., Ph.D., University of Michigan
Craft, John E. (1973)......................................*Associate Professor of Journalism and Telecommunication*
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Crawford, John E. (1980)..*Assistant Professor of Communication*
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Creath, J. Richard (1974) ....*Associate Professor of Philosophy*
    B.A., Knox College; M.A. (Phil.), M.A. (Hist./Phil.Sci.), Ph.D., University of Pittsburgh
Creighton, Judith M. (1967)..*Assistant Professor of Home Economics*
    B.S., University of Arizona; M.S., M.C., Arizona State University
Croft, Lee B. (1973)..*Associate Professor of Russian*
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Cronin, John R. (1966)...*Professor of Chemistry*
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Crosby, Lawrence A. (1983)...*Associate Professor of Marketing*
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Crouch, Beulah (1953) ....*Assistant Professor Emeritus of Education*
    B.A. in Ed., M.A. in Ed., Arizona State University
Crowder, Troy F. (1970)..............................*Associate Professor of Journalism and Telecommunication;*
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Crowe, Barbara J. (1981) ....*Assistant Professor of Music*
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Cummings, Lawrence T. (1970) ....*Associate Professor of Counselor Education*
    B.A., M.A., Arizona State University; Ed.D., University of California, Los Angeles
Cummings, Susan N. (1964)...*Associate Professor of Education*
    B.S., University of Chicago; M.A. in Ed., Ph.D., Arizona State University
Curran, Mark J. (1968)...*Professor of Spanish and Portuguese*
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Daane, Calvin J. (1963) ....*Professor Emeritus of Counselor Education*
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Dagger, Richard K. (1976)...*Associate Professor of Political Science*
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Dahl, Richard C. (1966) ....*Professor Emeritus of Law*
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Daley, Michael J. (1978) ....*Professor of Social Work*
    B.S., Spring Hill College; M.S.W., St. Louis University; M.S., University of Pittsburgh; D.S.W., Tulane University
Dalgleish, Donald D. (1962)...*Associate Professor of Political Science*
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D'Alonzo, Bruno J. (1976)...*Professor of Education*
    B.S., Ohio State University; M.S., West Virginia University; Ph.D., Bowling Green State University
Damos, Diane L. (1981) ....*Assistant Professor of Psychology*
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D'Andrea, Frank L. (1972)...*Associate Professor Emeritus of Music*
    B.A., M.A., Ed.D., Columbia University
Daneke, Gregory A. (1982) ....*Associate Professor of Public Affairs*
    A.A., San Bernardino Valley College; B.A., M.A., Brigham Young University; Ph.D., University of California,
    Santa Barbara
D'Angelo, Frank J. (1970)..*Professor of English*
    B.A., Loyola University, New Orleans; M.A., Tulane University; Ph.D., University of Nebraska, Lincoln
Daniel, Norman E. (1970) ....*Associate Professor of Transportation*
    B.S., M.S., University of Tennessee, Knoxville; Ph.D., Indiana University
Daniels, John D. (1984)..*Professor of Management*
    B.B.A., University of Miami; M.B.A., University of the Americas; Ph.D., University of Michigan
Dannenfeldt, Karl H. (1956) ....*Professor of History*
    A.B., Valparaiso University; M.A., Indiana University; Ph.D., University of Chicago
Dantico, Marilyn (1978)..*Associate Professor of Political Science*
    B.A., University of Illinois; M.A., Ph.D., Florida State University

Darst, Paul W. (1976)...*Assistant Professor of Physical Education*
    B.S., M.S., Akron University; Ph.D., Ohio State University
Datesman, Susan K. (1979)..*Associate Professor of Justice Studies*
    B.A., Kutztown State College; M.A., Ph.D., University of Delaware
Datta, Ajoy K. (1984)...*Assistant Professor of Computer Science*
    B.E., P.G., Ph.D., Jadavpur University
Dauten, Joel J. (1960)..*Professor Emeritus of Finance*
    B.S., M.S., Washington University; Ph.D., University of Iowa
Davey, William G. (1976)...*Associate Professor of Communication*
    B.A., Pennsylvania State University; M.A., Columbia University; Ph.D., Indiana University
Davidson, Joseph K. (1973)...*Professor of Engineering*
    B.M.E., M.Sc., Ph.D., Ohio State University
Davis, George R. (1980)..*Associate Professor of Engineering*
    B.S.E.E., M.S., University of Illinois; Ph.D., University of Arizona
Davis, Joseph M. (1975)...*Associate Professor of Real Estate*
    B.S., University of South Carolina; M.B.A., Texas A & I University; Ph.D., University of Georgia
Davis, Keith (1958)..*Professor Emeritus of Management*
    B.B.A., M.B.A., University of Texas; Ph.D., Ohio State University
Davis, Robert E. (1959)..*Professor of Communication*
    B.A., M.A., Ph.D., University of Illinois
Davis, Sanford S. (1953)..*Professor Emeritus of Counselor Education*
    A.B., B.S., Central Missouri State College; A.M., University of Missouri, Kansas City; Ed.D., University of
    Colorado
Deach, Dorothy F. (1967)..*Professor Emeritus of Physical Education*
    B.S., M.S., University of Illinois; Ph.D., University of Michigan
Dean, Arthur G. (1971) ....*Associate Professor of Engineering*
    B.A., M.S., Texas Tech University; Ph.D., Texas A & M University
Debenport, Sylvia (1978)..*Associate Professor of Music*
    B.M.E., B.M., M.M., Indiana University
DeBerg, Curtis L. (1984)..*Assistant Professor of Accounting*
    B.A., University of Northern Iowa; M.S., Ph.D., Oklahoma State University; C.P.A., Iowa
DeGroote, Steven (1981)...*Associate Professor of Music*
    Premier Prix (Piano), Conservatoire Royal de Musique (Brussels); Diploma, Curtis Institute of Music
    (Philadelphia)
de Kant, Ronald (1983) ....*Associate Professor of Music*
    A.D., Julliard School of Music
Dellheim, Charles J. (1980) ....*Assistant Professor of History*
    B.A., Harpur College; M.A., Ph.D., Yale University
DeMars, James R. (1981) ....*Assistant Professor of Music*
    B.A., Macalester College; M.A., Ph.D., University of Minnesota
DeMarsche, Katharine Urry (1975)..*Associate Professor of Art*
    B.A., Mills College; M.F.A., University of Colorado
DeMassa, Thomas A. (1966)..*Professor of Engineering*
    B.S.E.E., M.S.E.E., Ph.D., University of Michigan
de Matties, Nicholas (1974) ....*Associate Professor of Art*
    B.A., Long Beach State University; M.S., Illinois Institute of Technology
Demeke, Howard J. (1962) ....*Associate Professor Emeritus of Education*
    A.B., San Francisco State College; M.S., Ed.D., University of Southern California
Dermody, Jaime Cuevas (1984)..*Assistant Professor of Finance*
    B.S., University of Maryland; M.B.A., Ph.D., University of Pennsylvania
DeSerpa, Allan C. (1975)...*Associate Professor of Economics*
    B.A., University of Santa Clara; Ph.D., University of California, Santa Barbara
Detrie, Thomas (1984) ....*Associate Professor of Art*
    B.F.A., M.F.A., Louisiana Technical University
Dezelsky, Thomas L. (1968)..*Associate Professor of Health Science*
    B.S., Central Michigan University; M.A., University of Michigan; H.S.D., Indiana University
Diaz, José Luis (1984)...*Assistant Professor of Agriculture*
    B.S., Escuela Tecnica de Ingenieros Agronomos, Madrid; M.B.A., State University of New York, Buffalo; Ph.D.,
    Texas A&M University

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    B.S., M.S., Ph.D., University of Illinois
Ditsworth, Richard L. (1959) ....*Professor of Engineering*
    B.S., M.S., Iowa State College; Ph.D., Michigan State University
Dittert, Alfred E. Jr. (1967) ....*Professor of Anthropology*
    B.A., M.A., University of New Mexico; Ph.D., University of Arizona
Doan, Jerry (1979) ....*Associate Professor of Music*
    B.M.E., M.M., North Texas State University; D.M.A., University of Michigan
Doane, Winifred W. (1977) ....*Professor of Zoology*
    B.A., Hunter College of the City of New York; M.S., University of Wisconsin; Ph.D., Yale University
Dobkin, William E. (1970) ....*Professor of Theatre*
    A.B., Eastern Michigan University; M.A., University of Colorado; Ph.D., Indiana University
Doebler, Bettie Anne (1971) ....*Professor of English*
    B.A., M.A., Duke University; Ph.D., University of Wisconsin, Madison
Doebler, John W. (1970) ....*Professor of English*
    B.A., Duke University; M.A., Ph.D., University of Wisconsin, Madison
Donelson, Kenneth L. (1965) ....*Professor of English*
    B.A., M.A., Ph.D., University of Iowa
Donnelly, Aaron V. (1962) ....*Professor Emeritus of Engineering*
    B.S.E.E., M.S., University of Iowa; M.A., Columbia University; Ph.D., University of Iowa
Donovan, Jan (1980) ....*Assistant Professor of General Business; Director, Small Business Institute*
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Dorman, Michael F. (1976) ....*Professor of Speech and Hearing Science;*
    B.S., University of Washington; M.A., Hollins College;   *Chair, Department of Speech and Hearing Science*
    Ph.D., University of Connecticut
Dorson, William J. (1966) ....*Professor of Engineering*
    B.Ch.E., M.Ch.E., Rensselaer Polytechnic Institute; Ph.D., University of Cincinnati
Douglas, Joan S. (1980) ....*Assistant Professor of Nursing*
    B.S., Stanford University; M.P.H., University of North Carolina
Dove, Rita (1981) ....*Associate Professor of English*
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Downing, George D. Jr. (1964) ....*Professor Emeritus of Marketing*
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Doyle, Donald P. (1962) ....*Professor of Theatre*
    B.A., Arizona State University; M.A., Northwestern University; Ph.D., University of Minnesota
Doyle, Roy P. (1959) ....*Professor of Education*
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Drake, Jackson M. (1974) ....*Associate Professor of Education;*
    B.S., M.S., Southern Illinois University;   *Director of Arizona Educational Information System;*
    Ed.D., Columbia University   *Director of Field Services*
Dresskell, Nadine (1946) ....*Professor Emeritus of Music*
    B.S., Bowling Green State University; M.A., Columbia University
Driscoll, Michael F. (1971) ....*Associate Professor of Mathematics*
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Dubie, Norman (1978) ....*Professor of English*
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Dudek, Leona M. (1960) ....*Assistant Professor Emeritus of Education*
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Duffy, Dennis M. (1977) ....*Associate Professor of Engineering*
    B.S., M.S., Ph.D., University of Arizona
Duncan, William A. (1980) ....*Assistant Professor of Accounting*
    B.S., Portland State University; Ph.D., University of Texas; C.P.A., Texas
Dundas, Mary Jane (1975) ....*Associate Professor of General Business*
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Durrenberger, Robert W. (1971) ....*Professor Emeritus of Geography*
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    Ph.D., University of California, Los Angeles
Dycus, Augustus M. (1959) ....*Associate Professor Emeritus of Botany*
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Edelsky, Carole (1976)..*Associate Professor of Education*
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Eder, James F. Jr. (1975)..*Associate Professor of Anthropology*
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Edwards, John (1964)..............................*Professor of Education; Director, Off-Campus Academic Services*
    B.S., Ball State University; M.A., Ed.D., Arizona State University
Edwards, Mark R. (1978)..*Associate Professor of Agriculture*
    B.S.M.E., U.S. Naval Academy; M.B.A., D.B.A., Arizona State University
Edwards, Marvin J. (1959)...*Assistant Professor of Technology*
    B.S., M.A. in Ed., Arizona State University
Eeds, Maryann H. (1975) ....*Associate Professor of Education*
    B.S., California State University, Sacramento; Ph.D., University of Oregon
Effland, Richard W. (1967) ....*Professor Emeritus of Law*
    A.B., LL.B., University of Wisconsin; LL.M., Columbia University
Eisenberg, Nancy H. (1976) ....*Associate Professor of Psychology*
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Ekmanis, Rolfs (1963) ....*Professor of Russian*
    B.A., M.A., University of Wisconsin, Madison; Ph.D., Indiana University
Ellis, John C. (1957)..*Associate Professor Emeritus of English*
    B.A., M.A., Ph.D., University of Oregon
Ellis, Robert H. (1962).................................*Associate Professor of Journalism and Telecommunication;*
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Ellman, Ira Mark (1978)...*Professor of Law*
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Ellner, Anthony Jr. (1960)..*Professor Emeritus of Architecture*
    B.A., City University of New York; M.A., Columbia University; M. Arch., Yale University
Ellsworth, Lola M. (1938) ....*Professor Emeritus of Home Economics*
    B.S., Brigham Young University; M.A., Columbia University
Elmore, James W. (1949)...*Professor Emeritus of Planning*
    A.B., University of Nebraska; M.S. in Arch., Columbia University
Emery, Raymond C. (1962)..*Associate Professor Emeritus of English*
    B.A., M.A., University of Wyoming; Ed.D., Stanford University
Engel, Glorianne (1982) ....*Assistant Professor of Theatre*
    B.F.A., University of Arizona; M.A., Ph.D., University of Pittsburgh
Engelhardt, Florence P. (1965) ....*Associate Professor of Social Work*
    B.A., College of Mount Saint Vincent; M.S.S., Fordham University
Engelhardt, Jon M. (1972) ....*Professor of Education;*
    B.A., M.A., Arizona State University;   *Chair, Department of Elementary Education*
    Ph.D., University of Texas, Austin
English, William S. (1962)...*Professor of Music*
    B.M., Washburn University; M.A., Ph.D., George Peabody College
Entz, Adele (1984) ....*Instructor of Nursing*
    B.S.N., University of Washington; M.N., University of Kansas
Eribes, Richard A. (1976)..*Associate Professor of Public Affairs;*
    B.Arch., M.Arch., Ph.D., University of Southern California   *Director, Research and Publications*
Erno, Richard B. (1957-62; 1963)...*Professor of English*
    B.A., Michigan State University; M.A., University of Denver; Ph.D., University of Minnesota
Ernzen, James J., Captain (1983) ....*Assistant Professor of Military Science*
    B.S., M.S., Notre Dame University
Esparza, Delia (1982)..*Instructor of Nursing*
    B.S.N., University of Texas, Austin; M.S., University of Colorado
Esquer, Cecilia D. (1981)..*Assistant Professor of General Business*
    B.A., M.A., J.D., Arizona State University
Evans, Donovan L. (1966)..*Professor of Engineering*
    B.S.M.E., University of Cincinnati; Ph.D., Northwestern University

Evans, John X. (1964) ....*Professor of English*
    B.A.. Holy Cross College; M.A.. Ph.D., Yale University
Evans, Kenneth R. (1980) ....*Assistant Professor of Marketing*
    B.A., University of California, Davis; M.B.A.. California State University; D.B.A., University of Colorado,
    Boulder
Eyring, LeRoy (1961) ....*Professor of Chemistry*
    B.S.. University of Arizona; Ph.D., University of California, Berkeley

Faas, Larry A. (1967) ....*Professor of Education*
    B.S. Iowa State University; M.A.. Colorado State College; Ed.D., Utah State University
Fabes, Richard A. (1983) ....*Assistant Professor of Home Economics*
    B.A.. University of Colorado; M.S.. Ph.D., Oklahoma State University
Faeth, Stanley H. (1980) ....*Assistant Professor of Zoology*
    B.S.. M.S., University of Cincinnati; Ph.D., Florida State University
Fafitis, Apostolos (1984) ....*Assistant Professor of Civil Engineering*
    B.S.Eng.. Aristotolion University of Thessaloniki, Greece; M.Eng.. South Dakota School of Mines and
    Technology; Ph.D., Northwestern University 1984
Faith, Roger L. (1981)..*Professor of Economics*
    B.A.. St. Mary's College of California; M.A., Ph.D., University of California, Los Angeles
Faltz, Leonard M. (1979) ....*Associate Professor of English*
    B.S., City College of New York; M.A., Harvard University; Ph.D., University of California, Berkeley
Farber, Bernard (1971)..*Professor of Sociology*
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Faris, Norma J. (1984) ....*Assistant Professor of Engineering*
    B.S.. University of Massachusetts; M.S.. Ph.D.. Rensselaer Polytechnic Institute
Farmer, Frank D. (1970)..*Associate Professor of Mathematics*
    B.A.. M.A.. University of California, Riverside; Ph.D., University of Washington
Farness, Sherly F. (1969) ....*Assistant Professor of Art*
    B.A.. M.A., Michigan State University
Farrar, Roger D. (1974) ....*Associate Professor of Education*
    B.A., M.S.. Kearney State College; Ed.D.. University of Nebraska
Farris, Martin T. (1957)..*Professor of Transportation*
    B.A., M.A., University of Montana: Ph.D., Ohio State University
Fausel, Donald F. (1969) ....*Associate Professor of Social Work*
    A.B., S.T.B., S.T.L., St. Mary's University; M.S.W.. Fordham University; D.S.W., Columbia University
Faustini, Antony A. (1983) ....*Assistant Professor of Computer Science*
    B.S./C.S.. Ph.D., University of Warwick
Fay, Keith L. (1983) ....*Professor of Purchasing/Materials Management*
    B.S.. M.B.A., Arizona State University; Ph.D.. The American University
Fearon, Harold E. (1961) ....*National Association of Purchasing Management Professor*
    B.S.. M.B.A., Indiana University; Ph.D., Michigan State University
Fehr, Fred S. (1971)..*Associate Professor of Psychology*
    B.S., University of Wisconsin; M.A.. Ph.D., Washington University
Feldhaus, Anne (1981) ....*Associate Professor of Religious Studies*
    B.A.. Manhattanville College; Ph.D., University of Pennsylvania
Feldstein, Alan (1970) ....*Professor of Mathematics*
    B.A., Arizona State University; Ph.D., University of California, Los Angeles
Feller, Carolyn M. (1972) ....*Assistant Professor of Nursing*
    B.S.N., M.S., Arizona State University
Fellows, Rushia G. (1977)..*Assistant Professor of Architecture*
    B.S., Arizona State University
Fenske, Robert H. (1974)..*Professor of Education*
    B.S.. M.S.. Ph.D., University of Wisconsin
Fernando, Harindra (1984)..*Assistant Professor of Engineering*
    B.Sc., University of Sri Lanka; M.A.. Ph.D.. Johns Hopkins University; Post-Doctoral, California Institute of
    Technology
Ferraro, Kathleen (1982) ....*Assistant Professor of Justice Studies*
    B.A., Case Western Reserve University; M.A.. Ph.D., Arizona State University

Ferrell, Wilfred A. (1959) ....*Professor of English*
B.A., M.A., Ph.D., University of Texas

Ferry, David K. (1983) ....*Professor of Engineering; Center for Solid State Electronics*
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Fifield, Michael E. (1984) ....*Assistant Professor of Architecture*
B.A., University of California, Berkeley; M. Arch., University of California, Los Angeles

Finch, A. Joyce (1965) ....*Assistant Professor of Nursing*
B.S.N., Augustana College; M.S., University of Colorado

Findler, Nicholas V. (1982) ....*Professor of Computer Science*
B.Eng., Ph.D., Budapest University for Technical Sciences

Findley, Lisa R. (1984) ....*Assistant Professor of Architecture*
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Finer, Neal (1977) ....*Associate Professor of Education*
B.A., University of Houston; M.A., Mexico City College (University of the Americas);
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Fink, Jonathan H. (1982) ....*Assistant Professor of Geology*
B.A., Colby College; Ph.D., Stanford University

Fink, Raymond R. (1958) ....*Professor of Art*
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Firestone, Melvin M. (1968) ....*Associate Professor of Anthropology*
B.A., University of New Mexico; M.A., Ph.D., University of Washington

Fisher, Marvin M. (1958) ....*Professor of English*
A.B., A.M., Wayne University; Ph.D., University of Minnesota

Fisher, Stuart G. (1976) ....*Associate Professor of Zoology*
B.S., M.A., Wake Forest College; Ph.D., Dartmouth College

Fitch, Gregory W. (1974) ....*Associate Professor of Philosophy*
B.A., Western Washington State College; M.A., Ph.D., University of Massachusetts, Amherst

Flaherty, Richard E. (1978) ....*Professor of Accounting*
B.A., M.S., Ph.D., University of Kansas; C.P.A., Kansas

Fleig, Bernard M., Major (1982) ....*Assistant Professor of Aerospace Studies*
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Fleming, Robert C. (1974) ....*Associate Professor of Music; Associate Director of Bands*
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Fletcher, Grant (1956) ....*Professor Emeritus of Music*
B.M., Illinois Wesleyan University; M.M., University of Michigan; Ph.D., Eastman School, University of
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Fletcher, Ian (1982) ....*Professor of English*
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Flores, Barbara (1980) ....*Assistant Professor of Education*
B.A., California State University, Hayward; M.A., California State University, Sacramento;
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Florschuetz, Leon W. (1964) ....*Professor of Engineering*
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Flynn, George A. (1980) ....*Associate Professor of Journalism and Telecommunication*
B.A., University of Miami; M.A., Florida Atlantic University; A.B.D., North Texas State University; Ph.D., North
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Flys, Michael J. (1975) ....*Professor of Spanish*
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Foard, James H. (1977) ....*Associate Professor of Religious Studies*
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Foley, Thomas A. (1984) ....*Assistant Professor of Computer Science*
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Foster, Brian L. (1980) ....*Associate Professor of Anthropology; Chair, Department of Anthropology*
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Foster, David W. (1966) ....*Professor of Spanish*
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Fouquette, Martin J. Jr. (1965) ....*Associate Professor of Zoology*
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Evans, John X. (1964) ....*Professor of English*
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Eyring, LeRoy (1961) ....*Professor of Chemistry*
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Faas, Larry A. (1967) ....*Professor of Education*
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Fabes, Richard A. (1983) ....*Assistant Professor of Home Economics*
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Faeth, Stanley H. (1980) ....*Assistant Professor of Zoology*
  B.S., M.S., University of Cincinnati; Ph.D., Florida State University
Fafitis, Apostolos (1984) ....*Assistant Professor of Civil Engineering*
  B.S.Eng., Aristotolion University of Thessaloniki, Greece; M.Eng., South Dakota School of Mines and Technology; Ph.D., Northwestern University 1984
Faith, Roger L. (1981) ....*Professor of Economics*
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Faltz, Leonard M. (1979) ....*Associate Professor of English*
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Farber, Bernard (1971) ....*Professor of Sociology*
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Faris, Norma J. (1984) ....*Assistant Professor of Engineering*
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Farmer, Frank D. (1970) ....*Associate Professor of Mathematics*
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Farness, Sherly F. (1969) ....*Assistant Professor of Art*
  B.A., M.A., Michigan State University
Farrar, Roger D. (1974) ....*Associate Professor of Education*
  B.A., M.S., Kearney State College; Ed.D., University of Nebraska
Farris, Martin T. (1957) ....*Professor of Transportation*
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Fausel, Donald F. (1969) ....*Associate Professor of Social Work*
  A.B., S.T.B., S.T.L., St. Mary's University; M.S.W., Fordham University; D.S.W., Columbia University
Faustini, Antony A. (1983) ....*Assistant Professor of Computer Science*
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Fay, Keith L. (1983) ....*Professor of Purchasing/Materials Management*
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Fearon, Harold E. (1961) ....*National Association of Purchasing Management Professor*
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Fehr, Fred S. (1971) ....*Associate Professor of Psychology*
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Feldhaus, Anne (1981) ....*Associate Professor of Religious Studies*
  B.A., Manhattanville College; Ph.D., University of Pennsylvania
Feldstein, Alan (1970) ....*Professor of Mathematics*
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Feller, Carolyn M. (1972) ....*Assistant Professor of Nursing*
  B.S.N., M.S., Arizona State University
Fellows, Rushia G. (1977) ....*Assistant Professor of Architecture*
  B.S., Arizona State University
Fenske, Robert H. (1974) ....*Professor of Education*
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Fernando, Harindra (1984) ....*Assistant Professor of Engineering*
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Ferraro, Kathleen (1982) ....*Assistant Professor of Justice Studies*
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Ferrell, Wilfred A. (1959) ....*Professor of English*
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Ferry, David K. (1983) ....*Professor of Engineering; Center for Solid State Electronics*
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Fifield, Michael E. (1984) ....*Assistant Professor of Architecture*
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Finch, A. Joyce (1965) ....*Assistant Professor of Nursing*
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Findler, Nicholas V. (1982) ....*Professor of Computer Science*
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Findley, Lisa R. (1984) ....*Assistant Professor of Architecture*
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Finer, Neal (1977) ....*Associate Professor of Education*
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Fink, Jonathan H. (1982) ....*Assistant Professor of Geology*
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Fink, Raymond R. (1958) ....*Professor of Art*
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Fisher, Marvin M. (1958) ....*Professor of English*
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Fisher, Stuart G. (1976) ....*Associate Professor of Zoology*
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Fitch, Gregory W. (1974) ....*Associate Professor of Philosophy*
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Flaherty, Richard E. (1978) ....*Professor of Accounting*
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Fleig, Bernard M., Major (1982) ....*Assistant Professor of Aerospace Studies*
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Fletcher, Grant (1956) ....*Professor Emeritus of Music*
B.M., Illinois Wesleyan University; M.M., University of Michigan; Ph.D., Eastman School, University of
Rochester

Fletcher, Ian (1982) ....*Professor of English*
Ph.D., University of Reading, England

Flores, Barbara (1980) ....*Assistant Professor of Education*
B.A., California State University, Hayward; M.A., California State University, Sacramento;
Ph.D., University of Arizona

Florschuetz, Leon W. (1964) ....*Professor of Engineering*
B.S., M.S., Ph.D., University of Illinois

Flynn, George A. (1980) ....*Associate Professor of Journalism and Telecommunication*
B.A., University of Miami; M.A., Florida Atlantic University; A.B.D., North Texas State University; Ph.D., North
Texas State University

Flys, Michael J. (1975) ....*Professor of Spanish*
Licenciado en Filosofia y Letras, Doctor en Filosofia y Letras, Universidad de Madrid (Spain)

Foard, James H. (1977) ....*Associate Professor of Religious Studies*
B.A., College of Wooster; A.M., Ph.D., Stanford University

Foley, Thomas A. (1984) ....*Assistant Professor of Computer Science*
B.S., M.A., Ph.D., Arizona State University

Foster, Brian L. (1980) ....*Associate Professor of Anthropology; Chair, Department of Anthropology*
B.A., Northern Illinois University; A.M., Ph.D., University of Michigan

Foster, David W. (1966) ....*Professor of Spanish*
B.A., M.A., Ph.D., University of Washington

Fouquette, Martin J. Jr. (1965) ....*Associate Professor of Zoology*
B.A., M.A., Ph.D., University of Texas

Frasier, James E. (1963)..*Professor of Education*
    B.A., University of Northern Colorado; M.A., University of Michigan; Ed.D., University of Northern Colorado
Frazier, Robert C. (1973)..*Associate Professor Education*
    B.M.E., Kansas City Conservatory of Music; M.M., University of Denver; Ph.D., Arizona State University
Freund, John E. (1957)..*Professor Emeritus of Mathematics*
    B.A., M.A., University of California, Los Angeles; Ph.D., University of Pittsburgh
Friedman, Edward (1977)..*Associate Professor of Spanish*
    B.A., University of Virginia; M.A., Ph.D., Johns Hopkins University
Fritz, Karen (1983) ....*Instructor of Nursing*
    Diploma, Sioux Valley Hospital, Sioux Falls, South Dakota; B.A., Sioux Falls College; M.S., University of
    Minnesota
Fritzemeyer, Joe R. (1973)..*Professor of Accounting*
    B.B.A., Baylor University; M.B.A., D.B.A., Indiana University; C.P.A., Texas
Fronske, Jeanne Otis (1975)..*Associate Professor of Art*
    B.A., DePauw University; B.F.A., Denison University; M.F.A., Ohio State University
Frost, Melvin Jesse (1965) ....*Assistant Professor Emeritus of Geography*
    B.S., Arizona State University; M.S., Brigham Young University; Ph.D., University of Florida
Fry, Harold (1958)..*Associate Professor Emeritus of Engineering*
    B.S., Colorado State University; M.E., University of Wyoming; M.S., University of Colorado
Fry, Maurine A. (1967) ....*Professor of Education; Assistant Academic Vice President, Personnel*
    B.S., M.A., University of South Dakota; Ph.D., University of Iowa
Fuchs, Jacob (1951)..*Professor of Chemistry;*
    B.A., New York University; M.S., Ph.D., University of Illinois   *Director, Instruments Laboratory*
Fuchs, Rachel G. (1983) ....*Assistant Professor of History*
    B.A., M.A., Boston University; Ph.D., Indiana University
Fullerton, Bill J. (1958)..*Professor of Education*
    B.S., Northwestern State College; Ed.M., D.Ed., University of Oklahoma
Fullinwider, S. Pendleton (1967)..*Associate Professor of History*
    B.S., U.S. Naval Academy; M.S., Ph.D., University of Wisconsin, Madison
Furnish, Dale B. (1970) ....*Professor of Law*
    B.A., Grinnell College; J.D., University of Iowa; LL.M., University of Michigan

Gaffney, Philip D. (1957)..*Professor Emeritus of Education*
    B.S., Northern Illinois State University; M.A., Ph.D., State University of Iowa
Gaidis, William C. (1983)..*Assistant Professor of Marketing*
    B.S., M.B.A., California State University at Long Beach; Ph.D., University of Wisconsin, Madison
Gaines, Sylvia W. (1972)..*Associate Professor of Anthropology*
    B.A., M.A., Ph.D., Arizona State University
Gale, Betty J. (1982) ....*Instructor of Nursing*
    Diploma, Evangelical Deaconess Hospital; B.S.N., M.S., Arizona State University
Galat, David L. (1984)..*Assistant Professor of Zoology*
    B.S., Cornell University; M.S., Ph.D., Colorado State University
Galician, Mary Lou (1982) ....*Assistant Professor of Journalism and Telecommunication*
    B.A., Long Island University; M.S., Syracuse University; Ed.D., Memphis State University
Gallinger, George W. (1977)..*Assistant Professor of Finance*
    B.A., Waterloo Lutheran College; M.B.A., York University; Ph.D., Purdue University
Garcia, Eugene E. (1980) ....*Professor of Education*
    B.A., University of Utah; M.A., Ph.D., University of Kansas
Garcia, Margot (1984)..*Assistant Professor of Planning*
    B.Sc., University of New Mexico; M.Sc., University of Wisconsin; Ph.D., University of Arizona
Garrity, Marjorie L. (1975)..*Assistant Professor of Nursing*
    Diploma, Vassar Brothers Hospital; B.S., University of Bridgeport; M.S., Case Western Reserve University
Gasowski, Raymond E. (1971)..*Professor of Art*
    B.S.D., University of Michigan; M.F.A., University of Washington
Gereboff, Joel (1978) ....*Associate Professor of Religious Studies*
    B.A., New York University; Ph.D., Brown University
Gerking, Shelby D. (1974)..*Professor Emeritus of Zoology*
    A.B., DePauw University; Ph.D., Indiana University

Gerlach, Vernon S. (1963) ....*Professor of Education*
  B.A., Wayne State University; M.A., University of Minnesota; Ed.D., Arizona State University
Gesell, Laurence E. (1984) ....*Assistant Professor of Technology*
  B.A., Upper Iowa University; M.P.A., University of San Francisco
Gieschen, Donald W. (1959) ....*Associate Professor of Philosophy*
  B.S., Northwestern University; M.A., Ph.D., University of Minnesota
Giffin, Frederick C. (1967) ....*Professor of History; Chair, Department of History*
  B.A., Denison University; M.A., Ph.D., Emory University
Gill, George A. (1966) ....*Assistant Professor Emeritus of Education*
  B.S., M.A., Arizona State University
Gill, James D. (1981) ....*Assistant Professor of Marketing*
  B.S., M.A., Ph.D., University of Nebraska
Gillingwater, Denis (1973) ....*Associate Professor of Art*
  B.F.A., M.F.A., University of Cincinnati
Gilsdorf, Jeanette W. (1979) ....*Associate Professor of General Business*
  A.B., Creighton University, Omaha; M.A., Ph.D., University of Nebraska, Lincoln
Gisolo, Margaret (1954) ....*Professor Emeritus of Dance*
  B.S., Indiana State Teachers College; M.A., New York University
Glanzman, Dennis L. (1977) ....*Associate Professor of Psychology*
  B.A., M.A., Ph.D., University of California, Irvine
Glaunsinger, William S. (1972) ....*Professor of Chemistry*
  B.S., Miami University; Ph.D., Cornell University
Gober, Patricia A. (1975)........*Associate Professor of Geography; Acting Chair, Department of Geography*
  B.S., University of Wisconsin, Whitewater; M.S., Ph.D., Ohio State University
Godlewski, Fabienna (1983)..*Assistant Professor of Management Science*
  B.S., Ball State University; M.B.A., Ph.D., University of Cincinnati
Gold, Victor J. (1980) ....*Professor of Law*
  B.A., J.D., University of California, Los Angeles
Goldstein, Elliott S. (1974) ....*Associate Professor of Zoology*
  B.S., University of Hartford; M.S., Ph.D., University of Minnesota
Goldstein, Myron (1963)..*Professor of Mathematics*
  B.S., M.A., Ph.D., University of California, Los Angeles
Golen, Steven P. (1984)...*Associate Professor of General Business*
  B.S., M.A., Western Kentucky University; Ph.D., Arizona State University
Golio, John M. (1984)...*Assistant Professor of Engineering*
  B.S., University of Illinois; M.S., Ph.D., North Carolina State University
Gomez, Reynaldo A. (1980) ....*Assistant Professor of Education*
  B.A., Southwest Texas State University; M.Ed., Stephen F. Austin State University;
  Ph.D., Pennsylvania State University
Goo, Benjamin (1955) ....*Professor Emeritus of Art*
  B.F.A., University of Iowa; M.F.A., Cranbrook Academy of Art
Gooding, Elmer R. (1967) ....*Professor of Economics; Assistant Vice President for Academic Affairs*
  B.S., McPherson College; M.A., Ph.D., University of Kansas
Gordon, Leonard (1967)..*Professor of Sociology; Chair, Department of Sociology*
  B.A., Wayne State University; A.M., University of Michigan; Ph.D., Wayne State University
Gordon, Richard S. (1980) ....*Professor of Agriculture*
  A.B., University of Rochester; M.A., Harvard University; Ph.D., Massachusetts Institute of Technology
Goss, Walter, Master Sergeant (1983)..*Senior Instructor of Military Science*
Gourley, David R. (1967) ....*Associate Professor of Marketing*
  B.S., Miami University; M.B.A., University of Toledo; D.B.A., Indiana University
Goyer, Robert S. (1981) ....*Professor of Communication; Chair, Department of Communication*
  B.A., DePauw University; M.A., Miami University; Ph.D., Ohio State University
Grace, Edward E. (1963) ....*Professor of Mathematics*
  B.S., Ph.D., University of North Carolina
Graf, William L. (1978) ....*Associate Professor of Geography*
  B.A., M.S., Ph.D., University of Wisconsin, Madison
Graham, Denny L. (1974) ....*Associate Professor of Technology*
  B.S., Ohio State University; M.S., Denver University; Ph.D., Purdue University

Gratton, Brian J. (1983)...*Assistant Professor of History*
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Greathouse, Betty M. (1972)...*Associate Professor of Education*
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Greeley, Ronald (1977)..*Professor of Geology*
 B.S., M.S., Mississippi State University; Ph.D., University of Missouri, Rolla
Green, Gary I. (1980)...*Assistant Professor of Information Systems*
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Green, James L. (1967)...*Associate Professor of English*
 B.A., M.A., University of Kansas; Ph.D., University of Nevada
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Greene, Mildred S. (1966)...*Associate Professor of English*
 A.B., Wellesley College; M.A.T., Radcliffe College; M.A., University of Massachusetts;
 Ph.D., University of New Mexico
Greeneich, Edwin W. (1982)..*Associate Professor of Engineering*
 A.A., Diablo Valley College B.S.E.E., M.S.E.E., Ph.D., University of California, Berkeley
Greey, George W. (1969)...*Professor of Leisure Studies*
 B.A., M.A., Purdue University; Ph.D., University of Michigan
Gregory, David (1979) ....*Associate Professor of Dance*
 B.M., M.M., University of Michigan
Grier, Marvin (1957)..*Assistant Professor of Physical Education*
 B.S., Wisconsin State College, La Crosse; M.A., New York University
Griffith, LeRoy H. (1958) ....*Professor of Education*
 B.S. in Ed., M.S. in Ed., Drake University; Ph.D., University of Iowa
Grigsby, J. Eugene (1966)...*Professor of Art*
 A.B., Morehouse College; M.A., Ohio State University; Ph.D., New York University
Grinder, Robert E. (1973)...*Professor of Education*
 B.S., University of California; Ed.D., Harvard University
Grobe, Edwin P. (1957)...*Professor of French*
 A.B., William Jewell College; M.A., Ph.D., Indiana University
Grondin, Robert O. (1983) ....*Assistant Professor of Engineering*
 B.S., M.S., Ph.D., University of Michigan
Gronseth, Evangeline (1982)...*Associate Professor of Nursing*
 B.A., St. Olaf College; M.N., Yale University; M.A., Ph.D., Columbia University
Gross, Douglas R. (1968)...*Associate Professor of Counselor Education*
 B.A., M.A., Western Michigan University; Ph.D., University of Wisconsin, Madison
Grossman, Louis H. (1966) ....*Professor of Management*
 A.B., University of Michigan; M.B.A., Ph.D., Michigan State University
Gruzinska, Aleksandra (1973)...*Assistant Professor of French*
 Lycée Francais, Barcelona, Spain; B.A., M.A., State University of New York, Buffalo;
 Ph.D., Pennsylvania State University
Gryder, Robert (1959-63; 1964) ....*Professor of General Business*
 B.A., Northwestern State College; M.Ed., Louisiana State University; Ed.D., University of North Dakota
Gudykunst, William B. (1984)...*Associate Professor of Communication*
 B.S., M.A., Arizona State University; Ph.D., University of Minnesota
Guerin, Sanford M. (1984)...*Professor of Law*
 B.S., Boston University; J.D., University of San Francisco; LL.M., New York University
Guilbeau, Eric J. (1977)...*Professor of Engineering*
 B.S. in Ch.E., M.S., in Ch.E., Ph.D. in Ch.E., Louisiana Tech University
Guillot, Elizabeth F. (1964)...*Professor Emeritus of Sociology*
 B.S., Simmons College; M.A., Ph.D., University of Pennsylvania
Guinouard, Donald E. (1966) ....*Professor of Counselor Education; Counselor,*
 B.S., M.S., Montana State College; Ed.D., Washington State University   *University Counseling Service*
Guleserian, Theodore (1971)...*Associate Professor of Philosophy*
 B.A., University of California, Riverside; Ph.D., Yale University
Gully, Anthony Lacy (1972)...*Associate Professor of Art*
 B.A., University of California, Riverside; M.A., University of California, Berkeley; Ph.D., Stanford University

Guntermann, Gail (1977)..*Associate Professor of Spanish*
  B.S., University of Montana; M.A., University of New Mexico; Ph.D., Ohio State University
Guntermann, Karl L. (1982)..................................*Arizona Association of Realtors Professor of Real Estate*
  A.B., Knox College; M.B.A., D.B.A., Indiana University
Gurnee, Herbert (1943) ....*Professor Emeritus of Psychology*
  A.B., M.A., Wesleyan University; Ph.D., Harvard University
Gust, J. Devans (1975) ....*Associate Professor of Chemistry*
  B.S., Stanford University; M.S., Ph.D., Princeton University
Gwinner, Robert F. (1970) ....*Professor of Marketing*
  B.S., University of Southern Mississippi; M.B.A., Ph.D., University of Arkansas

Haberman, Donald C. (1967) ....*Professor of English*
  B.A., Rutgers, The State University; M.A., Ph.D., Yale University
Haberman, Lidia W. (1967)...*Instructor in Latin*
  B.A., Bryn Mawr College; M.A., Yale University
Hackbarth, Glen A. (1976)..*Associate Professor of Music*
  B.M., University of Wisconsin, Madison; M.M., D.M.A., University of Illinois
Haden, Clovis R. (1978) ....*Professor of Engineering; Dean, College of Engineering and*
  B.S., Arlington State College;   *Applied Sciences; Director, School of Engineering*
  M.S., California Institute of Technology; Ph.D., University of Texas
Hadley, Neil F. (1966)...*Professor of Zoology*
  B.A., Eastern Michigan University; Ph.D., University of Colorado
Haefer, J. Richard (1976) ....*Associate Professor of Music*
  B.M., Ohio State University; M.M., University of Arizona; Ph.D., University of Illinois
Haggerson, Nelson L. (1961-63; 1964)..*Professor of Education*
  B.A., Vanderbilt University; M.S. in Ed., New Mexico Western College; Ph.D., Claremont Graduate School
Hahn, Arthur W. (1962) ....*Professor of Art*
  B.F.A., California School of Fine Arts; M.A., San Francisco State University
Hajicek, James (1976)...*Associate Professor of Art*
  B.F.A., Kansas City Art Institute; M.F.A., University of New Mexico
Hakac, John (1966) ....*Associate Professor of English*
  A.B., Centre College; M.A., Ph.D., University of Texas
Hale, John Douglas (1956)...*Professor Emeritus of Art*
  B.F.A., M.F.A., University of Southern California; Ph.D., Ohio State University
Haley, Arthur J. (1976)........*Associate Professor of Leisure Studies; Chair, Department of Leisure Studies*
  B.A., Stonehill College; M.Ed., Springfield College; Ph.D., Ohio State University
Hall, John S. (1973) ....*Professor of Public Affairs; Director, School of Public Affairs*
  B.A., M.A., San Diego State University; Ph.D., University of Oregon
Hamilton, Robert (1980) ....*Professor of Music*
  B.M., Indiana University; M.M., Catholic University
Hanna, Albert Lyle (1967)..*Associate Professor of Music*
  B.M., College of Music of Cincinnati; Ph.D., Indiana University
Hannley, Maureen (1980)...................................*Assistant Professor of Speech and Hearing Science*
  B.A., M.A., University of Arizona; Ph.D., Baylor College of Medicine
Hanson, Hugh (1948) ....*Professor Emeritus of Zoology*
  B.S., Kansas State Teachers College; M.S., Ph.D., University of Illinois
Hanson, Roland C. (1966)...*Professor of Physics*
  B.S., Michigan College of Mining and Technology; M.S., Ph.D., University of Illinois
Happel, Stephen K. (1975) ....*Associate Professor of Economics*
  B.A., University of Missouri; M.A., Ph.D., Duke University
Hardert, Ronald A. (1966)..*Associate Professor of Sociology*
  A.B., M.A., University of Cincinnati; Ph.D., Indiana University
Hardt, Annanelle (1968) ....*Associate Professor of Education*
  B.A., Southwestern University; A.M., Cornell University; Ph.D., University of Texas
Haried, Andrew A. (1969) ....*Professor of Accounting*
  B.A., Hastings College; M.A.S., Ph.D., University of Illinois; C.P.A., Illinois, North Carolina and Arizona
Harper, Pegge (1983) ....*Instructor of Dance*
  B.F.A., University of Michigan; M.F.A., University of North Carolina

Harris, Anne E. (1982)..*Assistant Professor of Psychology*
    B.A., Harvard University; M.A., Ph.D., Ohio State University
Harris, Jerry D. (1972)..*Associate Professor of Education*
    B.S., Illinois State University; Ph.D., University of Minnesota
Harris, Joseph (1963)...........................*Professor of Chemistry; Associate Chair, Department of Chemistry*
    B.S., University of Maryland; M.A., Ph.D., Johns Hopkins University
Harris, Kathryn M. (1966)...*Instructor in English*
    B.A., M.A., Arizona State University
Harris, Mark (1980)...*Professor of English*
    B.A., M.A., University of Denver; Ph.D., University of Minnesota
Harris, Walter (1980) ....*Associate Professor of Music; Assistant Dean, College of Fine Arts*
    B.S., Knoxville College; M.M., Ph.D., Michigan State University
Harris, William H. (1960)...*Professor Emeritus of Marketing*
    B.S., University of Denver; M.B.A., Ph.D., Ohio State University
Hartwell, L. Kay (1975)...*Associate Professor of Education*
    B.S., M.A., Murray State University; Ph.D., Southern Illinois University
Hartwigsen, Gail L. (1979)..*Assistant Professor of Home Economics*
    B.A., Glassboro State College; M.A., University of Connecticut, Storrs; Ph.D., Michigan State University
Harward, Naomi (1956)...*Professor Emeritus of Sociology*
    B.D., Garrett Biblical Institute; B.A., Northwestern University;
    M.A., (Rel. Ed.), M.A., (Social Welfare), University of Chicago
Hasbrouck, Frank F. (1962)..*Professor Emeritus of Zoology*
    B.A., Ph.D., University of Illinois
Hassan, Ahmed A. (1981)...*Assistant Professor of Engineering*
    B.Sc., M.Sc., University of Cairo; Ph.D., University of Arizona
Hassett, Matthew J. (1966) ....*Associate Professor of Mathematics*
    B.A., Fordham University; M.S., Ph.D., Rutgers, The State University
Hastings, Vernon L. (1973) ....*Professor of Construction; Director, Division of Construction*
    B.S.M.E., University of Nebraska; M.S.I.E., Oklahoma A & M University
Hatzell, Hilda H. (1984) ....*Assistant Professor of Agriculture*
    B.A., University of South Florida, Tampa; M.S., University of Florida
Hawley, John B. (1957)..*Assistant Professor Emeritus of Engineering*
    B.S., E.M.E.T., Colorado School of Mines
Haygood, Robert C. (1970) ....*Professor of Pschology*
    B.S., University of Illinois, Urbana; M.S., Ph.D., University of Utah
Haynes, Peter (1975)..*Professor of Justice Studies*
    B.S., University of Southampton, England; M.A., Ph.D., University of Toronto
Hazel, Jeffrey R. (1975) ....*Professor of Zoology*
    B.A., College of Wooster; M.S., Ph.D., University of Illinois
Hecht, Michael L. (1983) ....*Assistant Professor of Communication*
    B.A., M.A., Queens College; Ph.D., University of Illinois
Heier, William D. (1966)..*Professor Emeritus of Management*
    B.S., University of Maryland; M.A., George Washington University; Ph.D., American University
Heimann, Robert A. (1952)..*Professor Emeritus of Counselor Education*
    B.S., Wisconsin State College; M.S., Ph.D., University of Wisconsin, Madison
Heller, Jules (1976) ....*Professor of Art*
    B.A., Arizona State University; M.A., Columbia University; Ph.D., University of Southern California
Helms, Loyce Randel (1976)..*Professor of English*
    B.A., University of California, Riverside; Ph.D., University of Washington
Helmstadter, G. C. (1959) ....*Professor of Education*
    B.S., M.S., Iowa State University; Ph.D., University of Minnesota
Helton, Jon C. (1973)..*Associate Professor of Mathematics*
    B.S., Southwest Texas State College; M.A., Ph.D., University of Texas, Austin
Henderson, Mark (1984)...*Assistant Professor of Engineering*
    B.S.M.E., M.S.M.E., Ph.D., Purdue University
Hendrickson, Lester E. (1968)..*Associate Professor of Engineering*
    B.S., M.S., Michigan Technological University; Ph.D., University of Illinois
Hendrickson, William L. (1976)...*Associate Professor of French*
    B.A., Arizona State University; M.A., University of Kansas; Ph.D., Princeton University

Henkel, Ray (1966) ....*Assistant Professor of Geography; Director, Center for Latin*
    B.S., Arizona State University; M.S., Ph.D., University of Wisconsin, Madison   *American Studies*

Hennington, Jo Ann (1975)...*Professor of General Business;*
    B.A., M.B.A., Ed.D., Arizona State University   *Assistant Dean, College of Business*

Henry, Nicholas L. (1975) ....*Professor of Public Affairs; Dean, College of Public Programs*
    B.A., Centre College; M.A., Pennsylvania State University; M.P.A., Ph.D., Indiana University

Henson, Dorothy A. (1974) ....*Assistant Professor of Nursing*
    B.S., Whitworth College; M.A., West Virginia College of Graduate Studies

Henze, Lura F. (1966)..*Professor Emeritus of Sociology*
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Hepburn, John R. (1984)...*Professor of Justice Studies; Director,*
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    B.S., M.A., University of Kansas

Hernandez, Armand P. (1974)...*Associate Professor of Justice Studies*
    B.A., M.A., San Jose State University; Ed.D., University of Southern California

Herrero, Domingo (1981)...*Professor of Mathematics*
    M.A., University of Buenos Aires; Ph.D., University of Chicago

Hershauer, James C. (1969)...*Professor of Decision and Information Systems*
    B.S., Purdue University; M.B.A., D.B.A., Indiana University

Hershberger, Robert G. (1969) ....*Professor of Architecture*
    A.B., Stanford University; B. Arch., University of Utah; M.Arch., Ph.D., University of Pennsylvania

Hestenes, David O. (1966) ....*Professor of Physics*
    B.A., Pacific Lutheran College; M.A., Ph.D., University of California, Los Angeles

Hickman, David R. (1982)...*Associate Professor of Music*
    B.M., University of Colorado; M.M., Wichita State University

Higgins, Norman C. (1968)...*Professor of Education*
    B.S., Central Missouri State College; M.S., Ph.D., Syracuse University

Higgins, Walter T. Jr. (1967)...*Professor of Engineering*
    B.E.E., Manhattan College; M.S., Ph.D., University of Arizona

Hill, Bernard (1966)..*Associate Professor Emeritus of Social Work*
    B.S.S., City College of New York, M.S.W., Tulane University

Hillman, Harry F. (1984)...*Assistant Professor of Construction*
    B.S., B.S.E., M.S., M.S.E., University of Michigan; Ph.D., University of Arizona

Hines, Harold C. (1952) ....*Professor Emeritus of Music*
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Hink, Heinz R. (1958) ....*Professor of Political Science*
    LL.B., University of Berlin (Germany); M.A., Ph.D., University of Washington

Hinks, Robert W. (1981)...*Assistant Professor in Engineering*
    B.Sc., University of Wales; M.S.E., M.A., Ph.D., Princeton University

Hinshaw, Donald A. (1966)...*Associate Professor Emeritus of Architecture*
    B. Arch., University of Notre Dame

Hirata, Ernest T. (1974)...*Associate Professor of Technology;*
    B.A., San Diego State College; Ed.D., Arizona State University   *Director, Division of Technology*

Hirleman, Edwin D. Jr. (1977) ....*Associate Professor of Engineering*
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Hoffer, Warren W. (1972)...*Associate Professor of Music*
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Hoffman, Dennis L. (1979) ....*Associate Professor of Economics*
    B.S., Grand Valley State Colleges; M.A., Ph.D., Michigan State University

Hoffmeister, J. Ronald (1983)...*Associate Professor of Finance*
    B.S., Milliken University; M.S., Ph.D., University of Illinois

Hogan, Timothy D. (1970) ....*Professor of Economics*
    A.B., University of California, Berkeley; M.A., University of California, Davis; Ph.D., Virginia Polytechnic
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Holbrook, Amy K. (1975)...*Assistant Professor of Music*
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Holloway, John R. (1969)...*Professor of Chemistry and Geology*
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Holmes, Jack E. (1972)..*Professor Emeritus of Political Science*
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Hom, Peter W. (1984)..*Associate Professor of Management*
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Homa, Donald L. (1975)...*Associate Professor of Psychology*
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Hoover, Eric John (1977) ....*Professor of Music*
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Hoover, Kenneth H. (1956)..*Professor of Education*
B.S., M.A., Louisiana State University; Ed.D., University of Washington

Horwath, Peter (1973)...............................*Professor of German; Chair, Department of Foreign Languages*
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Hoult, Thomas Ford (1964) ....*Professor Emeritus of Sociology*
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Houston, Sandra L. (1983) ....*Assistant Professor of Engineering*
B.S., University of Oklahoma; M.S.C.E., University of New Mexico; Ph.D., University of California, Berkeley

Houston, William N. (1984)..*Professor of Engineering*
Professional Degree in Geological Engineering, Colorado School of Mines;
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Howell, Kenneth W. (1975)..*Associate Professor of Education; Chair,*
B.A., M.A., Arizona State University; Ph.D., University of Oregon   *Department of Special Education*

Howells, Edmund G. (1960) ....*Assistant Professor of Philosophy*
B.A., University of Utah; M.A. (Phil.), University of Michigan; M.A. (English), Middlebury College;
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Howery, Betty I. (1975) ....*Professor Emeritus of Music*
B.S. in Ed., M.Mus.Ed., ED.S., University of Kansas

Hoy, Frank P. (1978)..*Associate Professor of Journalism and Telecommunication*
B.A., George Washington University; M.A., American University

Hoyt, Charles D. Jr. (1962) ....*Professor Emeritus of Engineering*
B.S., M.S., Ph.D., Purdue University

Hubbard, Paul G. (1950) ....*Professor of History*
A.B., Wabash College; M.A., Ph.D., University of Illinois

Hudson, John W. (1964)..*Professor of Sociology*
B.S., M.A., Ph.D., Ohio State University

Huey, Ben M. (1979)..*Associate Professor of Computer Science*
B.S., Harding College; M.S., Ph.D., University of Arizona

Hughston, George A. (1983)..*Associate Professor of Home Economics; Chair,*
B.S., M.S., Brigham Young University;   *Department of Home Economics*
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Huizingh, William (1959) ....*Professor Emeritus of Accounting*
B.S.B.A., M.B.A., University of Denver; Ph.D., University of Michigan; C.P.A., Arizona and Colorado

Humphrey, Ted (1966) ....*Professor of Philosophy*
A.B., M.A., University of California, Riverside; Ph.D., University of California, San Diego

Hunnicutt, Harold B. (1962) ....*Professor of Education*
B.S., Ed.M., Ed.D., University of Oklahoma

Hunter, Betty A. (1966) ....*Assistant Professor of Home Economics*
B.S., M.Ed., University of North Carolina, Greensboro

Huntington, Virginia R. (1962)...*Associate Professor Emeritus of Accounting*
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Hurston, Clifford J. (1975)...*Assistant Professor of General Business*
B.S., M.S., Tennessee State University; Ed.D., Arizona State University

Huskey, Sybil (1979) ....*Associate Professor of Dance*
B.F.A., M.F.A., University of Utah

Huston, Gerald D. (1962).................................*Associate Professor of Decision and Information Systems*
B.S.C., M.A., Ph.D., University of Iowa

Hutt, Michael D. (1982)..*Associate Professor of Marketing*
  B.B.A., M.B.A., Ohio University; Ph.D., Michigan State University
Hutt, Roger W. (1975) ....*Associate Professor of General Business; Assistant Dean, College of Business*
  B.S., M.B.A., Ohio State University; Ph.D., Michigan State University

Ifflander, A. James (1981)...*Assistant Professor of Finance*
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Ihrig, Edwin (1979)...*Associate Professor of Mathematics*
  B.S., M.A., University of Maryland; Ph.D., University of Toronto
Imdieke, LeRoy F. (1968) ....*Professor of Accounting*
  B.S., Valley City State College; M.A., University of North Dakota; Ph.D., University of Illinois; C.P.A., Illinois
Inman, Thomas H. (1975)..*Professor of General Business*
  B.S., M.A., George Peabody College; Ed.D., Northern Illinois University
Inskeep, Gordon C. (1968) ....*Professor Emeritus of Management*
  B.Ch.E., Ohio State University; Ph.D., Columbia University
Ismail, Mourad E. (1979)..*Professor of Mathematics*
  B.S., Cairo University; M.S., Ph.D., University of Alberta

Jacks, Mary L. (1955)...................................*Associate Professor Emeritus of General Business*
  B.A., M.A., Arizona State University; C.P.S., Arizona
Jackson, Donald W. Jr. (1972) ....*Professor of Marketing; Director of Research*
  B.A., Albion College; M.B.A., Ph.D., Michigan State University
Jackson, Marvin R. Jr. (1962) ....*Professor of Economics*
  B.S., M.A., University of Colorado; Ph.D., University of California, Berkeley
Jackson, Shirley M. (1981) ....*Assistant Professor of History*
  B.A., Southern University; M.A., Purdue University; Ph.D., Bowling Green State University
Jacob, Richard J. (1963) ....*Professor of Physics; Associate Chair, Department of Physics*
  B.S., Ph.D., University of Utah
Jacobowitz, Ronald (1970)...*Professor of Mathematics*
  B.A., City College of New York; M.S., University of Chicago; Ph.D., Princeton University
Jacobs, H. Donald (1972) ....*Associate Professor of Education*
  B.A. Ed., M.A. Ed., Central Washington State College; D.Ed., University of Oregon
Jacobson, Arthur (1956) ....*Professor of Art*
  B.S., M.S., University of Wisconsin, Madison
Jacobson, Dean L. (1974) ....*Professor of Engineering*
  B.S., M.S., University of Notre Dame; Ph.D., University of California, Los Angeles
Jain, Nemi C. (1976)..*Professor of Communication*
  B.S., M.S., Agra University; Ph.D., Michigan State University
Jakob, John H. (1960)..*Associate Professor of Architecture*
  B. Arch., Ohio State University; M.S. Arch., Columbia University
Jankowski, Daniel F. (1964)...*Professor of Engineering*
  B.S.E., M.S.E., Ph.D., University of Michigan
Janssen, James G. (1968)..*Associate Professor of English*
  B.A., M.A., Marquette University; Ph.D., University of Wisconsin, Madison
Jay, Bill (1974) ....*Professor of Art*
  B.A., Berkshire College of Art, England; M.A., University of New Mexico
Jelinek, James J. (1953)...*Professor Emeritus of Education*
  B.S., University of Illinois; M.A., Northwestern University; Ed.D., Indiana University
Jenkins, William (1979) ....*Associate Professor of Art*
  B.A., St. Lawrence University; M.F.A., State University of New York at Buffalo
Jennings, Marianne G. (1977)..*Professor of General Business*
  B.S., J.D., Brigham Young University
Jo, Yung-Hwan (1966)...*Professor of Political Science*
  B.A., Lincoln Memorial University; M.A., University of Tennessee, Knoxville; Ph.D., American University
Joehnk, Michael D. (1983)...............................*Professor of Finance; Chairman, Department of Finance*
  B.S., University of Arizona; M.B.A., Arizona State University; Ph.D., University of Arizona
Johnson, Alan P. (1967)..*Associate Professor of English*
  B.A., Amherst College; M.A., University of Michigan; Ph.D., University of Minnesota

Johnson, David N. (1969) ....*Professor Emeritus of Music*
    B.M., Trinity University; M.M., Ph.D., Syracuse University
Johnson, Douglas A. (1974) ....*Associate Professor of Accounting*
    B.B.A., Ph.D., University of Texas; C.P.A., Texas
Johnson, J. David (1982) ....*Assistant Professor of Communication*
    B.S., M.A., Ph.D., Michigan State University
Johnson, John M. (1972) ....*Professor of Justice Studies; Associate Director,*
    B.A., Indiana University; M.A., San Diego State College;   *School of Justice Studies*
    Ph.D., University of California, San Diego
Johnson, Kim K.P. (1984) ....*Assistant Professor of Home Economics*
    B.S., M.S., Ph.D., University of Wisconsin
Johnson, Mary F. (1984) ....*Associate Professor of Art*
    B.A., Montana State University; M.F.A., University of Cincinnati
Johnson, Nancy Lou (1983) ....*Instructor of Nursing*
    B.S., Mary College, Bismarck, North Dakota; M.S., Arizona State University
Johnson, Rosemary (1959) ....*Professor of Nursing*
    B.S., M.P.H., University of Minnesota
Johnson, Roy M. (1952-53; 1955) ....*Professor of Microbiology*
    A.B., M.S., University of Chicago; Ph.D., University of New Mexico
Jones, Austin E. (1968) ....*Professor of Psychology*
    A.B., University of Illinois; M.S., Purdue University; Ph.D., University of Rochester
Jones, Daisy M. (1963) ....*Professor Emeritus of Education*
    B.S., M.S., Indiana State University; Ed.D., Indiana University
Jones, Marion K. (1970) ....*Professor of Dance*
    B.A., Wayne State University; M.A., Arizona State University
Jones, Ruth (1969) ....*Professor of Political Science*
    B.S., Indiana State University; M.A., Ph.D., Georgetown University
Jorquez, James S. (1980) ....*Assistant Professor of Social Work*
    B.A., M.S.W., California State University; D.S.W., University of California
Judd, B. Ira (1937) ....*Professor Emeritus of Agriculture*
    B.S., M.S., Utah State University; Ph.D., University of Nebraska, Lincoln
Jurik, Nancy (1981) ....*Assistant Professor of Justice Studies*
    B.A., M.A., Southern Methodist University; Ph.D., University of California, Los Angeles; N.I.M.H. Postdoctoral
    Training Program in Mental Health Evaluation Research
Justus, Jerry T. (1968) ....*Associate Professor of Zoology*
    B.A., Franklin College; M.A., Ph.D., Indiana University
Juvet, Richard S. Jr. (1970) ....*Professor of Chemistry*
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Kadell, Kevin (1981) ....*Assistant Professor of Mathematics*
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    Ph.D., Pennsylvania State University
Kader, David (1979) ....*Professor of Law*
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Kagy, Virginia L. (1947) ....*Professor Emeritus of Home Economics*
    B.A., Drake University; M.S., Iowa State University; Ph.D., Johns Hopkins University
Kahn, B. Winston (1966) ....*Associate Professor of History*
    B.A., National Taiwan University (China); M.A., University of Minnesota; Ph.D., University of Pennsylvania
Kaida, Tamarra (1980) ....*Assistant Professor of Art*
    B.A., Goddard College; M.F.A., State University of New York at Buffalo
Kajikawa, William M. (1937) ....*Associate Professor Emeritus of Physical Education*
    B.A., M.A., Arizona State University
Kale Sudhir H. (1984) ....*Assistant Professor of Marketing*
    B.S., University of Poona, India; M.M.S., Jamnalal Bajaj Institute of Management Studies, Bombay;
    Ph.D., University of Illinois
Kamins, Martin P. (1970) ....*Associate Professor of Education*
    B.Ed., University of Miami; M.S., Florida State University; Ed.D., Wayne State University
Kaminsky, Elijah Ben-Zion (1962) ....*Professor of Political Science*
    A.B., A.M., Ph.D., Harvard University

Kanneman, Thomas A. (1970)..*Professor of Technology; Chair, Department*
    B.S.E.E., University of Wisconsin;   *of Electronics and Computer Technology*
    M.S.E.E., University of New Mexico; Ph.D., University of Wisconsin, Madison
Kaplan, Steve (1981)..*Assistant Professor of Accounting*
    B.S., Arizona State University; M.A.S., Ph.D., University of Illinois
Karasz, Lawrence (1981)...*Assistant Professor of Theatre*
    B.S., M.A., Southwest Missouri State University; M.F.A., Pennsylvania State University
Karjala, Dennis S. (1978) ....*Professor of Law*
    B.S.E., Princeton University; Ph.D., M.S., University of Illinois; J.D., University of California, Berkeley
Karnes, Thomas L. (1968) ....*Professor Emeritus of History*
    A.B., Colorado University; A.M., Ph.D., Stanford University
Karnig, Albert K. (1978).............*Professor of Public Affairs; Assistant Vice President for Academic Affairs*
    B.A., Augustana College; M.A., Ph.D., University of Illinois
Karoly, Paul (1982) ....*Professor of Psychology; Director, Clinical Training*
    B.A., City College of New York; Ph.D., University of Rochester
Kastenbaum, Beatrice (1982)..*Instructor of Nursing*
    B.S.N., University of Michigan; M.S.N., Wayne State University
Kastenbaum, Robert J. (1981) ....*Professor of Gerontology;*
    A.A., East Los Angeles College;   *Director, Adult Development and Aging Studies Program*
    B.A., Long Beach State College; Ph.D., University of Southern California
Katzenberger, Joan N. (1984) ....*Instructor in Nursing*
    Diploma, West Suburban Hospital, Oak Park, Illinois; B.S.N., Arizona State University;
    M.S.N., California State University, Los Angeles
Katzman, Elaine Menter (1983)..*Assistant Professor of Nursing*
    R.N., B.S., M.S., Ph.D., Syracuse University
Kaufman, Herbert M. (1973)...*Professor of Economics*
    B.A., State University of New York, Binghamton; Ph.D., Pennsylvania State University
Kaufman, Irving (1965)...*Professor of Engineering*
    B.E., Vanderbilt University; M.S., Ph.D., University of Illinois
Kaufman, Lucile B. (1951) ....*Assistant Professor Emeritus of Engineering*
    B.S.M.E., M.S., University of Colorado, P.E.
Kaufmann, William B. (1968)...*Associate Professor of Physics*
    A.B., M.A., Ph.D., University of California, Berkeley
Kaye, David (1976)...*Professor of Law*
    B.S., Massachusetts Institute of Technology; M.A., Harvard University; J.D., Yale University
Kazmier, Leonard J. (1965)...*Professor of Decision and Information Systems*
    A.B., M.A., Wayne State University; Ph.D., Ohio State University
Kearfott, Kimberlee (1984)..*Assistant Professor of Engineering*
    B.S., St. Mary's University; M.E.N.E., University of Virginia; Sc.D., Massachusetts Institute of Technology
Kearney, James R. III (1968)..*Associate Professor of History*
    B.A., Pomona College; M.A., Washington University; Ph.D., University of Wisconsin, Madison
Keating, Thomas (1972)...*Assistant Professor of Political Science*
    B.A., M.A., California State University, Sacramento; M.P.A., Ph.D., Indiana University
Keats, Barbara W. (1984)..*Assistant Professor of Management*
    B.A., M.S., Northeast Louisiana University; Ph.D., Oklahoma State University
Keats, J. Bert (1984) ....*Associate Professor of Engineering*
    B.S.I.E., Lehigh University; M.S., Ph.D., Florida State University; Ph.D., Oklahoma State University
Kehl, Delmar G. (1965)..*Professor of English*
    B.A., Bob Jones University; M.S., University of Wisconsin, Madison; Ph.D., University of Southern California
Keim, Robert T. (1979)..*Associate Professor of Information Systems*
    B.S., M.B.A., Ph.D., University of Pittsburgh
Keith, Marlow F. (1946) ....*Assistant Professor Emeritus of Technology*
    B.A. in Ed., M.A. in Ed., Arizona State University
Keller, Thomas (1980) ....*Assistant Professor of General Business*
    B.Ed., M.Ed., Ed. Spec., University of Toledo
Kelley, Donald G. (1980)..*Assistant Professor of Technology*
    B.S., M.S., Arizona State University
Kelly, John B. (1962)...*Professor of Mathematics*
    B.A., Columbia University; Ph.D., Massachusetts Institute of Technology

Kelly, Richard W. (1965)...*Professor of Engineering; Assistant Dean,*
    B.S.E., M.S.E., Ph.D., University of Iowa   *College of Engineering and Applied Sciences*

Kelly, Rita Mae (1982) ....*Professor of Public Affairs*
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Kennedy, Patricia (1981)..*Associate Professor of Education*
    B.A., M.A., Ph.D., University of Minnesota

Kennedy, Thomas D. (1974)..*Professor of Justice Studies*
    B.A., Tulane University; M.A., Ph.D., Louisiana State University

Kenrick, Douglas T. (1980)..*Associate Professor of Psychology*
    B.A., Dowling College; M.A., Ph.D., Arizona State University

Kerr, Nancy J. (1968)..*Professor of Education*
    B.S., University of Illinois; M.A., Ph.D., University of Houston

Kettner, Peter M. (1979)..*Associate Professor of Social Work*
    B.A., Valparaiso University; M.S.W., George Warren Brown School of Social Work, Washington University;
    D.S.W., University of Southern California

Kevane, Clement J. (1956)..*Professor of Physics*
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Kiesow, Milton A. (1957)..*Professor Emeritus of Education*
    B.S., University of Wisconsin; M.A., Ph.D., University of Nebraska, Lincoln

Kigin, Denis J. (1958-65; 1967) ....*Professor of Industrial Technology*
    B.S., Mankato State University; M.S., University of Wisconsin, Stout;   *Director, Summer Sessions*
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Killeen, Peter R. (1968)..*Professor of Psychology*
    B.S., Michigan State University; Ph.D., Harvard University

Kim, Joochul (1980)..*Assistant Professor of Planning*
    B.A., University of California, Berkeley; M.U.P., Ph.D., University of Michigan

Kimler, Stephen J. (1967)..*Associate Professor Emeritus of Education*
    B.Ed., Milwaukee State Teachers College; M.Ed., Marquette University; Ed.D., Arizona State University

Kingsbury, Warren T. (1964) ....*Professor Emeritus of Education*
    A.B., Central College, Fayette, Missouri; A.M., University of Missouri; Ed.D., New York University

Kingston, Jerry L. (1969)..*Professor of Economics*
    B.A., Wayne State University; M.S., Colorado State University; Ph.D., Pennsylvania State University

Kinicki, Angelo J. (1982) ....*Assistant Professor of Management*
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Kinnier, Richard (1982) ....*Assistant Professor of Counselor Education*
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Kinsinger, Jack B. (1982) ....*Professor of Chemistry; Vice President for Academic Affairs*
    B.S., Hiram College; M.S., Cornell University; Ph.D., University of Pennsylvania

Kirkman-Liff, Bradford L. (1981)..*Assistant Professor of Health Services Administration*
    B.S., M.S., Carnegie-Mellon University; D.P.H., University of North Carolina, Chapel Hill

Kirkpatrick, Samuel A. (1984) ....*Professor of Political Science;*
    B.S., Shippensburg State College; M.A., Ph.D., Pennsylvania State University   *Dean, College of Liberal Arts*

Kirkwood, Craig W. (1983)..*Professor of Management Science; Chair, Department of*
    S.B., S.M., E.E., Ph.D., Massachusetts Institute of Technology   *Decision and Information Systems*

Kisielewski, Robert V. (1978) ....*Associate Professor of Technology*
    B.S.M.E., M.S.M.E., University of Wisconsin

Klann, Margaret L. (1945)..*Associate Professor Emeritus of Physical Education*
    B.S., University of Illinois; M.A., University of Northern Colorado

Kleiner, Janice E. (1982) ....*Instructor of Nursing*
    B.S.N., California State University, Long Beach; M.S.N., University of North Carolina

Kleinfeld, Gerald R. (1962)..*Professor of History; Assistant Dean, College of Liberal Arts*
    B.A., New York University; M.A., University of Michigan; Ph.D., New York University

Kliewer, Darleen (1975) ....*Associate Professor of Music*
    B.M.E., Bethany College; M.M., Wichita State University

Klock, John W. (1960)..*Professor of Engineering*
    B.E., University of Southern California; M.S., Ph.D., University of California, Berkeley

Klopatek, Jeffrey, M. (1981)..*Assistant Professor of Botany*
    B.S., M.S., University of Wisconsin, Milwaukee; Ph.D., University of Oklahoma

Knaupp, Jonathan E. (1970) ....*Associate Professor of Education*
   B.S., Oregon State University; M.A., Ph.D., University of Illinois

Knauth, L. Paul (1979)...*Professor of Geology; Chair, Department of Geology*
   B.A., University of Chicago; Ph.D., California Institute of Technology

Kneer, Dan C. (1981)...*Assistant Professor of Accounting*
   B.S., University of Evansville; M.A., Ph.D., University of Missouri, Columbia; C.P.A., California, Missouri

Kniep, Willard M. (1975) ....*Associate Professor of Education*
   B.S., Concordia Teachers College; M.A., Ph.D., University of Minnesota

Knight, Donald O. (1982) ....*Associate Professor of Engineering*
   B.E.E., Marquette University; M.S.E., Ph.D., Arizona State University

Knight, Leland W. (1978)..*Associate Professor of Design Sciences*
   B.P.A., Art Center College of Design; M.F.A., Stanford University

Knowlton, John F. (1964) ....*Associate Professor of Spanish*
   B.A., Lewis and Clark College; M.A., Ph.D., University of Oregon

Knox, Robert L. (1963)...*Professor of Economics*
   B.S., M.S., Oklahoma State University; Ph.D., University of North Carolina

Knudsen, Frances S. (1964)..*Associate Professor of Nursing*
   B.S., University of Arizona; M.S., University of Colorado

Komnenich, Pauline (1984)................................*Associate Dean for Research, College of Nursing*
   B.S., Stanford University; M.N., University of Washington; M.A., Ph.D., University of Arizona

Koonce, Frank W. (1978) ....*Assistant Professor of Music*
   B.M., North Carolina School of the Arts; M.M., Southern Methodist University

Kozacik, Dorothy Piercey (1968)...*Professor Emeritus of Education*
   B.A., College of St. Francis; M.A., Arizona State University; Ph.D., University of Arizona

Krahenbuhl, Gary S. (1973) ....*Professor of Physical Education; Associate Dean, College of Liberal Arts*
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Krause, Stephen J. (1981) ....*Assistant Professor of Engineering*
   B.S., Northwestern University; M.S., Illinois Institute of Technology; Ph.D., University of Michigan

Kreitner, Robert J. III (1975)...*Associate Professor of Management*
   B.S., M.B.A., University of Nebraska, Omaha; Ph.D., University of Nebraska, Lincoln

Krenkel, John H. (1947)..*Professor Emeritus of History*
   B.S. in Ed., University of Illinois; M.A., Claremont Graduate School; Ph.D., University of Illinois

Krinsley, David (1976)..*Professor of Geology*
   Ph.B., S.B., S.M., Ph.D., University of Chicago

Kroelinger, Michael D. (1980)................................*Associate Professor of Design Sciences; Assistant Dean,*
   B.S., University of Alabama;   *College of Architecture and Environmental Design*
   M.S., Ph.D., University of Tennessee

Kronengold, Eric A. (1970) ....*Associate Professor of Art*
   B.A., M.A., San Francisco State University

Krueger, Janelle (1984)...*Professor of Nursing; Dean, College of Nursing*
   Diploma, St. Luke's Hospital, Cleveland, Ohio; B.S., M.S., Ph.D., University of Colorado

Krus, David J. (1975) ....*Associate Professor of Education; Director, University Testing Services*
   B.A., M.A., Charles University; Ph.D., University of Minnesota

Kruse, Diane (1984)..*Instructor of Nursing*
   B.S.N., M.S., Arizona State University

Kudla, Ronald J. (1977).. *Associate Professor of Finance*
   B.S.M.E., Pennsylvania State University; M.B.A., Ph.D., University of Pittsburgh

Kuester, James L. (1969) ....*Professor of Engineering*
   B.S., University of Texas; M.E., Ph.D., Texas A & M University

Kuiper, Hendrik J. (1971)..*Associate Professor of Mathematics*
   B.S., University of Wisconsin, Milwaukee; M.S. (Physics), M.A. (Math),
   Ph.D., University of Wisconsin, Madison

Kulhavy, Raymond W. (1971) ....*Professor of Education; Interim Chair, Department of*
   A.B., M.A., California State College, San Diego; Ph.D., University of Illinois   *Educational Psychology*

Kulis, Stephen (1984) ....*Assistant Professor of Sociology*
   B.A., George Washington University; M.A., Ph.D., Columbia University

Kupka, Timothy J. (1979)..*Assistant Professor of Theatre*
   B.S., St. Cloud State University; M.F.A., University of Iowa

Kurth, Chestine L. (1974)..*Assistant Professor of Nursing*
B.S.N., University of Kansas; M.S.N., University of California, San Francisco
Kurtz, Lynn C. (1967)..*Associate Professor of Mathematics*
B.S., South Dakota School of Mines and Technology; M.S., Ph.D., University of Utah
Kyrala, Ali (1960-62; 1964) ....*Professor of Physics*
B.S., Massachusetts Institute of Technology; M.S., Stanford University; S.M., Harvard University;
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Laananen, David (1983)..*Associate Professor of Engineering*
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Ladman, Jerry R. (1967)..*Professor of Economics*
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Lactz, Hans G. (1964)..*Assistant Professor of German*
A.B., University of California, Berkeley; A.M., Ph.D., Stanford University
Lafford, Barbara ....*Assistant Professor of Spanish*
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Lai, Richard T. (1973) ....*Associate Professor of Planning* ›
A.B., M.F.A. in Arch., Princeton University; Ph.D., University of Pennsylvania
Lake, Robert L. (1958) ....*Assistant Professor Emeritus of Mathematics*
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Lamberts, Jacob J. (1960) ....*Professor Emeritus of English*
B.A., Calvin College; M.A., Ph.D., University of Michigan
Lamm, Robert C. (1959)..*Professor of Education*
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LaMontagne, Lynda L. (1982)..*Assistant Professor of Nursing*
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Landeira, Ricardo L. (1962)..*Professor Emeritus of Spanish*
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Landers, Daniel M. (1981)..*Professor of Physical Education*
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Landers, E. James (1960) ....*Professor Emeritus of Zoology*
B.A., M.S., University of Wyoming; Ph.D., New York University
Laner, Mary R. (1976) ....*Associate Professor of Sociology*
B.A., University of Chicago; M.A., University of New Mexico;
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Lanyon, Richard I. (1975)..*Professor of Psychology*
B.E., University of Adelaide (Australia); M.A., Ph.D., University of Iowa
Lape, Jerry V., Lieutenant Colonel (1981)..*Assistant Professor of Military Science*
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LaPointe, Leonard L. (1984)..*Professor of Speech and Hearing Science*
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Larimer, John W. (1969) ....*Professor of Geology*
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Larson, George W. (1972) ....*Associate Professor of Planning*
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Lauderdale, Pat (1981)..*Professor of Justice Studies*
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Lawler, Eugene D. (1967) ....*Associate Professor of Technology*
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Lawson, Anton E. (1977)..*Associate Professor of Science Education/Physics*
B.S., University of Arizona; M.A., University of Oregon; Ph.D., University of Oklahoma
Leathers, Chester R. (1957) ....*Associate Professor of Microbiology*
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Leek, Marjorie R. (1982)...*Assistant Professor of Speech and Hearing Science*
  B.A., M.A., Ph.D., University of Kansas
Lehrer, Leonard (1977)..*Professor of Art; Director, School of Art*
  B.F.A., Philadelphia College of Art; M.F.A., University of Pennsylvania
Leigh, Frederic A. (1979) ....*Assistant Professor of Journalism and Telecommunication*
  B.A., University of South Dakota; M.A., University of Iowa
Leonard, Donald J. (1974) ....*Associate Professor of General Business*
  B.S., M.B.A., Nicholls State University; Ph.D., Louisiana State University
Leonard, Philip A. (1968)..*Professor of Mathematics*
  A.B., Boston College; M.A., Ph.D., Pennsylvania State University
Leshowitz, Barry H. (1970) ....*Associate Professor of Psychology*
  B.S., M.A., Brooklyn College; Ph.D., City University of New York
Leshy, John D. (1980)...*Professor of Law*
  A.B., J.D., Harvard University
Lessard, Elizabeth C. (1969)..............................*Professor of Dance; Chair, Department of Dance*
  B.S., Georgia College; M.A., Ph.D., Texas Woman's University
Levan, Frederick D. (1965) ....*Associate Professor of Education*
  B.S., M.Ed., Pennsylvania State University; Ed.D., Oklahoma State University
Levine, Gustav (1967)..*Associate Professor of Psychology*
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Lewis, Maurice S. (1954) ....*Professor Emeritus of Education*
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Lewis, Ronald G. (1981) ....*Professor of Social Work*
  B.A., Oklahoma Baptist University; M.S.W., Our Lady of the Lake-Worden, San Antonio; Ph.D., University of Denver
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Lightfoot, Marjorie J. (1964)...*Professor of English*
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Limbert, Douglas A. (1976) ....*Assistant Professor of Engineering*
  S.B., S.M., Ph.D., Massachusetts Institute of Technology
Lin, Sheng H. (1965)..*Professor of Chemistry*
  B.S., M.S., National Taiwan University (China); Ph.D., University of Utah
Linder, Darwyn E. (1972)..*Professor of Psychology*
  B.A., Macalester College; Ph.D., University of Minnesota
Linderman, Earl W. (1966)..*Professor of Art*
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Lindholm, Ernest (1971) ....*Associate Professor of Psychology*
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Lindsay, Stuart M. (1978) ....*Associate Professor of Physics*
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Lindstrom, Frederick B. (1953) ....*Professor of Sociology; Associate Chair, Department of Sociology*
  A.B., A.M., Ph.D., University of Chicago
Liskovec, Richard F. (1958)..*Assistant Professor of Mathematics*
  B.S., M.A., Kent State University
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Liu, Chui H. (1965)..*Professor of Chemistry*
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Liu, Danny D. (1982) ....*Associate Professor of Engineering*
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Liu, Marjory Bong-Ray (1973)..*Associate Professor of Philosophy*
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Lock, Ethan (1981)..*Assistant Professor of General Business*
  B.A., University of California, Berkeley; M.B.A., Arizona State University;
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Lockwood, Ralph G. (1972) ....*Professor of Music*
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Loewenberg, Robert J. (1972) ....*Professor of History*
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Logan, Earl Jr. (1963) ....*Professor of Engineering*
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Lohr, Dennis E. (1979)..*Associate Professor of Chemistry*
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LoPresti, Ronald (1964)..*Professor of Music Theory*
  B.M., M.M., Eastman School of Music
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Lounsbury, John F. (1969)..*Professor of Geography*
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Low, Stuart A. (1979) ....*Associate Professor of Economics*
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Lowe, John W. (1956)..*Associate Professor of Economics*
  B.S., Arizona State University; M.S., University of Wisconsin, Madison; Ph.D., University of Florida
Lowe, Robert W. (1966)..*Professor Emeritus of Romance Languages*
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Lowenstein, Milton D. (1959) ....*Professor Emeritus of Planning*
  B.A., M.A., Columbia University
Lowenthal, Gary T. (1976)...*Professor of Law*
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Lu, Pao (1964)...*Professor of Physics*
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Luchsinger, Wayne W. (1966) ....*Professor Emeritus of Chemistry*
  B.S., M.S., Ph.D., University of Minnesota
Luckingham, Bradford F. (1971) ....*Associate Professor of History*
  B.S., Northern Arizona University; M.A., University of Missouri, Columbia;
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Ludlow, Elizabeth A. (1972)..*Assistant Professor of Nursing*
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Ludwig, Ann (1979)...*Associate Professor of Dance*
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Lukes, Eileen N. (1984)...*Instructor in Nursing*
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Lundgren, Harry R. (1962)..*Professor of Engineering*
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Lundin, Robert F. (1962) ....*Professor of Geology*
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MacKinnon, Stephen R. (1971) ....*Associate Professor of History*
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Magel, Donald (1978) ....*Associate Professor of Social Work*
    A.B., Sacramento State College; M.S.W., University of California, Berkeley; Ph.D., University of Pittsburgh
Magenta, Muriel (1968) ....*Professor of Art*
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Magers, William D. (1971) ....*Professor of Music*
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Maienschein, Jane (1981)..*Assistant Professor of Philosophy*
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Malin, Michael C. (1979) ....*Associate Professor of Geology*
    A.B., University of California, Berkeley; Ph.D., California Institute of Technology
Malone, Charles F. (1966) ....*Professor of Education*
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Mamlouk, Michael S. (1984)..*Associate Professor of Engineering*
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Manera, Elizabeth S. (1967) ....*Associate Professor of Education*
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Mankin, Lawrence D. (1973) ....*Associate Professor of Public Affairs; Assistant to the*
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Maracas, George N. (1984)......................................*Assistant Professor of Engineering*
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Marcus, Melvin G. (1974) ....*Professor of Geography*
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Marohnic, Charles S. (1981) ....*Associate Professor of Music; Director of Jazz Studies*
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Martin, John F. Jr. (1966) ....*Associate Professor of Anthropology*
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Martin, Linda J. (1980)...*Assistant Professor of Finance*
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Martin, Philip E. (1983) ....*Assistant Professor of Physical Education*
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Martin, Richard (1975) ....*Associate Professor of Religious Studies*
    B.A., University of Montana; B.D., University of Dubuque;
    Th.M., Princeton Theological Seminary; Ph.D., New York University
Martin, Thomas (1982) ....*Assistant Professor of Zoology*
    B.S., Washington State University; M.S., South Dakota State University; Ph.D., University of Illinois
Martinez, Quino E. (1957)...*Professor of Spanish*
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Marzke, Mary (1978)..*Assistant Professor of Anthropology*
    B.A., University of California; M.A., Columbia University; Ph.D., University of California

Marzke, Robert F. (1969) ....*Associate Professor of Physics*
    A.B., Princeton University; Ph.D., Columbia University
Mason, Bruce B. (1960) ....*Professor of Political Science*
    B.S., North Texas State College; M.A., Texas Christian University; Ph.D., University of Texas
Matheson, Alan A. (1967) ....*Professor of Law*
    B.A., M.S., J.D., University of Utah
Matson, John H. (1978) ....*Assistant Professor of Technology*
    B.S. in Ed., M.S., Illinois State University
Matt, Pamela (1980)..*Instructor of Dance*
    A.B., University of Washington; M.A., University of Illinois
Matthias, Judson S. (1967) ....*Professor of Engineering*
    B.S., U.S. Military Academy; M.S., Oregon State University; Ph.D., Purdue University
Mayer, Albert J. (1968) ....*Professor of Sociology*
    A.B., A.M., Ph.D., University of Chicago
Mayer, Lawrence S. (1983) ....*Professor of Statistics*
    B.S., M.S., Ph.D., Ohio State University
Mayer, Michael (1978)..*Associate Professor of Communication*
    B.A., M.A., University of Wyoming; Ph.D., University of Kansas
Mazen, S. David (1970) ....*Associate Professor of Counselor Education*
    B.A., Whitworth College; M.Ed., Eastern Washington State College; Ed.D., Washington State University
McCafferty, Richard B. (1982)....................*Assistant Professor of Journalism and Telecommunication*
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McCarter, Joan H. (1961)...*Assistant Professor of Mathematics*
    B.S., M.A., University of Arizona
McClain, Paula D. (1982)..*Associate Professor of Public Affairs*
    B.A., M.A., Ph.D., Howard University
McClure, Jesse F. (1983) ....*Professor of Social Work; Dean, School of Social Work*
    A.B., M.S.W., University of Michigan; Ph.D., Brandeis University
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    B.S., M.S., Portland State University; Ph.D., University of Oregon
McCready, Richard R. (1960) ....*Professor Emeritus of Decision and Information Systems*
    B.S., Valley City State Teachers College; M.A., Ed.D., University of Northern Colorado
McCurdy, Lyle B. (1973)..*Associate Professor of Technology*
    B.S., M.S., Arizona State University
McDonald, John N. (1969) ....*Professor of Mathematics*
    A.B., Kings College; M.S., Ph.D., Rutgers, The State University
McDowell, John M. (1978) ....*Associate Professor of Economics*
    B.A., M.A., University of California, Los Angeles
McEwen, Douglas R. (1969)..*Professor of Music; Director of Choirs*
    B.S., Bowling Green State University; M.M., Indiana University; Ed.D., University of Northern Colorado
McFarland, Elaine H. (1973).................................*Associate Professor Emeritus of Health Science*
    B.A., Marietta College; M.N., Case Western Reserve University
McGaughey, Robert W. (1971)...*Professor of Zoology*
    B.A., Augustana College; M.A., University of Colorado; Ph.D., Boston University
McGaw, Dickinson L. (1968)...*Associate Professor of Political Science*
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McGinty, Tim (1983).............*Associate Professor of Architecture; Assistant Dean, College of Architecture*
    B. Arch., University of Kansas; M. Arch., University of Pennsylvania   *and Environmental Design*
McGowan, Patrick J. (1979) ....*Professor of Political Science; Chair, Department of Political Science*
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McGrath, G.D. (1950) ....*Professor Emeritus of Education*
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McHenry, Albert L. (1978)..*Associate Professor of Technology*
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McIntosh, Patricia G. (1983) ....*Assistant Professor of Architecture*
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McIsaac, Marina Stock (1980)..*Assistant Professor of Education*
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McKlveen, John W. (1974)..*Professor of Engineering*
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   A.A., Stephens College

McMahon, Douglas (1978)..*Associate Professor of Mathematics*
   B.S., M.S., Ph.D., Case Western Reserve University

McMillan, Paul F. (1981)..*Assistant Professor of Chemistry*
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McPheters, Lee R. (1976) ....*Professor of Economics*
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Mead, Alice Pasetta (1984)..*Associate Professor of Law*
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Meister, Arnold G. (1957) ....*Professor Emeritus of Physics*
   B.S., Central YMCA College; Ph.D., Illinois Institute of Technology

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Merbs, Charles F. (1973) ....*Professor of Anthropology*
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Meyerson, Lee (1962) ....*Professor of Psychology*
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Michels, LeMoyne F. (1963)..*Professor Emeritus of Construction*
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Miller, Barbara K. (1976)..*Assistant Professor of Nursing*
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Miller, Donald S. (1981)..*Associate Professor of Computer Science*
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Miller, Fred L. (1971)..*Professor of Physical Education*
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Miller, Karen A. (1984) ....*Associate Professor of Sociology*
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Miller, Paul T. (1947)...*Professor Emeritus of Geology*
    B.A., Simpson College; M.S., Ph.D., University of Iowa
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Miller, Warren (1954) ....*Professor of Political Science*
    B.S., M.A., University of Oregon; Ph.D., Maxwell School of Citizenship and Public Affairs, Syracuse University
Miller, William Edgar (1966)......................................*Associate Professor of Counselor Education;*
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Misner, Robert L. (1975)..*Professor of Law*
    B.A., University of San Francisco; J.D., University of Chicago
Mitchell, Frederic F. (1961)..*Professor of Education*
    B.A., M.A., University of Arizona; Ph.D., Columbia University
Mittelman, Hans Detlef (1982)...*Professor of Mathematics*
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Moeller, Therald (1969)..*Professor Emeritus of Chemistry*
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Monts, Elizabeth A. (1973)...*Professor of Home Economics*
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    B.S., University of Arizona; M.S., Kansas State University; Ph.D., Purdue University
Moor, William C. (1968)...*Associate Professor of Engineering*
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Moore, J. Douglas (1969)..*Associate Professor of Mathematics*
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Morehart, Thomas B. (1975) ....*Associate Professor of Insurance*
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Morris, Donald H. (1962)..*Professor of Anthropology*
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Morris, John P. (1968)..*Professor of Law*
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Morrison, Kenneth M. (1983) ....*Associate Professor of Religious Studies*
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Moulton, Gerald L. (1967) ....*Professor of Education*
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 B.A., M.A., Florida State University; Ph.D., Arizona State University
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Muhlenkamp, Ann F. (1973)..*Professor of Nursing*
 B.S., M.S., Marquette University; Ph.D., University of Kansas
Mulhollan, Paige E. (1978) ....*Professor of History; Executive Vice President*
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Munk, Morton E. (1961) ....*Professor of Chemistry; Chair, Department of Chemistry*
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Murphy, Jeffrie G. (1981)...................................*Professor of Philosophy; Chair, Department of Philosophy*
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Murphy, Juanita F. (1971)..*Professor of Nursing*
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Murphy, Nina L. (1924)..*Professor Emeritus of Physical Education*
 B.S., University of Arizona; M.A., University of Southern California
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Musheno, Michael C. (1977) ....*Professor of Justice Studies*
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Myers, Louis M. (1937)...*Professor Emeritus of English*
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Myler, Charles E. Jr. (1968)...*Associate Professor of Real Estate*
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   B.A., University of Hawaii; M.A., Ph.D., University of Washington
Nagrin, Daniel (1982)..*Professor of Dance*
   B.S., College of the City of New York
Nash, Leanne T. (1971)...*Associate Professor of Anthropology*
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Nash, Thomas H. III (1971) ....*Professor of Botany*
   B.S., Duke University; M.S., Ph.D., Rutgers, The State University
Navrotsky, Alexandra (1969)..*Professor of Chemistry and Geology;*
   B.S., M.S., Ph.D., University of Chicago   *Director, Center for Solid State Science*
Nebeker, Helen E. (1958)............................*Professor of English; Associate Chair, Department of English*
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Neilson, Gregory M. (1970)..*Associate Professor of Computer Science*
   B.A., M.S., Ph.D., University of Utah
Neitzel, G. Paul (1979) ....*Associate Professor of Engineering*
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Nelson, Harold D. (1967) .... *Professor of Engineering*
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Nichols, Catherine G. (1952)...............................*Professor Emeritus of Counselor Education*
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Nielsen, Michael J. (1969)...*Associate Professor of Design Sciences*
   B.P.D., North Carolina State University; M.A., Stanford University
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   B.A., New Mexico Highlands University; M.S., University of Wyoming
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Northey, William T. (1959)..*Professor Emeritus of Microbiology*
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O'Dell, Michael A. (1980) ....*Assistant Professor of Accounting*
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Page, John B. (1969) ....*Professor of Physics*
   B.S., Ph.D., University of Utah
Pai, Ammembal L. (1982) ....*Associate Professor of Computer Science*
   B.E., University of Mysore; M.E, Indian Institute of Science; Ph.D., Ohio State University
Palais, Joseph C. (1964)...*Professor of Engineering*
   B.S.E.E., University of Arizona; M.S.E., Ph.D., University of Michigan
Palmgren, Dale E. (1984) ....*Assistant Professor of Technology*
   B.S., M.S., University of Wisconsin, Madison
Palumbo, Dennis J. (1983) ....*Professor of Public Affairs*
   M.A. (Social Science), M.A. (Political Science), Ph.D., University of Chicago
Pangrazi, Robert P. (1973)..........................*Professor of Physical Education; Acting Chair, Department of*
   B.A., M.S., Ph.D., Washington State University   *Health and Physical Education*
Pany, Kurt J. (1978) ....*Associate Professor of Accounting*
   B.S.B.A., University of Arizona; M.B.A., University of Minnesota; Ph.D., University of Illinois; C.P.A., Arizona
Papier, Bruce L. (1984) ....*Assistant Professor of Design Sciences*
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Pardini, Louis J. (1967) ....*Associate Professor of Technology*
   B.A., A.M., Idaho State University; Ed.D., University of Northern Colorado
Parker, L. Mayland (1955)..*Professor of Geography*
   B.S., Brigham Young University; M.S., University of Utah; Ph.D., Cornell University
Parkinson, Stanley R. (1971)...*Professor of Psychology*
   A.B., University of California, Berkeley; M.A., Ph.D., University of California, Davis
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Parrish, H. Wayne (1967) ....*Assistant Professor of Education*
   A.B., San Diego State College; M.Ed., Ed.D., University of Oregon
Parsons, Michael L. (1967)...*Professor of Chemistry*
   B.A., M.S., Kansas State College; Ph.D., University of Florida
Pasqualetti, Martin J. (1977)..*Associate Professor of Geography*
   B.A., University of California, Berkeley; M.A., Louisiana State University; Ph.D., University of California, Riverside
Pastin, Mark (1980) ....*Professor of Management; Director, Center for Private and*
   B.A., University of Pittsburgh; A.M., Ph.D., Harvard University   *Public Sector Ethics*
Patten, Duncan T. (1965) ....*Professor of Botany*
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Patterson, Dan B., Captain (1983) ....*Assistant Professor of Military Science*
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Patterson, John D. (1967)..*Professor of Engineering*
    B.S.E.E., M.S., Ph.D., University of California, Berkeley
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    B.S., University of Michigan; Ph.D., Ohio State University
Pattison, Diane D. (1980)..*Assistant Professor of Accounting*
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Paulsen, George E. (1959) ....*Professor of History*
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    B.S., Columbia University; M.S., Boston University; Ed.D., Arizona State University
Pearson, John N. (1981).....................*Assistant Professor of Production/Operations Management*
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Pedrick, Willard H. (1966)...*Professor Emeritus of Law*
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Perantoni, Daniel T. (1982)..*Professor of Music*
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Perrell, Richard C. (1976) ....*Assistant Professor of Architecture*
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    B.A., Ohio Wesleyan University; M.A., Ohio State University;
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Perrill, Norman K. (1966) ....*Professor of Communication*
    B.S., M.A., Northwestern University; Ph.D., University of Southern California
Perry, Ronald W. (1983)...*Professor of Public Affairs*
    B.Sc., M.A., Arizona State University; Ph.D., University of Washington
Peterman, Gordon G. (1966) ....*Professor of Construction*
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Peters, Kathleen A. (1967)..*Assistant Professor of Home Economics*
    B.S., M.S., Kansas State University
Peterson, Edward R. (1977)...*Assistant Professor of Technology*
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Peterson, John R. (1963)..*Professor of Architecture*
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Pettit, George R. (1964)...*Professor of Chemistry*
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Petuskey, William T. (1977)...*Associate Professor of Chemistry*
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Péwé, Troy L. (1965) ....*Professor of Geology*
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Pfuhl, Erdwin H. Jr. (1968)...*Professor of Sociology*
    A.B., Whitman College; A.M., University of Idaho; Ph.D., Washington State University
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Plumer, Alice (1983)...*Instructor of Nursing*
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Price, Thornton W. (1961)..*Professor Emeritus of Engineering*
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Randall, Virginia R. (1962)..*Associate Professor of English*
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Rapp, James R. (1962)..*Professor of Architecture*
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Rasler, Karen (1981) ....*Assistant Professor of Political Science*
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  M.A., Ph.D., University of Chicago
Rice, Roy C. (1946)..*Professor Emeritus of Education*
  B.S., University of New Mexico; M.S., University of Massachusetts; Ph.D., University of Texas
Rice, Warren (1958)..*Professor of Engineering*
  B.S., M.S., Ph.D., Texas A & M University
Richards, Gale L. (1965)...*Professor of Communication*
  B.A., University of Akron; M.A., Ph.D., University of Iowa
Richards, Mary L. (1978)...*Assistant Professor of Nursing*
  B.S.N., M.S.N., De Paul University
Richardson, Deane E. (1970)...*Professor of Physical Education*
  B.S., Bradley University; M.A., Ed.D., Stanford University
Richardson, Grant L. (1953)..*Professor Emeritus of Agriculture*
  B.S., M.S., University of Arizona; Ph.D., Oregon State University
Richardson, H.D. (1940)...*Professor Emeritus of Counselor Education*
  Ph.B., Ph.M., University of Wisconsin; Ph.D., Northwestern University; LL.D., Arizona State University
Richardson, Richard C. Jr. (1977)...*Professor of Education; Chair,*
  B.S., Castleton State College;   *Department of Higher and Adult Education*
  M.S., Michigan State University; Ph.D., University of Texas
Rickel, Harry P. (1948)..*Professor Emeritus of Music*
  B.M., M.M., University of Arizona
Rider, Graham W. (1983)...*Professor of Purchasing/Materials Management*
  B.S., U.S. Military Academy, West Point; M.S., Air Force Institute of Technology;
  D.B.A., Arizona State University
Rider, Wendell J. (1953)..*Professor Emeritus of Music*
  B.S., Iowa State Teachers College; M.M., Eastman School of Music; Ph.D., University of Iowa
Riegelhaupt-Barkin, Florence (1976)...*Associate Professor of Spanish*
  B.A., State University of New York, Albany; M.A., Ph.D., State University of New York, Buffalo
Ringhofer, Christian (1983)..*Assistant Professor of Mathematics*
  M.A., Ph.D., University of Vienna
Rios, Alberto A. (1982)..*Assistant Professor of English*
  B.A., M.F.A., University of Arizona
Risseeuw, John L. (1980)...*Assistant Professor of Art*
  B.S., M.A., M.F.A., University of Wisconsin, Madison
Ritchie, Barry G. (1984)...*Assistant Professor of Physics*
  B.S., Appalachian State University; M.S., Ph.D., University of South Carolina
Ritchie, Kathleen E. (1972)..*Instructor in Psychology*
  B.A., University of Arizona; M.A., Arizona State University
Robbins, Earl R. (1961)..*Associate Professor of Computer Science*
  B.S.E.E., Texas Technological College; M.S.E., Ph.D., Arizona State University
Roberts, Carolyn (1982) ....*Associate Professor of Nursing*
  B.Sc.N., University of Western Ontario; M.Ed., Teachers College, Columbia University;
  Ph.D., Wayne State University

Roberts, Thomas G. (1970)..*Associate Professor of Education*
    B.A., Wake Forest University; M.A., Ph.D., University of North Carolina

Robertson, Rachel D. (1981)...*Assistant Professor of Leisure Studies*
    B.A., University of Iowa; M.S., University of Oregon; Ph.D., University of Iowa

Robinson, Daniel O. (1950)..*Professor Emeritus of Agriculture*
    A.B., Brigham Young University; M.S., University of Arizona; Ph.D., Ohio State University

Robinson, Helene M. (1967)..*Associate Professor Emeritus of Music*
    B.A., University of Oregon; M.M., Northwestern University

Robinson, Sharon E. (1978).................*Associate Professor of Counselor Education; Chair, Department of*
    B.S., M.S., University of Wisconsin, LaCrosse; Ph.D., Indiana University   *Counselor Education*

Rodd, Laurel R. (1975)...*Associate Professor of Japanese*
    B.A., DePauw University; M.A.T., East Tennessee State University; M.A., Ph.D., University of Michigan

Rodman, Leiba (1984) ....*Associate Professor of Mathematics*
    M.A., Ph.D., Tel-Aviv University

Roe, Keith B. (1979)..*Associate Professor of Technology*
    B.S., Wisconsin State College; M.A., University of Michigan

Roedel, Ronald J. (1981)..*Associate Professor of Engineering*
    B.S.E., Princeton University; M.S., Ph.D., University of California, Los Angeles

Rogers, Bradley B. (1984) ....*Assistant Professor of Technology*
    B.S., M.S., Montana State University

Rogers, Rhonda M. (1983)...*Assistant Professor of Aerospace Studies*
    B.B.A., University of Texas; M.P.A., Ball State University

Rollier, Dwayne A. (1971)...*Associate Professor of Engineering*
    B.S., M.S., Oklahoma State University; Ph.D., Florida State University

Rook, Fern H. (1969)..*Assistant Professor Emeritus of Technology*
    B.A., University of Colorado; M.A., Arizona State University

Roosa, Mark W., (1980) ....*Assistant Professor of Home Economics*
    B.S., Ohio State University; M.A., Ph.D., Michigan State University

Roper, Devon J. (1966) ....*Associate Professor of Technology*
    B.S., Utah State University; M.S., Arizona State University

Rosales, F. Arturo (1980) ....*Associate Professor of History*
    B.A., Arizona State University; M.A., Stanford University; Ph.D., Indiana University

Rose, Jonathan (1968) ....*Professor of Law*
    B.A., University of Pennsylvania; LL.B., University of Minnesota

Rose, Seth D. (1976)...*Associate Professor of Chemistry*
    B.S., University of California, Berkeley; Ph.D., University of California, San Diego

Rossi, Patrick J. (1967)..*Associate Professor of Psychology*
    B.S., St. Mary's College; M.A., San Fernando Valley State College; Ph.D., University of California, Riverside

Rossman, Mark H. (1974).........................*Associate Professor of Education; Interim Chair, Department of*
    B.A., New York University; M.S., University of Bridgeport;   *Higher and Adult Education*
    Ed.D., University of Massachusetts

Rothschild, Mary A. (1975) ....*Associate Professor of History*
    B.A., M.A., Ph.D., University of Washington

Rover, R. Craig (1952)...*Professor Emeritus of Education*
    B.A., Upsala College; M.A., St. Lawrence University; Ph.D., Cornell University

Rowe, Kenneth L. (1962) ....*Professor of Marketing*
    B.A., M.A., Northern Iowa University; Ph.D., Michigan State University

Roy, Asim (1983)...*Assistant Professor of Management Science*
    B.E., Calcutta University; M.S., Case Western Reserve University; Ph.D., University of Texas at Austin

Roy, Radha R. (1963) ....*Professor of Physics*
    B.Sc., M.Sc., Presidency College, University of Calcutta; Ph.D., University of London

Roy, Ramendra P. (1981) ....*Associate Professor in Engineering*
    B.Sc., University of Calcutta; B.S., University of Jadavpur; M.S., University of Washington; M.Sc.,
    Ph.D., University of California, Berkeley

Ruccolo, James S. (1974)...*Professor of Music*
    B.M., Eastman School of Music; M.M., Arizona State University; D.M.A., University of Arizona

Ruch, William A. (1968) ....*Professor of Purchasing/Transportation/Operations*
    B.S., M.B.A., D.B.A., Indiana University

Rueda, Robert (1978) ....*Associate Professor of Education*
  B.A., University of California, Los Angeles; M.S.W., University of Southern California
Ruff, Paul F. (1958)...*Professor of Engineering*
  B.S.C.E., M.S.C.E., Case Western Reserve University
Rummell, John R. (1975)..*Associate Professor Emeritus of Architecture*
  B.A., M.S., Stanford University
Ruppé, Reynold J. (1960)...*Professor Emeritus of Anthropology*
  B.A., University of New Mexico; Ph.D., Harvard University
Russell, Paul E. (1967)..*Professor of Engineering*
  B.S.E.E., B.S.M.E., New Mexico A&M University; M.S.E.E., Ph.D., University of Wisconsin, Madison; P.E.
Rutherford, Robert B. Jr. (1976)..*Professor of Education*
  B.S., M.Ed., University of Virginia; Ed.S., Ph.D., George Peabody College
Rutowski, Ronald L. (1976)...*Associate Professor of Zoology*
  B.A., University of California, Santa Cruz; Ph.D., Cornell University
Ryan, Jr., Ray D. (1984)...*Associate Professor of Technology*
  B.S., University of Wisconsin, Stout; M.Ed., Ed.D., University of Missouri, Columbia

Sacks, Benjamin (1963) ....*Professor Emeritus of History*
  B.A., University of New Mexico; M.A., McGill University; Ph.D., Stanford University
Sackton, Frank J. (1976).........................*Professor Emeritus of Public Affairs; Deputy Director of Athletics*
  B.S., University of Maryland; M.P.A., Arizona State University
Sadalla, Edward K. (1974)..*Associate Professor of Psychology*
  B.A., University of California, Berkeley; Ph.D., Stanford University
Sadler, William E. (1975)..*Assistant Professor of Design Sciences*
  B.S., M.S., Kent State University
Saeks, Richard (1983) ....*Professor of Engineering; Chair, Department of Electrical
  B.S.E.E., Northwestern University; M.S., Colorado State University;   and Computer Engineering*
  Ph.P., Cornell University
Saldaña, Johnny (1981)...*Assistant Professor of Theatre*
  B.F.A., M.F.A., University of Texas at Austin
Salerno, Nicholas A. (1961) ....*Professor of English; Chair, Department of English*
  B.A. in Ed., M.A., Arizona State University; Ph.D., Stanford University
Saletta, Anne L. (1981)..*Instructor of Nursing*
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Salmirs, Seymour (1981)...*Assistant Professor of Technology*
  B.A.E., M.S.A.E., Georgia Institute of Technology
Sanders, Bevie T. (1957) ....*Associate Professor Emeritus of Accounting*
  B.B.A., North Texas State University; M.S., Texas A & M University;
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Sanderson, R. Thomas (1963)..*Professor Emeritus of Chemistry*
  B.S., Yale University; Ph.D., University of Chicago
Sandler, Irwin (1975)..*Associate Professor of Psychology*
  B.A., Brooklyn College; Ph.D., University of Rochester
Sands, Kathleen M. (1977) ....*Associate Professor of English*
  B.A., Fort Wright College; M.A., Ph.D., University of Arizona
Sankey, Otto F. (1982) ....*Assistant Professor of Physics*
  B.S., University of Missouri, St. Louis; M.S., Ph.D., Washington University
Sansone, Fred J. (1965)...*Associate Professor of Mathematics*
  B.S.E., M.S.E., University of Michigan; M.S., Ph.D., Rutgers, The State University
Sargent, Charles S. Jr. (1971)...*Associate Professor of Geography*
  B.A., University of Wyoming; M.A., Ph.D., University of California, Berkeley
Saric, William (1984) ....*Professor of Engineering*
  B.S., Illinois Institute of Technology; M.S., University of New Mexico; Ph.D., Illinois Institute of Technology
Sater, Vernon E. (1962) ....*Professor of Engineering*
  B.S.Ch.E., M.S.Ch.E., Ph.D., Illinois Institute of Technology
Satterlie, Richard A. (1980)..*Assistant Professor of Zoology*
  B.A., Sonoma State University; Ph.D., University of California, Santa Barbara

Satterthwaite, Lester L. Jr. (1968) ....*Professor of Education*
    B.S., M.S., Ed.D., Indiana University
Sattler, Howard E. (1967) ....*Professor of Education*
    B.S., M.S., Ph.D., Arizona State University
Savage, Nevin W. (1959)..*Professor of Mathematics*
    B.S., M.A., Pennsylvania State University; Ph.D., University of California, Los Angeles
Scalise, James W. (1975) ....*Associate Professor of Planning*
    B. Arch., Arizona State University; M. Arch., University of California, Berkeley
Schabacker, Joseph C. (1963) ....*Professor of Management*
    B.S., Temple University; M.B.A., Ph.D., University of California, Los Angeles
Schade, Thomas V. (1974) ....*Associate Professor of Justice Studies*
    B.A., Hope College; M.A., Ph.D., Western Michigan University
Schall, Merri H. (1960-66; 1967)..*Associate Professor of Education*
    B.A., Albion College; M.S., Ed.D., Arizona State University
Schaumburg, Donald R. (1953)..*Professor of Art*
    B.A. in Art Ed., College of Arts and Crafts; M.F.A., Claremont Graduate College
Scheatzle, David G. (1979)..*Associate Professor of Architecture*
    B.S., Kent State University; M.S.E., Arizona State University
Schildgen, Thomas E. (1981) ....*Assistant Professor of Technology*
    B.S., S., Illinois State University
Schilit, Rebecca (1984) ....*Assistant Professor of Social Work*
    A.B., M.S.W., Ph.D., University of Michigan
Schlacter, John L. (1969)...*Professor of Marketing*
    B.B.A., Western Reserve University; M.B.A., Ph.D., Ohio State University
Schlagenhauf, Don E. (1976)..*Associate Professor of Economics*
    B.S., Marquette University; M.A., Ph.D., University of Illinois
Schluntz, Roger L. (1980)..............................*Professor of Architecture; Chair, Department of Architecture*
    B.Arch., University of Nebraska; M.Arch., University of California, Berkeley
Schmidt, Alfred H. (1960)..*Professor Emeritus of Marketing*
    B.S., University of Oklahoma; M.B.A., D.B.A., Indiana University
Schmidt, Jean M. (1966)..*Professor of Microbiology*
    B.A., M.S., University of Iowa; Ph.D., University of California, Berkeley
Schmidt, Peter A. (1978)...*Associate Professor of Technology; Chair,*
    B.S. in Ed., Northern Illinois University;   *Department of Manufacturing Technology*
    M.A. in Ed., Ed.D., Arizona State University
Schmidt, Randall B. (1968)..*Associate Professor of Art*
    B.A., Hamline University, Minnesota; M.A., University of New Mexico
Schmitz, Paul A., Major (1983).................................*Assistant Professor of Military Science*
    B.S., University of Minnesota
Schoen, Robert A. (1966)..*Assistant Professor of Technology;*
    B.S., M.S., Arizona State University   *Acting Chair, Department of Aeronautical Technology*
Schoenwetter, James (1967) ....*Professor of Anthropology*
    A.B., University of Chicago; M.S., University of Arizona; Ph.D., Southern Illinois University
Schon, Isabel (1974)..*Professor of Education*
    B.S., Mankato State College; M.A., Michigan State University; Ph.D., University of Colorado
Schroder, Dieter K. (1981)...*Professor, Research; Engineering*
    B.S.E.E., M.S.E.E., McGill University; Ph.D., University of Illinois
Schroeder, Milton R. (1969)...*Professor of Law*
    B.A., Wesleyan University; J.D., University of Chicago
Schuback, Gertrud B. (1966) ....*Instructor of German*
    B.A., M.A., Arizona State University
Schwada, John W. (1971) ....*Past President of the University; Professor Emeritus of Political Science*
    B.S., Northeast Missouri State College; M.A., University of Missouri, Columbia;
    Ph.D., University of Texas, Austin
Schwartz, Kenneth, Captain (1982).................................*Assistant Professor of Military Science*
    B.S., Kearney State College; M.A., Webster College
Schwuttke, Guenter (1983)..*Professor of Engineering*
    B.S., Ph.D., University of Munich, Germany

Scoular, David B. (1952) ....*Professor Emeritus of Music*
    B.A., Texas Christian Univeristy; B.M., Lawrence College; M.A., Columbia University
Searfoss, Lyndon W. (1973)..*Professor of Education; Associate Chair,*
    B.S., West Chester State College; M.A., Ph.D., Syracuse University   *Department of Elementary Education*
Sebald, Hans (1963) ....*Professor of Sociology*
    B.A., Manchester College; M.S., Ph.D., Ohio State University
Sehested, Colene R. (1967) ....*Assistant Professor of Nursing*
    B.S., University of Arkansas; M.S.N., University of Maryland
Seipp, Kenneth F. (1963)...*Professor of Music*
    B.S., Hartwick College; M.M., Conservatory of Music, University of Kansas City; Mus.Ed.D., Indiana University
Selleck, Herbert H. (1973)..*Associate Professor Emeritus of Construction*
    B.S.C.E., Iowa State University
Senner, Wayne M. (1973) ....*Associate Professor of German*
    B.A., Portland State University; M.A., University of Washington; Ph.D., University of Illinois
Seperich, George J. (1976)...................*Associate Professor of Agriculture; Director, Division of Agriculture*
    B.S., Loyola University, Chicago; M.S., Ph.D., Michigan State University
Serrao, Lancelot O. (1984) ....*Assistant Professor of Computer Science*
    B.S., M.S., Ph.D., Technical University, West Berlin, West Germany
Seymour, John F., Major (1983) ....*Assistant Professor of Military Science*
    B.S., University of Utah; M.B.A., University of Northern Colorado
Shafer, Robert E. (1966)...*Professor of English; Director, English Education*
    B.S., M.S., University of Wisconsin, Madison; Ed.D., Columbia University
Shafer, Susanne M. (1966)...*Professor of Education*
    A.B., Smith College; M.A., Syracuse University; Ph.D., University of Michigan
Shah, Jami (1984)...*Assistant Professor of Engineering*
    B.E., N.E.D., Engineering College; M.S., University of Pittsburgh; Ph.D., Ohio State University
Sharer, Jon W. (1975)..*Associate Professor of Art*
    B.A., Roosevelt University, Chicago; M.S., Illinois Institute of Technology; Ph.D., Ohio State University
Shaw, Keith B. (1981) ....*Assistant Professor of Music*
    B.S., University of Wisconsin, LaCrosse; M.F.A., Oklahoma University
Shaw, Milton C. (1978)...*Professor of Engineering*
    B.S.M.E., Drexel University; M.E.Sc., Sc.D., University of Cincinnati; Dr.H.C., University of Louvain
Shell, Leon G. (1967)..............................*Associate Professor of Counselor Education; Dean of Student Life*
    B.A., University of Colorado; A.M., Ed.D., University of Northern Colorado
Shen, C. C. (1982)..*Associate Professor of Engineering*
    B.S.E.E., National Taiwan University; M.S., State University of New York, Stony Brook; Ph.D., Stanford
    University
Sheppard, Douglas C. (1971)...*Professor of Spanish*
    B.A., Montana State University; M.A., Ph.D., University of Wisconsin, Madison
Sheridan, Eleanor (1973) ....*Assistant Professor of Nursing*
    B.S.N., M.S.N., Wayne State University
Sheridan, Michael F. (1966)..*Professor of Geology*
    B.A., Amherst College; M.S., Ph.D., Stanford University
Sherman, Thomas L. (1964) ....*Professor of Mathematics*
    B.A., University of California, Los Angeles; M.S., Ph.D., University of Utah
Sheydayi, E. Yury (1973)..*Associate Professor of Architecture*
    B.S.C.E., University of Arizona; M.S.C.E., Arizona State University
Shin, Kwang (1983)..*Assistant Professor of Engineering*
    B.S., Seoul National University; Ph.D., Northwestern University
Shinn, Randall A. (1978)..*Associate Professor of Music*
    B.A., Southwestern Oklahoma State University; M.M., University of Colorado; D.M.A., University of Illinois
Shinn, Thelma J. (1975)..*Associate Professor of English*
    B.A., Central Connecticut State College; M.A., Ph.D., Purdue University
Shipp, Vernon E. (1966) ....*Assistant Professor of Art*
    B.S., Grand Canyon College; M.A., Arizona State University
Shipper, Frank M. (1976) ....*Associate Professor of Management*
    B.S.M.E., West Virginia Tech; M.B.A., Ph.D., University of Utah
Shirreffs, Janet H. (1977) ....*Associate Professor of Health Science*
    B.S., Ithaca College; M.S., Syracuse University; Ph.D., Texas Woman's University

Shofstall, Weldon P. (1950)..*Professor Emeritus of Secondary Education*
   B.S. in Ed., Northeast Missouri State Teachers College; M.A.; Ph.D., University of Missouri
Shriver, Keith A. (1982) ....*Assistant Professor of Accounting*
   B.S., Linfield College; M.S., Arizona State University; Ph.D., University of Texas, Austin; C.P.A., Arizona
Shrock, David L. (1974)..*Professor of Transportation; Assistant Dean,*
   B.E.E., General Motors Institute; M.B.A., D.B.A., Indiana University   *Graduate College*
Shuman, I. Gayle (1974) ....*Associate Professor of Justice Studies*
   B.S., M.A. in Ed., Ed.D., Arizona State University
Shunk, Dan L. (1984) ....*Associate Professor of Engineering*
   B.S.I.E., M.S.I.E., Ph.D., Purdue University
Silvaroli, Nicholas J. (1963)......................................*Professor of Education; Director, Reading Education*
   B.S. in Ed., State University of New York, Fredonia; M.A., State University of New York, Buffalo;
   Ed.D., Syracuse University
Silver, Benjamin (1971)............................*Associate Professor of Journalism and Telecommunication*
   B.A., M.A., University of Iowa
Simmons, Douglas J. (1963)..*Assistant Professor of French*
   A.B., Wabash College; M.A.T., Harvard University; Certificat de francais usuel, degré supérieur;
   Certificat de pronónciation francaise, La Sorbonne (France)
Simon, Sheldon (1975)...............................*Professor of Political Science; Director, Center for Asian Studies*
   B.A., University of Minnesota; M.A., Princeton University; Ph.D., University of Minnesota
Singhal, Avi C. (1977) ....*Professor in Engineering*
   B.Sc. Math., Agra University; B.Sc.Engr., B.Sc. Hons., St. Andrews University, Scotland;
   S.M., C.E., Sc.D., Massachusetts Institute of Technology
Sinkov, Abraham (1964)..*Professor Emeritus of Mathematics*
   B.S., College of City of New York; M.S., Columbia University; Ph.D., George Washington University
Sirkis, Murray D. (1968)...*Professor of Engineering*
   B.S., Massachusetts Institute of Technology; M.S., Ph.D., University of Illinois
Skibo, Edward B. (1982) ....*Assistant Professor of Chemistry*
   B.S., M.S., Drexel University; Ph.D., University of California. San Francisco
Skinner, Elizabeth C. (1981) ....*Assistant Professor of Education*
   B.A., Brandeis University; M.A.T., Harvard University; Ph.D., Arizona State University
Skinner, James S. (1982)..*Professor of Physical Education*
   B.S., M.S., Ph.D., University of Illinois, Urbana
Skoldberg, Phyllis (1977) ....*Professor of Music*
   B.M., M.M., New England Conservatory of Music; M.M.E., D.M., Indiana University
Smith, Andrew T. (1978) ....*Associate Professor of Zoology*
   A.B., University of California, Berkeley; Ph.D., University of California, Los Angeles
Smith, Arthur B. Jr. (1967) ....*Associate Professor of General Business*
   B.S., Hardin-Simmons University; M.B.A., Ed.D., University of Houston
Smith, A. Wade (1981) ....*Associate Professor of Sociology*
   A.B., Dartmouth College; M.A., Ph.D., University of Chicago
Smith, Brad (1984)..*Assistant Professor of Geology*
   B.S., University of Washington, Seattle; M.A., Ph.D., University of California, Berkeley
Smith, Charles B. (1964) ....*Professor Emeritus of General Business*
   B.S., Drake University; M.S., New Mexico Highlands University; Ed.D., University of Northern Colorado
Smith, David B. (1984) ....*Associate Professor of Accounting*
   B.A., Carleton College; M.B.A., University of Pennsylvania; Ph.D., University of Illinois; C.P.A., Illinois
Smith, David J. (1984) ....*Associate Professor of Physics, Center for Solid State Science*
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Smith, Hal L. (1979) ....*Associate Professor of Mathematics*
   B.S., Ph.D., University of Iowa
Smith, Harvey A. (1977)..*Professor of Mathematics*
   B.S., Lehigh University; M.S., A.M., Ph.D., University of Pennsylvania
Smith, Janet Kiholm (1981) ....*Assistant Professor of Economics*
   B.S., University of Utah; M.S., Arizona State University; Ph.D., University of California, Los Angeles
Smith, L. Christian (1971)..*Assistant Professor of History*
   B.A., Union College; M.A., Ph.D., University of Illinois
Smith, Lehi T. (1959) ....*Professor of Mathematics*
   B.S., M.A. in Ed., Arizona State University; Ed.D., Stanford University

Smith, Margo M. (1963)..*Associate Professor Emeritus of Music*
B.M., Grinnell College; M.A. in Ed., Arizona State University
Smith, Marion W. (1952) ....*Associate Professor of Music*
B.S., in Mus. Ed., Capital University; M.M., American Conservatory of Music
Smith, Ralph E. (1970)...*Professor of Accounting*
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Smith, Richard L. (1967)............................*Professor of Engineering; Chair, Department of Industrial and*
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Smith, Richard L. (1981)...*Assistant Professor of Finance*
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Smith, Ronald D. (1963) ....*Associate Professor of History; Assistant Dean,*
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Smith, Sandra (1984) ....*Assistant Professor of Anthropology*
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Smith, Scott L. (1981) ....*Assistant Professor of Economics*
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Smith, Stanley E. (1977)................................*Associate Professor of Journalism and Telecommunication*
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Snow, Robert (1970) ....*Associate Professor of Sociology*
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Snyder, Ernest E. Jr. (1958) ....*Professor Emeritus of Science Education-Physics*
A.B., M.A., Colorado State University; Ed.D., New York University
Snyder, Lester M. Jr. (1967).......*Professor of Counselor Education; Associate Dean, College of Education*
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So, Ronald Ming Cho (1981) ....*Professor in Engineering*
B.Sc., University of Hong Kong; M.Eng., McGill University; M.A., Ph.D., Princeton University
Somerville, Susan C. (1978)...*Associate Professor of Psychology*
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Sommerfeld, Milton R. (1968).........*Professor of Botany; Chair, Department of Botany and Microbiology*
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Sparks, Charles F., Captain (1979)....................................*Assistant Professor of Military Science*
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Spence, John C. H. (1976)...*Associate Professor of Physics*
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Spinosa, Frank (1965)...*Professor of Music*
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Squires, Rose L. (1981)...*Assistant Professor of Nursing*
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Stadmiller, Jack E. (1963)...........................*Associate Professor Emeritus of Engineering Communications*
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Stafford, Alfred B. (1958)..*Professor Emeritus of Engineering*
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Stafford, Kenneth R. (1957)..*Professor Emeritus of Educational Psychology*
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Stahl, Robert (1978)...*Associate Professor of Education*
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Stahnke, Herbert L. (1941)...*Professor Emeritus of Zoology*
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Staley, Frederick A. (1970)...*Associate Professor of Education*
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Stalzer, Frank S. (1955) ....*Associate Professor of Music*
B.M.Ed., University of Kansas; M.M., Eastman School of Music
Standridge, Lanny, Colonel (1984)...*Professor of Military Science*
B.S., Troy State University; M.S., Shippensburg State University
Stange, Jean B. (1970) ....*Associate Professor Emeritus of Home Economics*
B.S., Iowa State University; M.S., University of Minnesota

Stanley, James T. (1968)...*Professor of Engineering*
    B.S., M.S., Ph.D., University of Illinois
Stanton, Ann M. (1980)..*Professor of Law*
    B.A., University of Minnesota; J.D., Ph.D., Stanford University
Stark, Barbara L. (1972) ....*Associate Professor of Anthropology*
    B.A., Rice University; M. Phil., Ph.D., Yale University
Starrfield, Sumner G. (1972)...*Professor of Astronomy/Physics*
    B.A., University of California, Berkeley; M.A., Ph.D., University of California, Los Angeles
Steadman, Lyle B. (1971)..*Assistant Professor of Anthropology*
    B.A., Occidental College; M.A., University of California, Los Angeles; Ph.D., Australian National University
Stearns, MaryBeth (1981)...*Professor of Physics*
    B.S., University of Minnesota; Ph.D., Cornell University
Steere, Caryl J. (1960) ....*Assistant Professor Emeritus of Education*
    B.A., Albion College; M.A., Arizona State University
Steffl, Bernita M. (1961)...*Professor of Nursing*
    B.S.N., M.P.H., University of Minnesota
Steinmann, Wilbur L. (1959)......................................*Associate Professor Emeritus of Engineering*
    B.S.E.E., University of Minnesota; M.S., University of Iowa
Stellhorn, Martin H. (1963)..*Professor Emeritus of Music*
    Mus.B., St. Louis Institute of Music; Mus.M., Northwestern University; Ph.D., Washington University
Stengel, Jean Craig (1983)..*Assistant Professor of Nursing*
    B.S., University of Oregon; M.Ed., University of Minnesota; Ph.D., Arizona State University
Stephens, Nancy J. (1980)..*Assistant Professor of Advertising and Marketing*
    B.S., M.S., University of Illinois; Ph.D., University of Texas, Austin
Stevenson, Harold W. (1967)..*Professor of Finance*
    B.S., University of Minnesota; M.B.A., Ph.D., University of Michigan; C.F.A.
Steverson, Norris J. (1932)...*Associate Professor Emeritus of Physical Education*
    B.A., Arizona State University; M.S., University of Southern California
Stewart, Donald G. (1964)...*Associate Professor of Mathematics*
    B.A., M.S., University of Utah; Ph.D., University of Tennessee, Knoxville
Stewart, Ernest I. (1959)..*Professor Emeritus of Health Science*
    B.S., M.S., Utah State University; Ph.D., Columbia University
Stewart, Kenneth M. (1947)...*Professor Emeritus of Anthropology*
    A.B., M.A., Ph.D., University of California, Berkeley
Stiles, Philip G. (1969)...*Professor of Agriculture*
    B.S., University of Arkansas; M.S., University of Kentucky; Ph.D., Michigan State University
Stites, William H. (1954) ....*Professor of Communication*
    B.A., Louisiana Polytechnic Institute; M.A., Ph.D., University of Denver
St. Louis, Robert D. (1982)...*Associate Professor of Management Science*
    A.B., Rockhurst College; M.S., Ph.D., Purdue University
Stock, William A. (1973) ....*Professor of Education*
    B.A., Blackburn College; M.S., Ph.D., Iowa State University
Stocker, David Allen (1978)...*Associate Professor of Music*
    B.S., Concordia Teachers College; M.M., Ph.D., Northwestern University
Stolz, Richard W. (1982) ....*Assistant Professor of Finance*
    B.A., Linfield College; M.A., Syracuse University; Ph.D., Michigan State University
Stone, William J. (1967)...*Professor of Physical Education*
    B.S., Boston University; M.S., Florida State University; Ed.D., University of California, Berkeley
Stookey, John A. (1976) ....*Associate Professor of Political Science*
    A.B., M.A., Marshall University; Ph.D., University of Kentucky
Stout, Minard W. (1968)...*Professor Emeritus of Education*
    B.A., University of Northern Iowa; M.A., Ph.D., State University of Iowa
Stout, Robert (1978)...*Professor of Education*
    B.A., Carleton College, Northfield, Minn.; Ph.D., University of Chicago
Stowe, Noel J. (1967)...*Associate Professor of History*
    B.A., Ph.D., University of Southern California
Strang, Eleanor L. (1983)...*Instructor of Nursing*
    Diploma, Silver Cross Hospital; B.S., Illinois Wesleyan University; M.S., University of Michigan

Strange, Richard E. (1974)...*Professor of Music; Director of Bands*
    B.M.E., Wichita State University; M.M.E., University of Colorado; D.M.A., Boston University

Straub, Calvin C. (1961)...*Professor Emeritus of Architecture*
    B. Arch., University of Southern California

Strawn, Roland S. (1968) ....*Associate Professor of Technology; Assistant Director,*
    B.S.E.E., M.S.E.E., University of Illinois; Ph.D., Arizona State University   *Division of Technology*

Streufert, Hildegarde (1961)...*Associate Professor of Design Sciences*
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Strojnik, Ales (1969) ....*Professor of Physics*
    Diplom. Ing., Ph.D., University of Ljubljana (Yugoslavia)

Strom, Robert D. (1969)..*Professor of Education*
    B.S., Macalester College; M.A., University of Minnesota; Ph.D., University of Michigan

Stuler, John H. (1962)..*Professor of Art*
    B.A., M.F.A., Arizona State University

Stump, Edmund (1976)..*Associate Professor of Geology*
    A.B., Harvard University; M.S., Yale University; Ph.D., Ohio State University

Stumpf, Angela M. (1959)...*Associate Professor Emeritus of Nursing*
    B.S.N.E., Marquette University; M.A., University of Chicago

Stutsman, Paul S. (1967)...*Associate Professor Emeritus of Chemistry*
    B.S., University of Illinois; Ph.D., University of Wisconsin, Madison

Stutz, Jean C. (1981)...*Assistant Professor of Agriculture*
    B.S., Ursinus College; M.S., University of Delaware; Ph.D., Pennsylvania State University

Sullivan, Deborah (1967)..*Associate Professor of Sociology*
    B.S., University of Massachusetts, Amherst; M.A., University of California, Irvine; Ph.D., Duke University

Sullivan, Howard J. (1971)..*Professor of Education*
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Sullivan, John J. (1976) ....*Assistant Professor Emeritus of Education*
    B.A., Villanova University; M.A., Ph.D., Arizona State University

Sullivan, William G. (1983) ....*Professor of Engineering*
    B.S., University of Tennessee; M.S., Ph.D., Georgia Institute of Technology

Sundwall, Harry W. (1962)..*Professor Emeritus of Education*
    B.S., Brigham Young University; Ph.D., University of California, Berkeley

Sunkett, Mark E. (1976) ....*Associate Professor of Music*
    B.M., Curtis Institute of Music; M.M., Temple University

Sushka, Marie E. (1984) ....*Professor of Finance*
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Svoboda, William S. (1969)..*Professor of Education*
    B.S. in Ed., M.S., Ed.D., University of Kansas

Swafford, James R. (1971)..*Assistant Professor of Microbiology*
    B.S., M.S., Arizona State University

Swagert, S. Laird (1971)...*Professor Emeritus of Political Science*
    B. in Ed., Western Illinois State Teachers College; M.A., Ph.D., University of Iowa

Swaim, S. Daniel (1975)...*Associate Professor of Music*
    B.M., Cincinnati College Conservatory of Music; M.M.E., Indiana University

Swartz, Teresa A. (1980)..*Assistant Professor of Marketing*
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Swimmer, Alvin (1963)...*Associate Professor of Mathematics*
    B.A., Pennsylvania State University; M.S., New York University; Ph.D., University of California, Berkeley

Sylvester, Edward J. (1982)................................*Assistant Professor of Journalism and Telecommunication*
    A.B., Princeton University; M.A., City College of New York

Szarek, Stanley R. (1974)...*Associate Professor of Botany*
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Tambs, Lewis A. (1969)...*Professor of History*
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Tate, Donald J. (1958)...*Professor Emeritus of General Business*
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Tathwell, Shirley M. (1979)...*Instructor of Nursing*
  B.S., Mount St. Scholastica; M.S., University of Iowa
Taylor, Jack J. (1960)..*Professor of Art*
  B.S. in Art Ed., Kutztown Teachers College; M.Ed., Pennsylvania State University
Taylor, Janet (1977)..*Associate Professor of Art*
  B.F.A., Cleveland Institute of Art; M.F.A., Syracuse University
Taylor, Thomas (1983)..*Assistant Professor of Mathematics*
  B.S., California State University; Ph.D., Harvard University
Taysom, Elvin D. (1953)..*Professor Emeritus of Agriculture*
  B.S., University of Idaho; M.S., Utah State University; Ph.D., Washington State University
Tenney, Lester I. (1969) ....*Professor Emeritus of Insurance*
  B.A., University of Miami; M.A., San Diego State College; D.B.A., University of Southern California
Tesón, Fernando R. (1984) ....*Associate Professor of Law*
  J.D., Universidad de Buenos Aires (Argentina); LL.M., Universite Libre de Bruxelles (Belgium)
Teye, Victor B. (1984)..*Assistant Professor of Leisure Studies*
  B.A., University of Ghana; M.A., Ph.D., University of Manitoba
Theobald, Clarabelle (1962) ....*Associate Professor of Nursing*
  B.S., Arizona State University, M.S., University of California, Los Angeles; Ph.D., Arizona State University
Thomas, Keith J. (1975)..*Associate Professor of Education*
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Thomas, M. George (1981)...*Assistant Professor of Sociology*
  B.A., Arizona State University; M.A., Ph.D., Stanford University
Thomason, Leslie L. (1969)...*Professor Emeritus of Technology*
  A.B., M.A., Ed.D., University of Oklahoma
Thompson, Lee P. (1955) ....*Professor of Engineering*
  B.A., Indiana University; M.S., Ph.D., Texas A & M University; P.E.
Thompson, Truet B. (1959)..*Professor Emeritus of Engineering*
  B.S., B.S.E.E., Louisiana Polytechnic Institute; M.S., Oklahoma State University; Ph.D., Northwestern University
Thomson, Jeffrey (1981)...*Assistant Professor of Theatre*
  B.A., Ripon College; M.A., University of Washington; M.F.A., Wayne State University
Thomson, Ronald G. (1947) ....*Professor Emeritus of Physical Education*
  B.S., Springfield College; M.A., Arizona State University; Ed.D., University of Southern California
Thomson, Tom R. (1961)..*Professor Emeritus of Chemistry*
  B.A., University of California, Berkeley; M.S., Ph.D., Kansas State University
Thorne, Anita (1983)..*Instructor of Nursing*
  Diploma, Allegheny General Hospital; B.S.N.Ed., M.A., University of Pittsburgh
Thuman, Karen Hayes (1984)...*Assistant Professor of Art*
  B.S., University of Cincinnati; M.F.A., Indiana University, Bloomington
Tice, Thomas E. (1967) ....*Professor of Engineering*
  B.S.E.E., M.S.E.E., Ph.D., Ohio State University
Tidwell, Victor H. (1971) ....*Professor of Accounting*
  B.S., Illinois College; M.B.A., D.B.A., Indiana University; C.P.A., Iowa and Arizona
Tilden, Arnold (1937)..*Professor Emeritus of History*
  B.A., M.A., DePauw University; Ph.D., University of Southern California
Tillery, Bill W. (1973) ....*Professor of Science Education/Physics*
  B.S., Northeastern State College; M.A., Ed.D., University of Northern Colorado
Tillman, Hoyt C. (1976)..*Associate Professor of History*
  B.A., Belhaven College; M.A., University of Virginia; A.M., Ph.D., Harvard University
Tippeconnic, John W. III (1976) ....*Associate Professor of Education*
  B.S., Oklahoma State University; M.A., Ph.D., Pennsylvania State University
Tipton, Gary P. (1969)..*Assistant Professor of Chinese*
  B.A., Brigham Young University; Ph.D., Indiana University
Tobiason, Sarah J. (1963; 1974)..*Assistant Professor of Nursing*
  B.S.N., Vanderbilt University; M.A., Columbia University
Toohey, Jack V. (1966) ....*Professor of Health Science*
  B.A., Arizona State University; M.S.E., University of Illinois;
  M.S., Northern Arizona University; Ed.D., Arizona State University

Torok, Steven J. (1981)..*Assistant Professor of Agriculture*
    B.S., California State College, Stanislaus; M.S., University of California, Santa Barbara; Ph.D., Iowa State University

Torrest, Robert S. (1980)..*Associate Professor of Engineering*
    B.S., Polytechnic Institute of Brooklyn; Ph.D., University of Minnesota

Towe, Bruce (1981)..*Associate Professor of Engineering*
    B.S., M.S., Ph.D., Pennsylvania State University

Towill, Leslie R. (1975) ....*Associate Professor of Botany*
    B.S., M.S., University of Wisconsin, Milwaukee; Ph.D., University of Michigan

Trantina, Debra (1984)..*Instructor of Computer Science*
    B.S., M.S., Arizona State University

Trelease, Richard N. (1971)..*Professor of Botany*
    B.S., M.S., University of Nevada; Ph.D., University of Texas

Trennert, Robert A. (1974)..*Professor of History*
    B.A., Occidental College; M.A., Los Angeles State College; Ph.D., University of California, Santa Barbara

Tsen, Kong-Tong (1984)..*Assistant Professor of Physics*
    B.S., Fu-Jen Catholic University; M.S., Ph.D., Purdue University

Tsong, Ignatius S.T. (1981)..*Professor of Physics*
    B.Sc., University of Leeds; M.Sc., Ph.D., University of London, Sir John Cass College

Tu, Eugenia Y. (1973)..*Instructor of Chinese*
    B.Ed., Taiwan Normal University; B.A., Baylor Women's College; M.S., University of Arizona

Tuma, Jan J. (1978) ....*Professor of Engineering*
    B.S., College of Engineering, Prague; M.S. Oklahoma State University; Ph.D., University of Colorado

Turnbow, James W. (1959) ....*Professor Emeritus of Engineering*
    B.S.M.E., Texas Technological College; M.S.E.M., Ph.D., University of Texas

Turner, Christy G. II (1966)..*Professor of Anthropology*
    B.A., M.A., University of Arizona; Ph.D., University of Wisconsin, Madison

Turner, Katharine C. (1946) ....*Professor Emeritus of English*
    B.Ed., Illinois State Normal; M.A., Ph.D., University of Michigan

Tylavsky, Daniel John (1982)..*Assistant Professor of Engineering*
    B.S., M.S.E.E., Ph.D., Pennsylvania State University

Umberger, Emily (1982) ....*Assistant Professor of Art*
    B.A., University of Pennsylvania; M.A., University of Texas; Ph.D., Columbia University

Umberson, George E. (1977)..*Professor of Music; Director, School of Music*
    B.M.E., Eastern New Mexico University; M.A., University of Iowa; Ed.D., University of Northern Colorado

Upchurch, Jonathan E. (1982)..*Assistant Professor of Engineering*
    B.S., M.S. University of Illinois; Ph.D., University of Maryland

Uustal, Diann B. (1981)..*Assistant Professor of Nursing*
    B.S., University of Rhode Island, Kingston; M.S., Ed.D., University of Massachusetts, Amherst

Valdivieso, L. Teresa (1971) ....*Associate Professor of Spanish*
    B.A., M.A. in Ed., M.A., Ph.D., Arizona State University

Valentine, Carol Ann (1975)..*Assistant Professor of Communication*
    B.A., M.A., University of Michigan; Ph.D., Pennsylvania State University

Valentine, Kristin B. (1976) ....*Professor of Communication*
    B.S., University of Wisconsin; M.A., University of Washington; Ph.D., University of Utah

Vallejo, Carlos J. (1976)..*Assistant Professor of Education*
    B.S., Chadron State Teachers College; M.A., Ed.D., University of Nebraska, Lincoln

Van Den Beldt, Jack R., Captain (1984)..*Assistant Professor of Military Science*
    B.S., M.B.A., Arizona State University

Van Hook, Barry L. (1976) ....*Associate Professor of General Business*
    B.S., Illinois State University; M.S. in Ed., Ed.D., Northern Illinois University

Van Wagenen, R. Keith (1963) ....*Professor of Education*
    B.A., Pacific Union College; M.A. in Ed., Arizona State University; Ph.D., University of Utah

Van Wyk, Cornelius G. Jr. (1984)..*Assistant Professor of Architecture*
    B.A., Calvin College; B.S., M.Arch., University of Michigan

Varhue, Walter (1984)..*Assistant Professor of Engineering*
    B.S., University of Connecticut; M.S., Ph.D., University of Virginia
Vasquez, Mary (1975)...*Associate Professor of Spanish*
    B.A., Florida State University; M.A., Ph.D., University of Washington
Vaughan, Linda A. (1982) ....*Assistant Professor of Home Economics*
    B.S., University of California, Davis; M.N.S., Cornell University; Ph.D., University of Arizona
Veatch, Jeannette (1968)..*Professor Emeritus of Education*
    A.B., Western Michigan University; M.A., Ph.D., New York University
Vellenga, David B. (1984)...*Professor of Transportation*
    A.B., Calvin College; M.B.A., University of Illinois, Urbana; Ph.D., Pennsylvania State University
Verdini, William A. (1976) ....*Associate Professor of Management Science*
    B.S., Case Western Reserve University; M.B.A., D.B.A., Kent State University
Vergis, John P. (1954)...*Professor Emeritus of Education*
    B.S., M.A., New York University; Ed.D., University of Southern California
Vestre, Norris P. (1972)...*Professor of Psychology*
    B.A., Ph.D., University of Minnesota
Villegas, Daniel J. (1983) ....*Assistant Professor of Economics*
    B.A., University of Southern California; M.S., Ph.D., Stanford University
Vining, David C. (1975) ....*Associate Professor of Theatre*
    B.A., University of Redlands; M.F.A., University of Minnesota
Virden, Randy J. (1984)..*Instructor in Leisure Studies*
    B.S., M.S., Arizona State University
Virgillo, Carmelo (1965)..*Professor of Romance Languages*
    A.B., State University of New York, Albany; A.M., Ph.D., Indiana University
Volek, Emil (1975)..*Associate Professor of Spanish*
    Prom. Phil., Ph.D., Charles University, Prague (Czechoslovakia)
Von der Heydt, Alfred (1950)..*Professor Emeritus of German*
    Diploma, University of Frankfurt-on-the-Main (Germany); M.A., Yale University; Ph.D., Cornell University
Von Dreele, Robert B. (1971)...*Professor of Chemistry*
    B.S., Ph.D., Cornell University
Voss, Howard G. (1964) ....*Professor of Physics*
    A.B., Hope College; M.N.S., Arizona State University; M.S., Purdue University
Votichenko, T. Alexander (1956)...*Assistant Professor Emeritus of Philosophy*
    A.B., Princeton University; M.A., Columbia University

Wagner, J. Bruce (1977) ....*Professor, Center for Solid State*
    B.S., Ph.D., University of Virginia   *Science/Physics/Chemistry/Engineering*
Wagner, Ronald F. (1962) ....*Professor of Art*
    B.S., University of Wisconsin; M.F.A., University of Iowa
Waite, Richard W., Col. (1984) ....*Professor of Aerospace Studies*
    B.A., Chapman College; M.S., Central Missouri State College
Walker, Bruce J. (1974) ....*Professor of Marketing; Chair, Department of Marketing*
    B.A., Seattle University; M.B.A., D.B.A., University of Colorado
Walker, Charles Thomas (1971).................................*Professor of Physics; Chair, Department of Physics*
    A.B., M.S., University of Louisville; Ph.D., Brown University
Walker, John E. (1970) ....*Associate Professor of Education*
    B.A., Albion College; M.A., Michigan State University; Ed.D., Utah State University
Walker, Stephen G. (1969) ....*Associate Professor of Political Science*
    A.B., Creighton University; M.A., Ph.D., University of Florida
Walker, Vicki S. (1982)...*Instructor of Computer Science*
    B.A.E., M.S., Arizona State University
Wallace, Charles E. (1958)..*Professor of Engineering*
    B.S., Lewis and Clark College; M.S., Oregon State University; Ph.D., Stanford University
Wallen, Carl J. (1973) ....*Professor of Education*
    B.A., University of California, Santa Barbara; M.A., San Francisco State College; Ed.D., Stanford University
Walsberg, Glenn E. (1978) ....*Associate Professor of Zoology*
    B.S., California State University, Long Beach; Ph.D., University of California, Los Angeles

Wamacks, Naomi W. (1968) ....*Associate Professor of Education; Assistant Dean,*
    B.A., M.A., Ed.D., Arizona State University   *College of Education*

Wang, Alan P. (1970) ....*Professor of Mathematics*
    B.S., Washington State University; M.S., University of Southern California;
    Ph.D., University of California, Los Angeles

Wang, Cecelia (1971)..*Professor of Mathematics*
    B.S., Immaculate Heart College; M.A., Ph.D., University of California, Los Angeles

Wang, Edward Y. (1979) ....*Professor of Engineering*
    B.S., Morningside College; M.S., Purdue University; Ph.D., Tufts University

Ward, Jack W. (1964)..*Associate Professor of Construction*
    B.S.C.E., University of Idaho

Warnicke, Retha M. (1973)..*Professor of History*
    A.B., Indiana University; M.A., Ph.D., Harvard University

Warren, Morrison F. (1968)......................................*Professor Emeritus of Education; Director, I. D. Payne*
    B.A., M.A., Ed.D., Arizona State University   *Institute for Social and Cultural Relations*

Wasser, Paula K. (1927) ....*Professor Emeritus of Art*
    B.S. in Ed., University of North Dakota; M.A., Stanford University

Watkins, Thomas B. (1972) ....*Associate Professor Emeritus of Technology*
    B.S., University of Wyoming; M.S., Arizona State University

Watson, Clyde W. (1971) ....*Associate Professor of Art*
    B.F.A., Bethany College; M.A., Kansas State University

Watson, George L. (1969) ....*Associate Professor of Political Science*
    B.A., Phillips University; M.A., Ph.D., Duke University

Webb, L. Dean (1978)..................*Professor of Education; Acting Chair, Department of Special Education*
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Weems, Charles W. (1976)..*Professor of Agriculture*
    B.S., M.S., East Tennessee State University; Ph.D., West Virginia University

Wegner, Artnoll L. (1957)..*Professor Emeritus of Physical Education*
    B.S., Wisconsin State College; M.S., University of Wisconsin; P.E.D., Indiana University

Weigend, Guido G. (1976)..*Professor of Geography*
    B.S., M.S., Ph.D., University of Chicago

Weiner, Gordon M. (1968)..*Assistant Professor of History*
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Weiss, Neil A. (1970)..*Professor of Mathematics*
    B.A., M.A., Ph.D., University of California, Los Angeles

Weitz, Rose (1978)..*Associate Professor of Sociology*
    B.A., Lehman College, City University of New York; M.A., Ph.D., Yale University

Welch, H. William (1967)..*Professor of Engineering*
    B.A., DePauw University; M.S., Ph.D., University of Michigan; P.E.

Wells, Barrie E. (1981)..*Associate Professor of Music*
    B.M., M.M., University of the Pacific; D.M.A., University of Oregon

Wells, Christine L. (1976)..*Professor of Physical Education*
    B.S., University of Michigan; M.S., Smith College; Ph.D., Pennsylvania State University

Welsh, William (1965)..*Professor of Political Science*
    B.A., M.A., & Ph.D., Northwestern University

Wentz, Richard E. (1972)..*Professor of Religious Studies*
    A.B., Ursinus College; B.D., Lancaster Theological Seminary; M.Phil., Ph.D., George Washington University

Werther, William Jr. (1971)..*Professor of Management*
    B.S.B.A., M.A., Ph.D., University of Florida

Weschler, Louis F. (1980)..*Professor of Public Affairs*
    B.A., California State University; M.A., Ph.D., University of California, Los Angeles

West, Stephen G. (1981)..*Associate Professor of Psychology*
    B.A., Cornell University; M.A., Ph.D., University of Texas

Whiffen, Marcus (1960) ....*Professor Emeritus of Architecture*
    B.A., M.A., University of Cambridge

Whitam, Frederick L. (1966)..*Associate Professor of Sociology*
    B.A., Millsaps College; A.M., Ph.D., Indiana University

White, Harold C. (1966) ....*Professor of Management*
    B.S., M.S., University of Oregon; Ph.D., University of Florida

White James R. (1981) ....*Associate Professor of Art*
  B.F.A., M.F.A.; Ohio Univesity
White, John P. (1963) ....*Professor of Political Science*
  A.B., University of Cincinnati; A.M., Ph.D., University of Chicago
White, Kenneth L. (1984)..*Associate Professor of Art*
  B.F.A., Kansas City Art Institute; M.F.A., Yale University
White, Michael J. (1974) ....*Associate Professor of Philosophy*
  B.A., Arizona State University; M.A., Ph.D., University of California, San Diego
Whitehurst, Harry B. (1958)..*Professor of Chemistry*
  B.A., M.A., Ph.D., Rice University
Whysong, Gary L. (1974)..*Associate Professor of Agriculture*
  B.S., M.S., Montana State University; Ph.D., University of Wyoming
Wigand, Rolf T. (1975)..*Professor of Public Affairs*
  B.B.A., M.A., Texas Tech University; Ph.D., Michigan State University
Wilcox, Sidney W. (1955)................................*Professor Emeritus of Engineering Communications*
  B.A., Bethany-Peniel College; M.A., University of Oklahoma
Wilkinson, Joseph W. (1964)..*Professor of Accounting*
  B.S., Carnegie Institute of Technology; M.B.A., Stanford University; D.B.A., University of Oregon; C.P.A.,
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Williams, Frank G. (1975)................................*Associate Professor of Health Services Administration*
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Williams, Peter (1981) ....*Professor of Chemistry*
  B.S., Ph.D., University of London, King's College
Williams, Robert C. (1978) ....*Associate Professor of Anthropology*
  B.A., M.A., University of Cambridge; B.A., M.A., Ph.D., University of Michigan
Williams, Scott H. (1974)..*Associate Professor of Technology*
  B.S., M.T., Georgia Southern College
Williamson, Madeline J. (1976)..*Associate Professor of Music*
  B.Mus., Ohio Wesleyan University; M.M., Western Michigan University
Willson, Loretta L. (1947) ....*Assistant Professor Emeritus of Communication*
  B.A., University of South Dakota; M.A., Northwestern University
Wilson, Cindy C. (1984)..*Assistant Professor of Health Science*
  B.S., M.S., Ph.D., University of Tennessee, Knoxville
Wilson, Gail Eugene (1972)..*Associate Professor of Music*
  B.S., Ohio State University; M.M., Arizona State University
Wilson, Gloria N. (1961)..*Associate Professor of General Business*
  B.A., Montclair State College; M.A., Ed.D., Columbia University
Wilson, Gregory P. (1979) ....*Assistant Professor of Construction*
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Wilson, L. A. II (1979) ....*Associate Professor of Public Affairs; Acting Director,*
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Wilson, Lee Ann (1980)..*Assistant Professor of Art*
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Wilson, Lorna A. (1968) ....*Instructor of French*
  B.Ed., University of Saskatchewan; M.A., Arizona State University
Wilson, Lynn D. (1961)..*Professor Emeritus of Engineering*
  B.S., M.S., Ph.D., Marquette University
Wilt, Glenn A. Jr. (1963)..*Associate Professor of Finance*
  A.B., Occidental College; M.B.A., Miami University; Ph.D., University of Michigan; C.F.A.
Winer, Laurence H. (1983)..*Associate Professor of Law*
  B.A., Ph.D., Boston University; J.D., Yale University
Winkleman, Richard D. (1965)..*Associate Professor of Economics*
  A.B., Southern Illinois University; A.M., Ph.D., University of Illinois
Wirtz, Dorothy (1959)..*Professor Emeritus of French*
  B.A., University of Iowa; M.A., Ph.D., University of Denver
Wiseman, Douglas E. (1976)..*Associate Professor of Education*
  B.S., M.A., Eastern Michigan University; Ph.D., University of Illinois
Witt, Daniel (1966) ....*Professor of Theatre*
  B.F.A., Art Institute of Chicago; M.A., Ph.D., University of Denver

Witt, Tom (1975) ....*Associate Professor of Design Sciences; Chair, Department of*
  B.A., M.A., M.F.A., University of California, Los Angeles   *Design Sciences*
Wixted, J. Timothy (1978)...*Associate Professor of Asian Languages*
  B.A., University of Toronto; A.M., Stanford University; D.Phil; Oxford University
Wochner, Raymond E. (1952)..*Professor Emeritus of Education*
  B.S., York College; M.A., University of Nebraska, Lincoln; Ph.D., University of Wyoming
Wolchik, Sharlene (1980)...*Assistant Professor of Psychology*
  B.A., Vasser College; M.S., Ph.D., Rutgers, The State University
Wolf, Donald J. (1969) ....*Associate Professor of Political Science*
  B.A., M.A., Gonzaga University; S.T.M., University of Santa Clara; Ph.D., Georgetown University
Wollam, Owen A. (1964) ....*Associate Professor of French*
  B.A., M.A., Montana State University; Ph.D., University of Washington
Wong, Paul (1979)...*Professor of Social Work*
  B.A., M.A., Ph.D., University of California, Berkeley
Wong, Timothy C. (1974) ....*Associate Professor of Chinese*
  B.A., Saint Mary's College of California; M.A., University of Hawaii; Ph.D., Stanford University
Wood, Billy G. (1977)..*Associate Professor of Technology*
  A.B., University of California; B.S. in Ed., Eastern Illinois University; M.S., University of Arizona
Wood, Byard D. (1970)..*Professor of Engineering*
  B.S.M.E., M.S.M.E., Utah State University; Ph.D., University of Minnesota
Wood, Harry (1954)..*Professor Emeritus of Art*
  B.A., M.A., University of Wisconsin, Madison; B.A., Ph.D., Ohio State University
Wood, Jean M. (1980) ....*Professor of Nursing*
  B.S., Loyola University; M.P.H., University of Michigan; Ph.D., University of North Carolina
Wood, Steven D. (1975).........................*Professor of Decision and Information Systems; Associate Dean,*
  B.S., M.A., California State University, San Diego;   *College of Business*
  Ph.D., University of Wisconsin, Madison
Woodfield, Scott N. (1981) ....*Assistant Professor of Computer Science*
  B.S., M.S., Brigham Young University; Ph.D., Purdue University
Woodfield, Terry J. (1982) ....*Assistant Professor of Mathematics*
  B.S., M.A., Lammar University; Ph.D., Texas A & M University
Woodfill, Marvin C. (1966) ....*Professor of Computer Science*
  B.S., M.S., Ph.D., Iowa State University
Wooding, Robert R. (1971).......................................*Associate Professor Emeritus of Construction*
  B.S., U.S. Naval Academy; B.C.E., M.C.E., Rensselaer Polytechnic Institute
Woodman, Natalie J. (1969)..*Associate Professor of Social Work*
  B.A., Washington Square College of New York University; M.S.S., Smith College School of Social Work
Woods, Roosevelt Jr. (1965) ....*Professor of Art*
  B.S., M.A. in Ed., Arizona State University
Wooldridge, Charles B. (1959).....................................*Associate Professor Emeritus of Engineering*
  A.B., B.S., University of Kentucky; M.S., Ph.D., Purdue University
Wooldridge, Mary C. (1959)...*Assistant Professor Emeritus of Home Economics*
  B.S., M.S., University of Kentucky; Ph.D., Purdue University
Woolf, Charles M. (1961-63; 1964)......................................*Professor of Zoology; Dean, Graduate College*
  B.S., M.S., University of Utah; Ph.D., University of California, Berkeley
Woolverton, Michael W. (1981)...*Associate Professor of Agriculture*
  B.S., M.B.A., Kansas State University; Ph.D., University of Missouri, Columbia
Wootten, William W. (1959) ....*Associate Professor of History*
  B.A., University of Chicago; M.A., University of Iowa; Ph.D., University of Minnesota
Wootton, Richard T. (1964)......................................*Professor of Education; Coordinator, Special Projects*
  B.S., M.S., Ed.D., University of Utah
Wrenn, C. Gilbert (1965)..*Professor Emeritus of Counselor Education*
  A.B., Willamette University; M.A., Ph.D., Stanford University; LL.D., Willamette University
Wright, M. Lin (1973)...*Professor of Theatre; Chair, Department of Theatre*
  B.A., M.A., Ph.D., University of Minnesota
Wu, HoFu (1984)...*Assistant Professor of Architecture*
  B.Arch., Tankang University, Taiwan; M.Arch., University of Illinois
Wulk, Ned W. (1957) ....*Assistant Professor of Physical Education*
  B.S., Wisconsin State University; M.Ed., Xavier University

Wunsch, Alan P. (1973) ....*Associate Professor of General Business*
    B.Ed., M.S.T., University of Wisconsin, Whitewater; Ed.D., University of California, Los Angeles
Wurster, Stanley R. (1971) ....*Associate Professor of Education*
    B.S., Lock Haven State College; M.S., Elmira College; Ed.D., New Mexico State University
Wurzell, Carol A. (1965)..*Assistant Professor of Nursing*
    B.S., Chico State College; M.S., University of Maryland
Wyckoff, Susan (1979)..*Professor of Astronomy/Physics*
    B.A., Mount Holyoke College; Ph.D., Case Western Reserve
Wyndelts, Robert (1974) ....*Associate Professor of Accounting*
    B.B.A., M.P.A., Georgia State University; Ph.D., University of Georgia; C.P.A., Georgia, Arizona
Wytko, Joseph R. (1975) ....*Associate Professor of Music*
    B.M.E., West Virginia University; M.M., Northwestern University

Yale, Francis G. (1952).....................................*Associate Professor Emeritus of Science Education/Physics*
    A.B., M.A., University of Northern Colorado; Ed.D., Columbia University
Yamamoto, Kaoru (1972)..*Professor of Counselor Education*
    B.S., University of Tokyo; M.A., Ph.D., University of Minnesota
Yao, Lun-Shin (1981) ....*Professor of Engineering*
    B.S.E., Cheng Kung University; M.S., University of Texas; Ph.D., University of California, Berkeley
Yeater, James W. (1958) ....*Professor of Theatre*
    B.A., Baker University; M.A., University of Washington; Ph.D., University of Illinois
Yellott, John I. (1973)..*Professor Emeritus of Planning*
    B.S., M.M.E., Johns Hopkins University
Young, Dennis L. (1975)..*Professor of Mathematics*
    B.S., St. Louis University; M.S., Ph.D., Purdue University
Young, Hewitt H. (1967)..*Professor of Engineering*
    B.S.M.E., M.S.I.E., Case Institute of Technology; Ph.D., Arizona State University
Young, Joseph E. (1979)..*Associate Professor of Art*
    B.A., California State College; M.A., University of California, Los Angeles
Young, Otis E. Jr. (1963)..*Professor of History*
    A.B., A.M., Ph.D., Indiana University
Young, Paul H. (1981) ....*Assistant Professor of Technology*
    B.S.E.E., M.S.E.E., San Jose State University
Youngblood, Robert L. (1972)..*Associate Professor of Political Science*
    B.A., Willamette University; M.A., University of Hawaii; Ph.D., University of Michigan
Yuen, George U. (1957)..*Professor of Chemistry*
    B.S., Arizona State University; Ph.D., University of Utah

Zacher, Robert V. (1947) ....*Professor Emeritus of Advertising*
    B.S. in B.A., M.S.B.A., University of Alabama
Zaslow, Bertram (1956) ....*Professor of Chemistry*
    B.A., Cornell University; M.S., University of Minnesota; Ph.D., Iowa State University
Zatz, Marjorie S. (1982)..*Assistant Professor of Justice Studies*
    B.A., University of Massachusetts; M.A., Ph.D., Indiana University
Zautra, Alex (1976)..*Associate Professor of Psychology*
    B.A., Antioch College; M.S., Ph.D., University of Utah
Zimmer, Carl R. (1959)..*Associate Professor of Engineering*
    B.S.E.E., Cornell University; M.S.E.E., Ph.D., Syracuse University
Zonn, Leo E. (1975) ....*Associate Professor of Geography*
    B.A., M.A., California State University, Northridge; Ph.D., University of Wisconsin, Milwaukee
Zornow, Ruth A. (1970) ....*Professor of Nursing*
    B.S., Case Western Reserve University; M.Ed., Ed.D., Columbia University
Zsohar, Helen (1982)..*Assistant Professor of Nursing*
    B.S.N., M.S.N., University of Texas; Ph.D., Arizona State University
Zucker, Stanley H. (1975) ....*Professor of Education*
    B.A., State University of New York, Stony Brook; M.S., Hofstra University; Ph.D., University of Missouri, Columbia

Zwiebel, Imre (1979) .... *Professor of Engineering; Chair, Department of Chemical and Bio Engineering*
    B.S., University of Michigan; M.S., Ph.D., Yale University
Zygas, K. Paul (1984) .... *Assistant Professor of Architecture*
    A.B., M.Arch., Harvard University; Ph.D., Cornell University

Associated Faculty

INTERCOLLEGIATE ATHLETICS

Tamburo, Richard P. (1980) .... *Director of Intercollegiate Athletics*
    B.A., Michigan State University
Plummer, Ramona F. (1957) .... *Associate Professor; Associate Athletic Director*
    B.S., M.A., University of Alabama
Littlewood, Mary L. (1965).. *Assistant Professor; Softball Coach*
    B.S., Miami University; M.S., University of Colorado
Brock, James L. (1971)... *Instructor; Head Baseball Coach*
    B.A., M.A., Ed.D., Arizona State University
Robinson, Don R. (1968) .... *Instructor; Gymnastics Coach*
    B.A., University of Northern Colorado; M.S., Eastern New Mexico University
Robison, Ray C. (1967)... *Instructor; Assistant Trainer*
    B.S., Morningside College; M.S., Indiana University
Young, Troy L. (1971) .... *Instructor; Head Trainer*
    B.S., Fort Hays State College; M.S., Indiana University
Douglas, Bobby E. (1974).. *Lecturer; Wrestling Coach*
    B.S., Oklahoma State University; M.A., Arizona State University
Kerr, Roger D. (1977) .... *Lecturer; Women's Track Coach*
    B.S., University of Iowa; M.A., University of Iowa; Ph.D., Purdue University

VISITING PROFESSORS

Bishop, Jan G. (1984) .... *Visiting Instructor of Physical Education*
    B.S., Ursinus College; M.S., Indiana University
Bomstad, Roland G., Jr. (1979) .... *Visiting Assistant Professor of Religious Studies*
    B.S., B.A., University of Florida; M.A., M.Phil., Ph.D., Yale University
Brentrup, Dale A. (1981).. *Visiting Assistant Professor of Architecture*
    B.Arch., Arizona State University; M.A., University of California, Los Angeles
Brown, M. Gordon (1984) .... *Visiting Assistant Professor of Architecture*
    B.S., University of Illinois; M.B.A., University of Pennsylvania; M.Sc. Arch., University of London
Cachey, Theodore (1984)... *Visiting Assistant Professor of Italian*
    B.A., Northwestern University; M.A., University of California, Los Angeles
Downing, Frances E. (1984).. *Visiting Assistant Professor of Architecture*
    B. Arch., M. Arch., University of Oregon
Fink, Jonathan H. (1982) .... *Visiting Assistant Professor of Geology*
    B.A., Colby College; Ph.D., Stanford University
Gerbert, Elaine (1981) .... *Visiting Lecturer in Japanese*
    B.A., University of California, Berkeley; M.A., University of Chicago
Guenthner, Franz (1984) .... *Visiting Professor of Computer Science*
    Halbilitation, University of Stuttgart; M.A., University of Grenoble; Ph.D., University of Paris
Hiatt, Timothy (1984) .... *Visiting Lecturer in Japanese*
    B.A., Oberlin College; M.A., Ohio State University
Islam, Obaidul (1980)... *Visiting Professor in Engineering*
    B.Sc. (M.E.), University of Dacca; M.S., Texas A&M University; Ph.D., Arizona State University
Leek, Marjorie R. (1982)................................... *Visiting Assistant Professor of Speech and Hearing Science*
    B.A., M.A., Ph.D., University of Kansas
Lenna, Harry (1983) .... *Visiting Assistant Professor of Social Work*
    B.A., Niagara University; M.S., State University of New York at Buffalo
Lessner, Richard (1983).. *Visiting Assistant Professor of Religious Studies*
    B.A., Pacific Christian; M.Div., Southern Baptist Theological Seminar; Ph.D., Baylor University

Licht, Seymour (1981)..*Visiting Assistant Professor of Technology*
   B.A., Syracuse University; B.E.E., New York University; M.S., Nova University
Mittelman, Hans Detlef (1982)..*Visiting Professor of Mathematics*
   Ph.D., Technical University, Darmstadt
Mogey, John M. (1980)...*Visiting Professor of Sociology*
   B.A., M.A., D.Sc., Queen's University, Belfast, Northern Ireland
Nelson, Edwin S. (1983)...*Visiting Assistant Professor of Religious Studies*
   B.A., Platte Valley Bible College; M.A., Gordon-Conwell Theological Seminary; Ph.D., Boston University
Norman, Gerald J. Norman (1983)...*Visiting Associate Professor of Technology*
   B.A., Eastern Washington State College; M.S., Oregon State University
Predock, Antoine (1980)..*Visiting Assistant Professor of Architecture*
   M. Arch., Columbia University
Rogers, Benjamin T. (1984)...*Visiting Professor of Architecture*
   B.S.E., University of Wisconsin
Russo, James R. (1980)...*Visiting Assistant Professor of English*
   B.A., M.A., M.F.A., Ph.D., University of Arizona
Saddler, Ivan R. (1984)..*Visiting Assistant Professor of Technology*
   B.S.E.E., University of Texas, El Paso
Unks, Ray (1983)...*Visiting Assistant Professor of Social Work*
   B.A., University of Detroit; M.S.W., Wayne State University; Ph.D., University of Washington
Wehinger, Peter A. (1981)..*Visiting Professor of Physics*
   B.S., Union College, Schenectady; M.S., Indiana University, Bloomington; Ph.D., Case Institute of Technology

LECTURERS

Alexander, James (1984)..*Lecturer in Public Affairs*
   B.A., University of Missouri; M.B.A., Arizona State University
Counts, Richard (1985)...*Lecturer in Public Affairs*
   A.B., Williams College; J.D., University of Chicago
DesJardin, Margaret E. (1949)...*Lecturer Emeritus in Dance*
Dominguez, Majel (1977)..*Lecturer in Sociology*
   B.A., M.A., University of Wyoming, Ph.D., Arizona State University
Driggs, Ken (1984)..*Lecturer in Public Affairs*
   B.A., M.S., Brigham Young University
Dykhuizen, Ronald C. (1981)..*Lecturer in Engineering*
   B.S., University of Virginia; M.S., University of Illinois
Ehret, Patricia M. (1980)...*Lecturer in Speech and Hearing Science*
   B.A., Elmira College; M.S., Gallaudet College
Ferrall, J. Eleanor (1969)..*Lecturer in Public Affairs*
   A.B., Heidelberg College; M.A., Arizona State University
Gibbs, Christine (1980)...*Lecturer in Public Affairs*
   B.A., University of Arizona; M.P.A., Arizona State University
Hardesty, Esther (1984)...*Lecturer in Sociology*
   B.A., M.A., Arizona State University
Heiser, Mary Lee (1981)...*Lecturer in Sociology*
   B.S., Tennessee Technological University; M.A., Marshall University
Horwitch, Arnold M. (1974)..*Lecturer in Humanities*
   Ph.B., University of Chicago; M.A., Arizona State University; M.S., Lowell Technological Institute
Hoyt-Croft, Lesley (1983)..*Lecturer in Sociology*
   B.S., M.A., Ph.D., Arizona State University
Ikegami, Kazukuni (1981)...*Lecturer in Architecture*
   B.S.E., Osaka Institute of Technology; M. Arch., University of Texas, Austin
Ingraham, Leonard W. (1973)...*Lecturer Emeritus in Education*
   B.S., City College of City University; M.A., Ed.D., Teachers College, Columbia University
Jamieson, Bill Jr. (1980)...*Lecturer in Public Affairs*
   B.A., University of Arizona; M.S., Georgia State University
Jarman, Beth S. (1985)...*Lecturer in Public Affairs*
   B.S., M.S., Ph.D., University of Utah

Kay, Wendell P. (1975) ....*Lecturer in Law*
    B.A., DePauw University; J.D., Northwestern University
Landrith, David (1984) ....*Lecturer in Public Affairs*
    B.A., Arizona State University; M.P.A., Harvard University
Landry, Lawrence David (1980)..*Lecturer in Public Affairs*
    B.A., University of Notre Dame; M.A., University of Wisconsin
Lea, John H. (1980) ....*Lecturer in Management*
    B.S., M.B.A., Arizona State University
Maltbie, John (1984)...*Lecturer in Public Affairs*
    B.A., M.A., San Jose State University
Manion, Patrick W. (1980)..*Lecturer in Public Affairs*
    B.A., M.P.A., Arizona State University
Martinelli, Phylis C. (1984) ....*Lecturer in Sociology*
    B.A., San Jose State University; M.A., San Francisco State University; Ph.D., Arizona State University
McMullen, Gail (1984) ....*Lecturer in Sociology*
    B.S., M.A., Arizona State University; Ph.D., Brown University
Milstein, Stanley R. (1974) ....*Lecturer in Zoology*
    B.A., City College New York; M.A., M.D., University of Iowa
Olson, Clark D. (1984)..*Lecturer in Communication*
    B.A., Iowa State University; M.S., University of Utah
Smith, Scott L. (1981)...*Lecturer in Economics*
    B.S., George Mason University
Twist, Steve (1980) ....*Lecturer in Public Affairs*
    B.A., J.D., Arizona State University
Williams, Dudley A. (1982)..*Lecturer in Communication*
    B.A., University of Maryland; M.A., University of Hawaii; Ph.D., Ohio University

ADJUNCT FACULTY

Ayres, James E. (1982)..*Adjunct Instructor of Anthropology*
    B.A., Fresno State University; M.A., University of Arizona
Breunig, Robert G. ....*Adjunct Assistant Professor of Anthropology*
    B.A., Indiana University, Bloomington; Ph.D., University of Kansas, Lawrence
Canby, William C., Jr. (1967)..*Adjunct Professor of Law*
    A.B., Yale University; LL.B., University of Minnesota
Cheung, Susanna (1979)...*Adjunct Lecturer of Home Economics*
    B.S., University of Washington; M.A., Arizona State University
Coke, F. Van Deren (1983)..*Adjunct Professor of Art*
    B.A., University of Kentucky; M.F.A., Indiana University
Costilow, Ralph N. (1982).....................................*Adjunct Professor of Botany and Microbiology*
    B.A., West Virginia University; M.S., North Carolina State College; Ph.D., Michigan State College
Cox, Jerry R. ....*Adjunct Associate Professor of Agriculture*
    B.S., M.S., New Mexico State University; Ph.D., University of Wyoming
Dahlberg, Albert A. ....*Adjunct Professor of Anthropology*
    B.S., Loyola University, Chicago; D.D.S., Loyola University, Chicago
Daspit, C. Phillip (1981) ....*Adjunct Associate Professor of Speech and Hearing Science*
    B.S., M.D., Louisiana State University
Dearen, Dan (1975) ....*Adjunct Professor of Health Services Administration*
    B.S., Texas Tech University; M.A., Ed.D., Arizona State University
DeBano, Leonard F. ....*Adjunct Associate Professor of Agriculture*
    B.S., Colorado State University; M.S., Utah State University; Ph.D., University of California, Berkeley
Dockstader, Frederick J. (1983) ....*Adjunct Professor of Art*
    A.B., M.A., Northern Arizona University; Ph.D., Western Reserve University
Dover, C. J. (1982) ....*Adjunct Professor of Communication*
    B.A., Kent State University; M.A., Western Reserve University
Dragos, Stephen G. (1984)..*Adjunct Professor of Architecture*
    B. Arch., University of Notre Dame

Euler, Robert C. ....*Adjunct Professor of Anthropology*
    B.A., M.A., Northern Arizona University; Ph.D., University of New Mexico
Ford, George H. ....*Adjunct Assistant Professor of Anthropology*
    A.B., Kansas University, Lawrence; M.A., Ph.D., Arizona State University
Foster, Joyce (1972) ....*Adjunct Professor of Zoology*
    B.A., M.A., DePauw University; Ph.D., Arizona State University
Glick, Paul C. ....*Adjunct Professor of Sociology*
    B.A., Depauw University; M.A., Ph.D., University of Wisconsin, Madison
Greenberg, James F. (1981) ....*Adjunct Assistant Professor of Anthropology*
    B.A., M.A., Ph.D., University of Michigan
Hecht, Frederick (1978)...*Adjunct Professor of Zoology*
    B.A., Dartmouth College; M.D., University of Rochester
Hendrix, Donald Louis (1981) ....*Adjunct Associate Professor of Botany and Microbiology*
    B.A., Central Washington University; M.S., University of Washington; Ph.D., Washington State University
Horton, Paul B. (1983) ....*Adjunct Professor of Sociology*
    B.A., Kent State University; Ph.D., Ohio State University
Idso, Sherwood B. (1984)...................................*Adjunct Professor of Botany and Microbiology*
    B.S., M.S., Ph.D., University of Minnesota
Johnson, Randall A. ....*Adjunct Associate Professor of Agriculture*
    B.S., California State Polytechnic University, Pomona; M.S., Ph.D., University of Missouri, Columbia
Karasek, Francis W. (1977) ....*Adjunct Professor of Chemistry*
    B.S., Elmhurst College; Ph.D., Oregon State University
Kenney, Kathryn W. (1979)..................................*Adjunct Lecturer in Speech and Hearing Science;*
    B.S., M.S., Arizona State University   *Clinical Supervisor, Speech and Hearing Clinic*
Kisslinger, Leonard S. (1982) ....*Adjunct Professor of Physics*
    B.S., St. Louis University; M.S., Ph.D., Indiana University
Knipe, Duane D. (1972)..*Adjunct Associate Professor of Agriculture*
    B.S., M.S., New Mexico State University; Ph.D., University of Arizona
Koff, Theodore H. (1982) ....*Adjunct Assistant Professor of Social Work*
    M.S., Columbia University; Ed.D., University of Arizona
LaSota, John A. Jr. (1972)...*Adjunct Professor of Law*
    LL.B., University of Arizona
Lee, Sheryl (1979)...*Adjunct Lecturer of Home Economics*
    B.S., M.P.H., University of California at Berkeley
Maresca, Robert L. (1977) ....*Adjunct Associate Professor of Speech and Hearing Science*
    B.S., Yale University; M.D., Albany Medical
McCaw, Barbara K. (1978)...*Adjunct Professor of Zoology*
    B.A., M.A., Stanford University; Ph.D., University of Oregon
Mogey, John M. (1980) ....*Adjunct Professor of Sociology*
    B.A., M.A., D.Sc., Queen's University, Belfast, Northern Ireland
Mudgett, Carol A. ....*Adjunct Assistant Professor of Anthropology*
    B.A., University of Nebraska, Lincoln; M.A., Ph.D., University of Nebraska, Lincoln
Obitz, Fred (1975) ....*Adjunct Assistant Professor of Psychology*
    B.A., University of Colorado; M.A., Ph.D., University of Utah
Patton, David R. (1964) ....*Adjunct Associate Professor of Agriculture*
    B.S., West Virginia University; M.S., Virginia Polytechnic Institute; Ph.D., University of Arizona
Plog, Frederick T. (1975) ....*Adjunct Professor of Anthropology*
    B.A., Northwestern University; M.A., Ph.D., University of Chicago
Prather, William F. (1980)................................*Adjunct Professor of Speech and Hearing Science*
    B.A., University of California; M.A., Ph.D., University of Iowa
Radin, John W. (1982)..*Adjunct Professor of Botany and Microbiology*
    B.S., Ph.D., University of California
Rice, Grace Elizabeth (1978) ....*Adjunct Assistant Professor of Anthropology*
    B.A., Reed College; Ph.D., University of California
Rowe, David N. (1979)..*Adjunct Professor of Political Science*
    A.B., Princeton University; M.A., University of Southern California; Ph.D., University of Chicago
Salvatore, Anthony P. (1977)...........................*Adjunct Associate Professor of Speech and Hearing Science*
    B.S., M.S., Emerson College; Ph.D., University of Pittsburgh

Sample, Tish (1978)..*Adjunct Assistant Professor of Anthropology*
    A.B., Whitman College; M.A., University of California; Ph.D., University of Wisconsin
Severson, Kieth E. ....*Adjunct Associate Professor of Agriculture*
    B.A., University of Minnesota; M.S., Ph.D., University of Wyoming
Shoemaker, Alice (1979) ....*Adjunct Lecturer of Home Economics*
    B.A., Goshen College; M.S., Purdue University
Smith, Linda Wheeler ....*Adjunct Assistant Professor of Anthropology*
    A.B., Oberlin College, Ohio; M.A., Ph.D., Arizona State University, Tempe
Snyder, Richard C. (1979) ....*Adjunct Professor of Political Science*
    A.B., Union College, Schenectady; M.A., Ph.D., Columbia University
Soleri, Paolo (1975) ....*Adjunct Professor of Architecture*
    D. Arch., Politecnico di Torino
Stark, Louisa R. (1981) ....*Adjunct Professor of Anthropology*
    B.A., Barnard College; M.A., Columbia University; Ph.D., New York University
Starr, Mortimer P. (1982) ....*Adjunct Professor of Botany and Microbiology*
    B.A., Brooklyn College; M.S., Ph.D., Cornell University
Stott, Brian (1983)...*Adjunct Professor of Engineering*
    B.S., M.S., Ph.D., University of Manchester (Great Britain)
Sutton, Samuel J. (1975)...*Adjunct Professor of Law*
    B.A., B.S., University of Arizona; J.D., George Washington University
Westie, Frank R. (1983) ....*Adjunct Professor of Sociology*
    B.S., Central Michigan University; Ph.D., Ohio State University
Whaley, Patricia (1975)...*Adjunct Lecturer in Speech and Hearing Science;*
    B.S., M.Ed., University of Georgia   *Director, Speech and Hearing Clinic*
Wilcox, David Robert ....*Adjunct Assistant Professor of Anthropology*
    B.A., Beloit College; Ph.D., University of Arizona
Zettler, Hugo F. (1977) ....*Adjunct Assistant Professor of Law*
    B.S., Arizona State University; J.D., University of Arizona

University Libraries

Riggs, Donald E. (1979) ....*University Librarian*
    B.A., Glenville State College; M.A., West Virginia University; M.L.S., University of Pittsburgh;
    Ed.D., Virginia Polytechnic Institute and State University
Biblarz, Dora (1980)...*Associate University Librarian for Collection Development*
    B.A., M.L.S., University of California, Los Angeles; M.A., University of California, Davis
Reneker, Maxine H. (1985) ....*Associate University Librarian for Public Services*
    B.A., Carleton College; A.M., University of Chicago
Corey, Constance H. (1973) ....*Assistant University Librarian for Management Services*
    B.A., Denison University; M.L.S., University of Arizona; M.B.A., Arizona State University
Foster, Sallie F. (1977) ....*Assistant University Librarian for Automation and Systems*
    B.A., M.L.S., University of California, Berkeley
August, Jack L. Jr. (1984)..*Assistant Archivist; Head, Field Collecting and Oral History*
    B.A., Yale University; M.A., University of Arizona, Ph.D., University of New Mexico
Batalden, Sandra (1977) ....*Assistant Librarian, Collection and Acquisition Services*
    B.A., M.A., University of Minnesota
Blouin, Deborah K. (1971) ....*Associate Librarian, Reference Service*
    B.A., Cedar Crest College; M.L.S., State University of New York, Albany
Borovansky, Vladimir R. (1968)...*Librarian; Head, Noble Library*
    M.L.S., Charles University (Prague, Czechoslovakia)
Brem, Walter V. Jr. (1979) ....*Assistant Librarian, Reference Service*
    B.A., M.A., University of California, Santa Barbara; M.L.S., University of California, Berkeley
Brownson, Charles W. (1980) ....*Associate Librarian, Collection Development*
    B.A., South Dakota State University; M.A., University of Oregon; M.L.S., University of California, Berkeley
Burke, Rebecca J. (1981) ....*Affiliate Librarian, Government Documents Service*
    B.A., San Jose State University; M.L.S., University of Arizona
Casey, Donis (1984)..*Assistant Librarian; Head, Government Documents Service*
    B.S., University of Tulsa; M.L.S., University of Oklahoma

Clancy, Justine (1985) ....*Assistant Librarian; Head, Architecture and Environmental Design Library*
  B.A., California State University, Fullerton; M.S., University of Southern California
Conrow, Jane A. (1968)...*Librarian; Head, Access Services*
  B.A., M.L.S., Indiana University
DeFato, Rosalinda (1970)...*Associate Librarian, Reference Service*
  B.A., St. John's University; M.L.S., University of California, Los Angeles
Dusenbury, Carolyn A. (1980)..*Librarian; Head, Reference Service*
  B.S., University of California, Santa Barbara; M.L.S., University of California, Los Angeles
Ferrall, J. Eleanor (1969)...*Librarian, Reference Service*
  A.B., Heidelberg College; M.A., Arizona State University
Friedman, Catherine (1983) ....*Assistant Librarian, Reference Service*
  A.B., M.S., University of Illinois
Grebles, Shelley (1983)..*Assistant Librarian, Arizona Collection*
  B.A., University of Arizona; M.A., Arizona State University; M.L.S., Indiana University
Knepp, Kenneth B. (1968) ....*Associate Librarian, Catalog Service*
  B.A., University of the Pacific; B.D., Garrett Theological Seminary; M.A., University of Denver
Leibold, Anne M. (1977) ....*Associate Librarian, Reference Service*
  M.A., University of Paris
Machovec, George S. (1977)..*Associate Librarian, Science Reference Service*
  B.S., M.L.S., University of Arizona
McColgin, Rhonda L. (1970)..*Associate Librarian, Catalog Service*
  B.A., Arizona State University; M.S.L.S., University of Southern California
McDonald, Arlys L. (1970)..*Associate Librarian; Head, Music Library*
  B.Mus., St. Mary of the Plains College; M. Mus., University of Illinois
McGehee, Shelley (1985)..*Assistant Librarian, Music Library*
  B.Mus., Converse College; M.Mus., M.L.S., University of Alabama
Miller, Rosanna (1974)...*Associate Librarian; Head, Map Service*
  B.A., M.A., Arizona State University; M.L.S., University of Arizona
Mulvihill, Josepha Anne (1983)..*Assistant Librarian, Reference Service*
  B.S., University of Kansas; M.L.S., Emporia State University
Oetting, Edward (1983) ....*Assistant Archivist; Head, Arizona Collections,*
  B.A., University of Michigan;   *University Archives, and Records Management*
  M.A., University of Illinois; M.S.L.S., Wayne State University
Palais, Elliot S. (1959-62; 1966) ....*Librarian, Collection Development*
  B.A., Bowdoin College; A.M.L.S., University of Michigan
Pinckard, Mary-Margaret (1982) ....*Assistant Librarian; Head, Science Reference Service*
  B.S., University of New Hampshire; M.L.S., University of Arizona
Rhodes, Diane B. (1980) ....*Assistant Librarian, Catalog Service*
  B.S., College of William and Mary; M.L.S., University of Wisconsin, Madison
Rich, Stephen K. (1976) ....*Assistant Librarian, Reference Service*
  B.A., Amherst College; M.L.S., Indiana University
Romer, James W. (1981)...*Assistant Librarian, Acquisitions Department*
  B.A., Erskine College; M.A., M.L.S., Ph.D., University of North Carolina
Ruppé, Carol V. (1962) ....*Librarian, Reference Service*
  B.A., University of New Mexico; M.A., University of Denver
Sager, Harvey M. (1977)...................................*Assistant Librarian, Library Instructional Service*
  B.A., San Francisco State College; M.A., California State University, Chico; M.A., University of Denver
Schneberger, Lois I. (1969)...*Librarian; Head, Catalog Service*
  B.A., Viterbo College; M.L.S., Kansas State Teachers College
Shackle, Linda A. (1984).......................................*Assistant Librarian, Science Reference Service*
  B.A., State University of New York, College of Arts and Sciences at Oswego; M.L.S., State University of New
  York at Albany
Steel, Virginia (1981)...*Assistant Librarian, Reference Service*
  B.A., University of Rochester; M.A., University of Chicago
Stern, H. David (1984)...*Assistant Librarian, Science Reference Service*
  B.S., University of Connecticut; M.L.S., M.A., Indiana University
Stewart, Douglas J. (1982)..*Assistant Librarian, Reference Service*
  B.A., M.A., University of Colorado; M.A., University of Denver

Swaty, Mary A. (1968) ....*Associate Librarian, Catalog Service*
    B.A., University of Missouri; M.I.S., Indiana University
Sylvester, Virginia R. (1981) ....*Assistant Librarian, Access Services*
    B.A., Hobart and William Smith Colleges; M.L.S., Rutgers University
Vanderhoff, Barbara A. (1968) ....*Associate Librarian; Head, Serial Records*
    B.A., Fort Hays Kansas State College; M.A., University of Denver
Varca, Susan (1984) ....*Associate Librarian; Head, Library Instructional Services*
    B.A., Florida State University; M.L.S., Louisiana State University
Voth, Annette (1978)..*Associate Librarian; Music Library*
    B.Mus., University of Kansas, Lawrence; M.L.S., M.A., University of California, Berkeley
Walters, Sheila A. (1971)..*Assistant Librarian, Science Reference Service*
    B.A., University of Oklahoma; M.L.S., Louisiana State University
Wherry, Timothy (1983) ....*Assistant Librarian, Science Reference Service*
    B.S., The Pennsylvania State University; M.L.S., University of Denver
Williams, Jenny L. (1967)..*Associate Librarian, Catalog Service*
    B.A., M.A., Indiana University
Wu, Ai-hwa (1964) ....*Associate Librarian, Catalog Service*
    B.A., National Taiwan University; M.L.S., University of Washington
Wurzburger, Marilyn J. (1960)..*Associate Librarian, Head, Special Collections*
    B.A., MacMurray College
Yao, Winberta M. (1975)..*Associate Librarian, Reference Service*
    B.A., University of California; M.S., Columbia University

Law Library

Brown, Richard L. (1982)..*Associate Professor of Law; Director, Law Library*
    B.A., University of California, Los Angeles; J.D., Indiana University; M.L.L., University of Washington
Nash, Richard M. (1976) ....*Assistant Director, Law Library*
    B.A., University of Missouri, Kansas City; M.A.L.S., University of Denver; J.D., Drake University
Alcorn, Marianne S. (1981) ....*Associate Librarian, Reference*
    B.A., University of Washington; M.L.S., University of Southern California
Au, Chih-Chun (1970)..*Librarian; Head of Technical Services*
    B.A., National Taiwan University; M.A., University of Chicago
Chase, Marcelle P. (1983) ....*Assistant Librarian, Reference/Circulation*
    J.D., University of Brussels, Belgium; M.L.S., Ball State University
Firestone, Sharon A. (1977) ....*Associate Librarian; Acquisition and Serials*
    B.A., M.L.S., University of Washington; M.A., Arizona State University
Larson, Donna Rae (1972)..*Librarian, Government Documents*
    B.A., M.A.L.S., University of Michigan

Student Health

Roth, Monty (1982) ....*Director*
    B.S., Oklahoma State University; M.S., University of Colorado; M.D., University of Oklahoma
Guerra, Frank B. Jr. (1969) ....*Assistant Director*
    B.S.B.A., B.S.Ph., University of Arizona
Bowen, Dale A. (1983) ....*University Physician*
    B.S., Washington State University; M.D., University of Washington
Baxter, Howard L. (1984)..*Consulting Roentgenologist - P/T*
    B.A., University of Colorado; M.D., Wayne State University
Brown, Glen H. (1984) ....*Consulting Dermatologist - P/T*
    B.A., Hamilton College; M.D., New York Medical College
Favata, James V. (1983)..*University Physician*
    B.S., M.D., University of Illinois
George, Edward G. (1984) ....*University Physician*
    B.S., Muhlenberg College; M.S., Northwestern University; M.D., Hahneman Medical School
Hirsch, Joanne R. (1984) ....*University Physician*
    B.A., Herbert H. Lehman College of New York; M.D., Albert Einstein College of Medicine

Lee, Richard V. (1981)..*University Physician*
  B.S., M.D., University of Illinois
Mankel, William C. (1979) ....*University Psychiatrist - P/T*
  B.S., M.D., University of Illinois
Maresca, Robert L. (1979) ....*Consulting ENT Specialist - P/T*
  B.S., Yale University; M.D., Union University Albany Medical College
Nuyen, Christine (1984)..*University Psychiatrist - P/T*
  M.D., University of Saigon
Rierson, Robert D. (1978) ....*Consulting Gynecologist - P/T*
  Boards in Obstetrics and Gynecology
Tong, Mark S. (1983) ....*Consulting Gynecologist - P/T*
  B.S., Southeastern State College; M.D., University of Oklahoma
Steinhauser, Gale (1981)...*University Physician*
  M.D., State University of New York
Tee, Conchita A. (1982)...*University Physician*
  B.S., M.D., University of Santo Thomas, Manila
Urrea, Don (1975) ....*Consulting Neurologist - P/T*
  B.A., University of Arizona; M.D., Cornell University
Van Pelt, Stephen A. (1984)......................................*Sports Medicine Physician - P/T*
  B.A., Hope College, Michigan; M.D., Emory University School of Medicine
Weems, M. Dudley (1984)...*University Psychiatrist*
  B.S., M.D., University of Florida
Winter, Lewis S. Jr. (1976) ....*University Physician*
  B.S., M.D., University of Nebraska; Board Certified in Surgery
Fee, Norman F. (1972)..*Consulting Orthopedic - P/T*
  B.A., Carlton College; M.D., George Washington University
Fife, Ray (1974)..*Consulting Orthopedic - P/T*
  B.S., University of Utah; M.D., Northwestern Medical School
Thaler, Millard P..*Consulting Dermatologist - P/T*
  M.D., University of California at San Francisco

University Academic Organization

Academic Administration

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  Assistant Academic Vice President ....*Maurine A. Fry*
  Assistant Academic Vice President...*Elmer R. Gooding*
  Assistant Academic Vice President ....*Albert K. Karnig*
  Assistant to the Vice President for Academic Affairs.......................*Linda Van Scoy*
  Manager, Academic Facilities...*Jack Shafer*

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College of Liberal Arts ....*Samuel A. Kirkpatrick, Dean*
College of Architecture and Environmental Design..........................*Gerald R. McSheffrey, Dean*
College of Business...*L. William Seidman, Dean*
College of Education..._____, *Dean*
College of Engineering and Applied Sciences ....*C. R. Haden, Dean*
School of Engineering ....*C. R. Haden, Director*
College of Fine Arts..._____, *Dean*
College of Law...*Paul Bender, Dean*
College of Nursing ....*Janelle C. Krueger, Dean*
College of Public Programs ....*Nicholas L. Henry, Dean*
Graduate College...*Charles M. Woolf, Dean*
School of Social Work...*Jesse F. McClure, Dean*

Instruction Units

Accounting...*Joseph Schultz Jr., Chair*
Aeronautical Technology ....*Robert Schoen*
Aerospace Studies...*Col. Richard Waite, Chair*
Agriculture ....*George Seperich, Director*
Anthropology..*Brian Foster, Chair*
Architecture ....*Roger L. Schluntz, Chair*
Art...*Leonard Lehrer, Director*
Botany and Microbiology.................................*Milton R. Sommerfeld, Chair*
Chemical and Bio Engineering....................................*Imre Zwiebel, Chair*
Chemistry...*Morton E. Munk, Chair*
Civil Engineering...*Charles O'Bannon, Chair*
Communication..*Robert Goyer, Chair*
Computer Science ....*William Lewis, Chair*
Construction...*Vernon Hastings, Director*
Counselor Education...*Sharon Robinson, Chair*
Dance ....*Elizabeth C. Lessard, Chair*
Decision and Information Systems.............................*Craig Kirkwood, Chair*
Design Sciences ....*Tom Witt, Chair*
Economics ....*William Boyes, Chair*
Educational Administration and Supervision ....*Thomas Metos, Interim Chair*
Educational Psychology ....*Raymond W. Kulhavy, Interim Chair*
Educational Technology and Library Science ....*Karen Beyard-Tyler, Chair*
Electrical and Computer Engineering.............................*Richard Saeks, Chair*
Electronic Technology ....*Thomas A. Kanneman*
Elementary Education ....*Jon Engelhardt, Chair*
Engineering Core and Special and Interdisciplinary Programs ....*George C. Beakley, Director/Associate Dean*
English ....*Nicholas A. Salerno, Chair*
Finance ....*Michael Joehnk, Chair*
Foreign Languages ....*Peter Horwath, Chair*
General Business...*Lohnie J. Boggs, Chair*
Geography..*Patricia Gober, Chair*
Geology ....*Paul Knauth, Chair*
Health and Physical Education....................................*Robert Pangrazi, Chair*
Health Services Administration, Center for ....*Frank Williams, Acting Director*
Higher and Adult Education ....*Mark Rossman, Interim Chair*
History ....*Fred Giffin, Chair*
Home Economics...*George Hughston, Chair*
Industrial and Management Systems Engineering ....*Richard L. Smith, Chair*
Industrial Technology...*Zenas A. Prust, Chair*
Journalism and Telecommunication, Walter Cronkite School of...........................*ElDean Bennett, Director*
Justice Studies, School of ....*John Hepburn, Director*
Leisure Studies ....*Arthur Haley, Chair*
Management...*William Ruch, Acting Chair*
Marketing...*Bruce Walker, Chair*
Manufacturing Technology ....*Peter A. Schmidt*
Mathematics...*Joaquin Bustoz, Chair*
Mechanical and Aerospace Engineering ....*Darryl E. Metzger, Chair*
Military Science ....*Col. Lanny Standridge, Chair*
Music ....*George Umberson, Director*
Philosophy ....*Jeffrie Murphy, Chair*
Physics ....————————, *Chair*
                                                                                        Elizabeth Burns, Chair
Planning...*Patrick G. McGowan, Chair*
Political Science...*Patrick G. McGowan, Chair*
Psychology ....*Stanley Parkinson, Chair*
    Clinical Psychology ....*Paul Karoly, Director*
Public Affairs, School of ....*John Hall, Director*

Purchasing, Transportation, Operations ....*Harold Fearon, Chair*
Religious Studies ....*Richard C. Martin, Chair*
Secondary Education...*John Bell, Chair*
Sociology..*Leonard Gordon, Chair*
Speech and Hearing Science ....*Leonard LaPointe, Chair*
Special Education ....*L. Dean Webb, Chair*
Technology ....*Ernest Hirata, Director*
Theatre ....*Lin Wright, Chair*
Zoology...*Kathleen Church, Chair*

Graduate Studies

Dean, Graduate College ....*Charles M. Woolf*
Assistant Dean, Graduate College ....*Walter Harris*
Assistant Dean, Graduate College...*Alleen Nilsen*
Graduate Admissions ....*Frances Gill*

Summer Sessions

Director, Summer Sessions...*Denis J. Kigin*

ASU West Staff

Chief Operating Officer ....*Paige E. Mulhollan*
Director, Community Relations and Affirmative Action ....*Donald Campbell*
Director, Student Services ....*Jill DeMichele*
Director, ASU West Library ....*Helen Gater*
Director, Operations...*Steffany Knirsch*
Director, Marketing ....*Gerie Lerner Leshin*

Off Campus Academic Services

Executive Director ....*John L. Edwards*
Director, Conference Services ....*Edward E. Scannell*
Director, American Language and Culture Program ....*Montgomery Van Wart*
Acting Director, ASU Computer Institute ....*Gary Bitter*

Retirement Programs and Development

Director ....*Obadiah S. Harris*
Program Coordinator, ASU Sun Cities ....*Jeanne Crawford*

University Administration Organization

Executive Vice President

Executive Vice President ....*Paige E*
    Associate Executive Vice President for Information Systems ....*Kenneth*
    Assistant Vice President for Community Relations..*Bren*
    Director or ASU Public Events ....*Jame*
    Executive Director, Alumni Association..*Don.*
    Director, Development..*Lonni.*
Director, Intercollegiate Athletics ....*Richard .*
General Manager, Television Station KAET...*Ro*

Student Affairs

Vice President for Student Affairs ....*Betty T*
Assistant to the Vice President, Student Affairs..
Dean of Students ....*L*
Director of Undergraduate Admissions ....*Christin*
Director of Career Services...
Director of Counseling and Consultation Center...*Rob*
Director of Student Financial Assistance ....*Paul (*
Director of Student Health Center...
Director of Residence Life...*Clifford*
Registrar...*Enos*
Director of Educational Development ....*Gec*
Director of Student Publications...'

Research and Service Agencies

Adult Development and Aging Program ....*Robert J. Kastenbau*
Animal Research Center...*Joseph Har*
Arid and Tropical New Crop Applied
    Science and Technology, Center for..*Richard Gord*
Asian Studies, Center for ....*Sheldon Sim*
Automated Engineering and Robotics, Center for..*Dan Shu*
Bilingual/Bicultural Education, Center for..*Eugene Gar*
Business and Economic Research, Bureau of...*Lee McPhet*
Cancer Research Institute ....*George R. Pe*
Career Services...*Robert F. Men*
Climatology Laboratory...*Anthony J. Bra.*
Computer Services...*Kenneth G. Pollock, Associate Executive Vi*
Energy Systems Research Center..*B. D. Wood, Act*
Engineering Research Center...*C. E. Back*
Environmental Studies, Center for..*Duncan T. Patt*
Executive Development, Center for ....*Robert Ball*
Faculty Development Program...*Sandra Colom*
Family Studies, Center for...*Mark Roc*
Student Financial Assistance Office ....*Paul G. Barber.*
Indian Education, Center for...*John W. Tippecon*
. . . . *Alan W. Corr*

Museum of Geology ....*Troy L. Péwé, Director*
News Bureau and Information Services...*Ann Bergin, Director*
Office of Field Services...*Jackson M. Drake, Director*
Office of Research Services (Education) ....*David F. Lancy, Director*
I. D. Payne Institute for Social and Cultural Relations...................*Morrison F. Warren, Director*
Private and Public Sector Ethics, Center for ....*Mark Pastin, Director*
Professional Development, Center for ....*J. S. Greenberg, Director*
Professional Field Experiences ....*Weston L. Brook, Director*
Reading Clinic ....*Donald Jacabos, Director*
Solid State Electronics Center...*David Ferry, Director*
Solid State Science, Center for ....*Alexandra Navrotsky, Director*
Southwest Studies, Center for...*William Graf, Director*
Student Health Service ....*Monty Roth, Director*
Television Station KAET..*Robert H. Ellis, General Manager*
Transportation Center, Advanced Research in ....*Mathew J. Betz, Director*
University Art Collections..*Rudy H. Turk, Director*
University Counseling Service..*Robbie Nayman, Director*
University Library ....*Donald E. Riggs, University Librarian*
University Media Systems...*Warren D. Fry, Director*
University Planning and Analysis................................*John Porter, Associate Director;*
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Urban Studies...*L. A. Wilson (Int.), Director*
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Director, Personnel...*Susan M. Malaga*
Manager, Operations...*Deanna Euritt*
   Manager, Compensation and Benefits..._____
   Manager, Placement and Training ....*John A. Zappe*
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John J. MacIntyre, '80JD

LIBERAL ARTS,
Ilene Lashinsky, '69, '72JD

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PUBLIC PROGRAMS,
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SOCIAL WORK,
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STUDENT FOUNDATION PRESIDENT

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APPENDIX A

November 9, 1982

TO: All Employees and Students

FROM: J. Russell Nelson, President

SUBJECT: Policy Statement on Equal Employment Opportunity and Affirmative Action

Arizona State University reaffirms its commitment to increasing opportunities at all levels of employment and participation in its programs and activities by all faculty, staff, and students without regard to race, color, religion, national origin, sex, age, handicap, or veteran status.

Our commitment extends to recruiting and hiring, promotion, and other personnel actions such as compensation, benefits, transfers, layoffs, return from layoff, terminations, University sponsored training, education, tuition assistance, and social and recreational programs.

The Office of Assistant to the President for Equal Employment Opportunity, Affirmative Action, and Minority Affairs has been established to advise, advocate, administer, coordinate, monitor, and supervise all programs in the areas of equal employment, affirmative action, and minority affairs.

The Office of Assistant to the President is the umbrella for authorizing personnel practices for complying with, coordinating, and administering all federal and state laws and regulations pertaining to discrimination and affirmative action in employment, programs, and activities of the University. The federal and state laws and regulations include but are not limited to:

Title VI of the Civil Rights Act of 1964, as amended

Title VII of the Civil Rights Act of 1964, as amended

Title IX of the Education Amendments of 1972, as amended

Executive Order 11246, as amended and regulations

Revised Order Number 4

Sections 503 and 504 of the Rehabilitation Act of 1973 and regulations

Vietnam Era Veterans Readjustment Assistance Act of 1974 and regulations

Equal Pay Act of 1963 and regulations

Age Discrimination in Employment Act of 1967, as amended in 1978

Age Discrimination Act of 1975 and regulations

Arizona Civil Rights Act of 1965, as amended

Arizona State University Policy on Sexual Harassment, 1982

Through the Office of Assistant to the President, matters involving allegations of discrimination in employment, educational programs or activities are channelled for investigation and resolution. Any employee or student may visit Luis Aranda, Assistant to the President for Equal Employment Opportunity and Affirmative Action, in confidentiality to discuss any concern and to explore available options without fear of jeopardizing either job or status with the University. The office is located in the Academic Services Building, room 113; the telephone number is 965-5057.

With the support of every individual at Arizona State University, the affirmative action effort should ultimately provide inclusion and utilization of all minorities and women in an appropriate manner at every level of responsibility and endeavor. I ask that you give equal employment opportunity and affirmative action your utmost attention and that you direct your energies to its ultimate success.

Revised 11-4-82
Supercedes 10-27-81

J. Russell Nelson
President

APPENDIX B

UNIVERSITY POLICY
FOR
STUDENT APPEAL PROCEDURES
ON GRADES

Informal: This procedure must be undertaken first. Grade grievance disputes must be filed within the regular semester immediately following the issuance of the grade in dispute, whether enrolled in the University or not.

A. The aggrieved student must first undergo the informal procedure of conferring with the instructor, stating the evidence (if any) and reasons for questioning that the grade received was not given in good faith. The instructor is obliged to review the matter, explain the grading procedure utilized, and show how the grade in question was determined. If the instructor is a graduate assistant and this interview does not resolve the difficulty, the student may then go to the faculty member in charge of the course (regular faculty member or director of the course sequence) with the problem.

B. If the grading dispute is not resolved in Step A, the student may appeal to the department chair or other appropriate chair of the area within the department (if any). The department chair may confer with the instructor to handle the problem. Step B applies only in departmentalized colleges.

C. If these discussions are not adequate to settle the matter to the complainant's satisfaction, the student may then confer with the dean of the college concerned (or the dean-designate), who will review the case. If unresolved, the dean or designate may refer the case to the college academic grievance hearing committee to review the case formally. In most instances, however, the grievance procedure will not go beyond this level.

Formal: The following procedure takes place after Steps A, B, and C (or A and C) have been completed.

D. Each college has on file in the Office of the Dean (and in each department of the college) the procedures and composition of the undergraduate or graduate academic grievance hearing committee for student grievances. Each college committee shall operate under grievance procedures as stated which satisfy due process requirements. The committee shall always meet with the student and the instructor in an attempt to resolve the differences. At the conclusion of the hearing, the committee shall make a written report containing its recommendations and provide copies to the student concerned, the instructor, the department chair (if any) and the dean.

E. Final action in each case will be taken by the dean after full consideration of the committee's recommendation. Grade changes (if any and if recommended by the committee) will be made by the instructor (or the dean of the college in the absence of the faculty member). The dean shall have authority to take action as is deemed necessary by the case and shall so inform the student, instructor, department chair (if any) and the Registrar of action taken.

Index

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