Departmental Minor Teaching Field Requirements

(Secondary Education)

Biological Sciences. The academic specialization consists of 24 semester hours as follows: BIO 181, 182, 340; MIC 205 (or 220), 206; and eight additional hours in courses listed under biology, botany, microbiology, and zoology, with the *exception* of: BIO 100 and 218; BOT 108, and ZOL 113, 300, and 318. BIO 480 is required in addition to the 24 semester hours in biological sciences.

Departmental Graduate Program

The Department of Zoology offers programs leading to the degrees of Master of Natural Science, Master of Science, and Doctor of Philosophy. Consult the *Graduate Catalog* for requirements.

BIOLOGY

For courses in biology, see "Biological Sciences" pages 117–118

ZOOLOGY

ZOL 113 Contemporary Zoology. (4) F S
Topics emphasizing social and environmental problems. Cannot be used for major credit in the biological sciences 3 hours lecture 3 hours lab *[Satisfies General Studies Requirement S2]*

120 Human Physiology. (4) F S
Basic concepts of general science will be discussed using current issues and basic concepts of human physiology as a focus. Cannot be used for major credit in biological sciences 3 hours lecture, 3 hours lab. *[Satisfies General Studies Requirement. S2]*

201 Human Anatomy—Physiology. (4) F S, SS
Structure and dynamics of the human mechanism Cannot be used for major credit in the Department of Zoology. 3 hours lecture, 3 hours lab. *[Satisfies General Studies Requirement. S2]*

202 Human Anatomy—Physiology. (4) F, S, SS
Continuation of ZOL 201. Cannot be used for major credit in the Department of Zoology 3 hours lecture 3 hours lab Prerequisite ZOL 201 or instructor approval.

241 Human Genetics. (3) F S
Introduction to human heredity and variation. Cannot be used for major credit in the Department of Zoology Prerequisite a course in the life sciences

270 Vertebrate Zoology. (4) S
Characteristics, classification, evolution and natural history of the major groups of vertebrate animals. 3 hours lecture 3 hours lab Prerequisite: BIO 182.

280 Animal Behavior. (3 F
Evolutionary, genetic, physiological and ecological bases of animal behavior. Prerequisite 4 hours of BIO or ZOL, or instructor approval

300 Biogenetics of Man. (4) S
Concepts of ecology, heredity and evolution and their relation to human affairs. Cannot be used for major credit in life sciences.

311 Animal Microtechnique. (2) N
Zoological microtechnique, including the preparation for microscopic examination of animal structures, tissues, cells and whole mounts 6 hours lab Prerequisite BIO 182.

316 History of Biology. (3) N
Focuses on 19th and 20th centuries considering biology as a discipline, evolution and problems of heredity development and cell theory. Cross listed as HPS 330. Prerequisite: 6 hours in life sciences *[Satisfies General Studies Requirement H]*

318 History of Medicine. 3) N
Scientific study of the human body, changing theories of disease evolution of opinions on treatment, emerging institutionalization of medical practice. Cross- listed as HPS 331 Prerequisite 6 hours in life sciences *[Satisfies General Studies Requirements: SB, H]*

330 Developmental Anatomy. (3) F
General developmental biology (embryology) and comparative structure of organ systems, illustrated mainly by vertebrate examples. Prerequisite BIO 182.

331 Laboratory in Vertebrate Developmental Anatomy. (2) F, S
Morphology of representative embryonic and adult vertebrates. Two 3 hour labs. Prerequisite BIO 182. ZOL 330 recommended.

350 Comparative Invertebrate Zoology. (4) F
Characteristics, life cycles, adaptations and evolution of invertebrate animals. 3 hours lecture 3 hours lab. Prerequisite BIO 182 or instructor approval

354 General Entomology. (4) S 91
Form, activities and classification of insects 3 hours lecture, 3 hours lab. Prerequisite: BIO 182

360 Basic Physiology. (4) F S
Physiological mechanisms of the higher vertebrates 3 hours lecture 3 hours lab Prerequisites: BIO 182 CHM 115 MAT 117

380 Sociobiology. (3) S
Survey of animal and human social behavior examined from an evolutionary perspective. Suitable for nonmajors Prerequisite ZOL 280 is recommended

394 Special Topics (Nonmajors). (2 3) N
Topics of current or special interest in one or more aspects of animal biology Topics vary Cannot be used for major credit in life sciences Prerequisite. junior standing

411 Wildlife Habitat Management. (4) F
Principles, practices and techniques of managing habitats for wildlife. 3 hours lecture, 3 hours lab or field trips; weekend field trips. Prerequisites: BIO 217, 320 ZOL 471 472, or instructor approval

412 Wildlife Population Management. 4 S
Principles practices and techniques for managing wild life populations. 3 hours lecture, 3 hours lab or field trips weekend field trips. Prerequisite. ZOL 411

413 Fisheries Management. (4) F
Principles and theory of fisheries management 3 hours lecture 3 hours lab or field trips, weekend field trips. Prerequisite 10 hours of biology

420 Field Zoology. (3) N
Experience in zoological field techniques. Requires weekend or longer field trips. Prerequisite: instructor approval.

423 Population and Community Ecology. (3) F '91
Organization and dynamics of population and communities, emphasizing animals. Theoretical and empirical approaches. Prerequisite: BIO 320 or instructor approval.

425 Animal Ecology. (3) N
Physiological and behavioral adaptations of individual animals to both abiotic and biotic environment. Prerequisite: BIO 320.

433 Animal Histology. (4) N
Microscopic study of animal tissues. 3 hours lecture, 3 hours lab. Prerequisite: BIO 182 or instructor approval.

440 The Nucleus. (3) N
Experimental studies in chromatin and chromosome structure. Molecular mechanisms of chromosome movement and mechanics, cell population kinetics, the nucleolus and the nuclear envelope. Prerequisites: BIO 340; CHM 261, 335 or 361.

441 Principles of Human Genetics. (3) N
Genetics in human populations, including medical aspects. Prerequisite: BIO 340.

454 Aquatic Insects. (3) N
Systematics and ecology of aquatic insects. Prerequisite: ZOL 354.

465 Neurophysiology. (3) S '92
Detailed treatment of cellular and organismal neurophysiology and nervous system function. Prerequisite: ZOL 360.

466 Neurophysiology Laboratory. (2) S '92
Intracellular and extracellular electrophysiological recording techniques, histological preparations and dye-filling techniques. 6 hours lab. Pre- or corequisite: ZOL 465.

470 Systematic Zoology. (3) S '91
Philosophy, theory and practice in interpreting patterns of animal diversity, including species concepts and speciation, nomenclature and taxonomy, evolutionary and phylogenetic classification. Prerequisites: junior standing; 18 hours in life science.

471 Ornithology. (3) S
The biology of birds. 2 hours lecture, 3 hours lab. Weekend field trips. Prerequisite: ZOL 270 or instructor approval.

472 Mammalogy. (4) F '90
Classification, structure, habits, ecology and distribution of mammals, emphasizing North American forms. 3 hours lecture, 3 hours lab or field trip. Weekend field trips. Prerequisite: ZOL 270 or instructor approval.

473 Ichthyology. (3) S '91
Systematics and biology of recent and extinct fishes. 2 hours lecture, 3 hours lab or field trip. Weekend field trips required. Prerequisites: ZOL 270, 425; or instructor approval.

474 Herpetology. (3) S '92
Systematics and biology of recent and extinct reptiles and amphibians. 2 hours lecture, 3 hours lab or field trip. Prerequisite: ZOL 270.

481 Research Techniques in Animal Behavior. (3) S '90
Experimental and field studies of animal behavior; description and quantification of animal behavior, interpretation of behavior within an evolutionary framework. 1 hour lecture, 6 hours lab. Prerequisite: ZOL 280.

515 Populations: Evolutionary Genetics. (3) F
Mathematical models in the description and analysis of the genetics of populations. Prerequisites: BIO 320, 415, 445; or instructor approval.

516 Populations: Evolutionary Ecology. (3) S
Principles of population biology and community ecology within an evolutionary framework. 2 hours lecture, 2 hours recitation. Prerequisites: BIO 320; 415 or MAT 210; ZOL 515.

532 Developmental Genetics. (3) S '91
Genetic approaches to the analysis of development during the life cycle of eukaryotic organisms, role of genes in the unfolding of the differentiated phenotype. Prerequisite: BIO 443.

560 Comparative Physiology. (3) F
The analysis of function in invertebrates and vertebrates, emphasizing evolutionary trends in physiological systems. 3 hours lecture. Prerequisite: ZOL 360 or equivalent.

566 Environmental Physiology. (3) F '91
Physiological responses and adaptations of animals to various aspects of the physical environment. Prerequisites: BIO 320; ZOL 360.

568 Mammalian Physiology. (3) S '91
Detailed treatment of mammalian organ system functions emphasizing integrative mechanisms. 3 hours lecture. Prerequisite: ZOL 360 or equivalent.

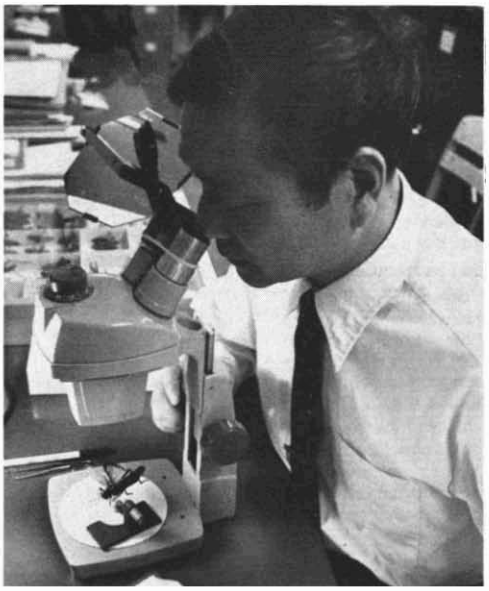
569 Cellular Physiology. (3) F '90
Emphasizing the molecular basis for cell structure and function. 3 hours lecture. Prerequisites: ZOL 360; organic chemistry.

591 Seminar. (1–3) F, S
Topics such as the following will be offered:

(a) Behavior	(e) Physiology
(b) Cell Biology	(f) Evolution
(c) Ecology	(g) Adaptations
(d) Genetics	(h) Genetic Engineering

May be repeated for credit.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



College of Architecture and Environmental Design

John Meunier, M.Arch.
Dean

Purpose

The practice of architecture and environmental design is the culturally responsible shaping of our environment from the scale of the cities we live in, to the buildings and interiors we inhabit, to the artifacts and products we use. What we design must be durable, useful, beautiful, appropriate to its context, and must not be a waste of resources, energy, and materials. Designing our environment is an art, a technology, and a social science that has a history as long as human culture. The goals of the faculty include offering students an education that becomes the basis for life long growth and improvement as professionals, advancing the discipline in both theory and practice, and improving the quality of the environment by making the expertise and knowledge of the faculty available to other professionals and to the public.

Organization

Academic Organization. The college is composed of three academic units: the School of Architecture, the Department of Design, and the Department of Planning. A fourth unit, the Professional Development Office, provides special programs for the public and offers advanced professional courses. Administration of the college is the responsibility of the dean, who in turn is responsible to the president of the university through the provost.

College Facilities. With the opening of an award winning 100,000-square foot expansion to the existing building in 1989, all the college's programs are now housed in a single complex. Facilities include design studios, lecture and seminar rooms, technology laboratories, offices for faculty, administration and student organizations, the College Library, the Gallery of Design, the Media Center, the Shop, the Slide Collection, and computer laboratories. The bridge between the original building and the expansion places the college's review and display space at the heart of the complex.

The College Library. As a branch of the University Library, the College Library provides easy access to books, periodicals, and reference materials for students, faculty, and the professional community. The collection includes the Howe Architecture Library, more than 18,000 volumes, and special research collections on the work of Paolo Soleri and Frank Lloyd Wright.

Gallery of Design. The Gallery of Design is one of eight university galleries and museums. It provides space for traveling exhibitions and exhibitions of student and faculty work.

Special Facilities. College programs are supported by several kinds of special laboratories. The college operates a computer aided design and graphics laboratory that is adjacent to a computer site managed by university Computing and Network Consulting Services. New space for special activities includes the high bay research lab, the lighting lab, the solar research lab, the solar roofdeck work area, as well as space for the college's community outreach activities and programs of the Council for Design Excellence. The college's photographic laboratory and darkroom provide high quality equipment and space for research projects. A shop equipped to handle wood, plastic, and metal supplements studio space. The college's Media Center includes traditional graphics and audiovisual equipment as well as portable video equipment. The Slide Collection, with more than 10,000 slides, is available for instructional use. The college also maintains materials testing equipment, and the Interior Design Building Materials Resource Center.

Admission

Lower-Division Programs. A new or transfer student who has been admitted to the university and has selected a college major is admitted to the lower-division program of his or her choice. A separate application procedure is required for entry to upper-division programs and graduate programs. Acceptance into lower-division programs does not guarantee acceptance to upper-division programs.

Transfer Credits. While the university accepts credits transferred from other accredited institutions, transfer credits are not applied to specific degree programs until reviewed and accepted by the appropriate academic units. Transfer course work must be equivalent in both content and level of offering. In addition, a review of samples of work (portfolio of work) from previous studio classes is required.

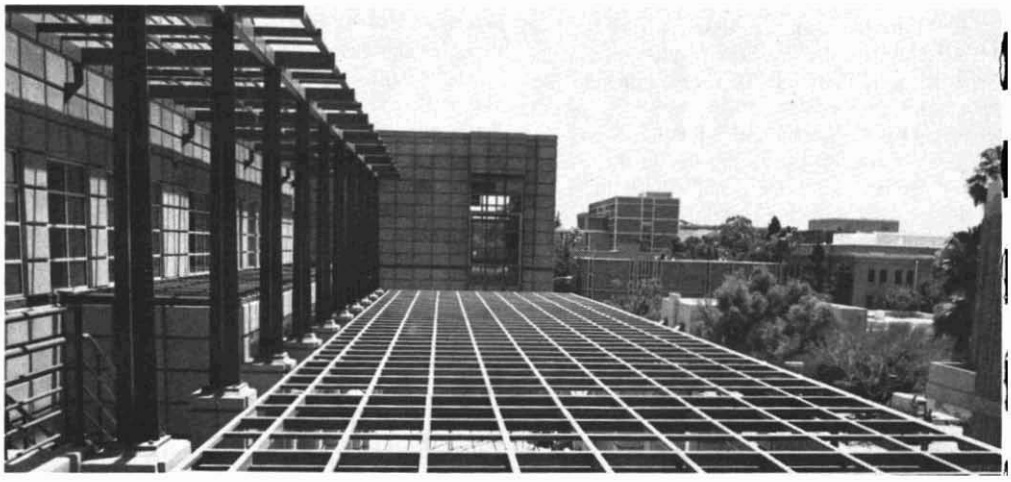
Upper-Division Programs. Admission to upper-division programs is competitive. Consult requirements for each major for details. Students applying to more than one program must make a separate application to each and must submit separate portfolios. Students not enrolled at ASU when they apply to upper-division programs must also make a separate application to the university. Students not admitted to the upper division are not dismissed from the university and may reapply or may transfer to other programs. Students who plan to reapply should contact the college academic advisor. Transfers into upper-division programs are considered only if vacancies occur and are limited to students with equivalent course work who are competitive with continuing students.

Graduate Programs. For admission to the graduate programs in the College of Architecture and Environmental Design, see requirements and procedures under the respective academic unit and the *Graduate Catalog*. Students must make separate applications and be admitted by both the Graduate College and the academic unit administering the degree program selected.

Advisement

While the college and its academic units provide academic advising, *it is ultimately the responsibility of each student to fulfill academic and program requirements*. Advising and recordkeeping for lower-division programs are the responsibility of the college academic advisor. Records for upper-division program students are kept in the appropriate academic units, and advising is by the faculty and the head of the academic unit. General career advising is available from all faculty members. Administration of program requirements is the responsibility of the head of the academic unit and the dean.

Appeals Procedures. Academic appeals and requests for variances are typically made first to the student's advisor and then, if necessary, to the head of the appropriate academic unit, the College Standards Committee, and, finally, the dean. A student who feels he or she has been unjustly treated in academic or other matters relating to his or her career as a student may contact the college academic advisor or may take his or her grievance to the college ombudsperson.



Degrees

Undergraduate. The college offers curricula leading to a four or five year undergraduate degree. Bachelor of Science in Design A student selects one of the following majors within the respective academic units.

MAJOR FIELD	DEGREE	SCHOOL/DEPARTMENT
Architectural Studies	B.S.D.	Architecture
Design Sciences	B S.D.	Design
Housing and Urban Development	B S.D.	Planning
Industrial Design	B.S.D.	Design
Interior Design	B.S.D.	Design
Urban Planning	B S D.	Planning

Each undergraduate program is divided into a lower division and an upper division program. Completion of a lower-division program does not guarantee advancement to an upper division program

Graduate. The Graduate College awards the master's degree to candidates who have successfully completed graduate programs offered in this college Four degrees are offered. the professional degree Master of Architecture (M.Arch), the professional degree Master of Environmental Planning (M.E.P.), the Master of Science (M.Sc.) degree with a major in Building Design, and the Master of Science in Design with majors in Industrial Design and Interior Design.

Degree Requirements

Students seeking the Bachelor of Science in Design degree must satisfactorily complete a curriculum of a minimum of 132 to 153 semester hours, depending on the major. These requirements include six hours of English proficiency and meet or exceed the University General Studies requirements.

Bachelor of Science in Design

Major in:	Semester Hours
Architectural Studies	134 or 135
Industrial Design	132
Interior Design	153
Design Science	132 or 153
Urban Planning	134
Housing and Urban Development	134

Dean's List. Undergraduate students who earn 12 or more graded semester hours "A," "B," "C," "D," or "E" during a semester in residence at Arizona State University with a grade point average of 3.50 or better are eligible for the Dean's List. A notation of achieving the distinction of being listed on the Dean's List appears on the final grade report for that semester

Special Honors at Graduation. At the time of graduation, students with academic distinction are awarded the respective designation *cum laude magna cum laude*, or *summa cum laude*. Also see university requirements for graduation with academic recognition, page 89 90.

General Studies Requirements

Each curriculum offered by the college meets or exceeds the General Studies requirements of the university. Courses are regularly reviewed to determine whether they meet one or more General Studies course credit requirements. See the listing of courses, pages 60–87.

The following key to General Studies credit abbreviations applies to each curriculum offered in the college.

Key to General Studies Credit Abbreviations

L1	Literacy and Critical Inquiry Core Courses (Intermediate level
L2	Literacy and Critical Inquiry Core Courses Upper division
N1	Numeracy Core Courses (Mathematics)
N2	Numeracy Core Courses (Statistics and Quantitative Reasoning
N3	Numeracy Core Courses (Computer Applications
HU	Humanities and Fine Arts Core Courses
SB	Social and Behavioral Science Core Courses
S1	Natural Science Core Courses Introductory)
S2	Natural Science Core Courses (Additional Courses
G	Global Awareness Courses
H	Historical Awareness Courses

Graduation Requirements

In addition to completing departmental degree requirements, students must fulfill university graduation requirements. Students must apply and pay a fee for a graduation requirements review.

Academic Standards

Lower-Division Retention Standards. A student in one of the college's lower division programs is placed on probation when he or she fails to maintain a cumulative grade point average (GPA) of 2.00. Students on probation must observe rules or limitations the college Standards Committee imposes on their probation as a condition of retention. If, after one semester on probation, the overall GPA is not at least a 2.00 and the conditions of probation have not been met, the student is disqualified for a minimum of two full academic semesters. Appeals may be made to the college Standards Committee. Also see university retention standards, pages 53-55.

Upper-Division Retention Standards. Students in upper division programs are placed on probation when they fail to meet *any* of the following requirements:

1. Failure, incomplete, or withdrawal from any required course;
2. A semester GPA below 2.00;
3. A grade of "D" or "E" in a design studio or a design laboratory;
4. Violation of the college *Code of Student Responsibilities* or any admission agreement.

Students on probation must observe rules or limitations that the Standards Committees or an academic unit places on their probation as a condition of continuation. Students are removed from a program if:

1. After one semester on probation, the requirements imposed are not met or the overall GPA is not above 2.00;
2. Failures or withdrawals in required courses are not resolved at the next offering of the course;
3. Failures or withdrawals from required sequential courses are not resolved;
4. Incompletes in required sequential courses are not completed before the first day of class of the next semester.

A student removed from a program is not guaranteed reinstatement in the program even if probation requirements or requirements placed on readmission are fulfilled. Appeals may be made first to the appropriate academic unit and, if necessary, to the college Standards and Appeals Committee. Also see university retention standards, pages 53-55.

Incompletes. It is the student's responsibility to contact the instructor regarding the process of requesting and fulfilling an incomplete. Tardiness in contacting the instructor may result in a failing grade. Students are to submit a written request for an incomplete to the instructor. This request must include a justification, a listing of requirements that have not been fulfilled, and a proposed schedule of completion. The instructor reviews the request, proposes modifications if necessary, and submits a copy of the request to the appropriate program head (for upper division students) or the college academic advisor (for lower division students). An incomplete in an upper division course that is a prerequisite for sequential courses automatically places the student on probation and denies enrollment in subsequent courses. Also see university requirements on incompletes page 51.

Withdrawals. University withdrawal regulations apply to lower division courses. In addition, because the college's upper division curricula are modular and sequential and space in the programs is limited, a student is expected to progress through the curriculum with his or her class. Withdrawal from a required upper division course automatically places a student on probation. Withdrawal from a required upper division course in a required sequence automatically removes the student from the program beginning the subsequent semester. Also see university requirements on withdrawals, pages 51-52.

Credit No Credit. The only courses accepted toward graduation with a grade of pass/fail or credit/no credit are transfer freshman composition courses, internships, and field studies.

Foreign Study. The College of Architecture and Environmental Design maintains active communications with several foreign institutions offering professional course work similar to the programs of the college. This opportunity is available for students who wish to pursue professional studies at a foreign institution in lieu of resident course work for up to a maximum of one academic year. Any interested student is encouraged to inform the head of his or her academic unit at the earliest possible date of any intentions for foreign study.

Exchange programs currently exist with the Universitat Stuttgart, West Germany, and the Universidad Autonoma de Guadalajara, Guada

lajara, Mexico. A foreign study program in London and summer off campus courses are offered by the School of Architecture.

Students are also encouraged to consider foreign travel for either a semester or an entire academic year. A leave of absence must be requested for foreign study and foreign travel. Each academic unit reserves the right to evaluate the content and the student's competency in each of the courses completed at foreign institutions.

Internships. Upper-division students in the college are required to complete an internship program during the summer, normally between the third and fourth year of study.

Student Responsibilities

Code of Student Responsibility. The purpose of this code is to promulgate standards of conduct for students of the College of Architecture and Environmental Design and to establish procedures for reviewing violations. Students are expected to support and maintain the highest professional standards with regard to their individual conduct and their personal and common environments in the college. Copies of the *Code of Student Responsibilities* are available from the Office of the Dean and the college academic advisor

Attendance. Attendance is expected at all classes, laboratories, and seminars and is a criterion for evaluating performance. Absences and missing work due to absences may result in failure of a course or academic probation. A student may not be excused from attending a class except for medical reasons or other serious personal conditions beyond his or her control. Requests for special consideration must be submitted in writing to the instructor. If accepted, a student may be allowed to take a late or special examination or submit missing work. Tardiness in contacting the instructor is cause for denying acceptance. Also see university policy regarding religious holidays, page 2.

Employment. It is difficult for students in professional programs to carry part time employment while in school. Acceptance to any of the college's upper division programs presumes a commitment of a minimum of eight hours a day for professional studies. Prior work experience is not a requirement for admission to upper division programs

Retention of Student Work. The college reserves the right to retain any or all projects or work submitted to meet course requirements for the college's future instructional, publication, and exhibition use.

Student Leave of Absence. Upper-division students who withdraw from classes or do not continue sequentially in enrollment must request both a leave of absence and readmission in writing from the head of the appropriate academic unit. Leaves of absence are for one year increments and may be approved for personal reasons, travel, work, or additional study in other disciplines. Students on leave must make their written request for readmission before May 1 for the fall semester of the year of return or before November 1 for the spring semester so that a space may be reserved Failure to request a leave of absence may result in removal from the program.

Special Programs

The college and its academic units regularly sponsor lecture series symposia and exhibits. In addition, there are regional and national meetings of educators and professionals that students and faculty attend. Academic units sponsor student awards programs and regularly invite professionals and critics to student reviews of student projects. The college also participates with the University Honors College and offers courses accepted in that college.

General Information

Accreditation. The program in architecture leads to the Master of Architecture degree, which is accredited by the National Architecture Accrediting Board. The Bachelor of Science in Design with a major in Interior Design is accredited by the Foundation of Interior Design Education and Research. The following programs maintain affiliations with the following accrediting agencies: Planning American Planning Association, American Society of Landscape Architects; Industria Design Industrial Design Society of America.

College of Architecture and Environmental Design Alumni Association. The College Alumni Association encourages graduates to contribute to the college by acting as liaisons among the college community, students, and practicing professionals. The college also calls on the members of the Architecture Guild of Arizona State for advice and to promote the goals of the college.

Council for Design Excellence. The Council for Design Excellence has been created to consolidate a partnership between the College of

Architecture and Environmental Design and key community leaders who share a vital interest in the development of high quality in the built environment of the Phoenix metropolitan area. By joining together professionals, business and civic leaders, students, and faculty in a common pursuit of design excellence, the council seeks to make a profound difference in the quality of life.

Affiliations. The College of Architecture and Environmental Design maintains active affiliations with the following organizations:

Architecture—Arizona Society of Architects, the Central Arizona and the Rio Salado Chapters of the American Institute of Architects, and the Association of Collegiate Schools of Architecture;

Industrial Design—the Industrial Designers Society of America;

Interior Design—the American Society of Interior Designers, the Interior Design Educators Council, and the Institute of Business Designers;

Planning—the American Planning Association, the Association of Collegiate Schools of Planning, and the American Society of Landscape Architects.

Student Professional Associations. The purpose of the student associations is to assist students with the transition into professional life and to acquaint them with the profession relating to their program of study. These include:

American Institute of Architecture Students
College of Architecture and Environmental Design Pre-Studies Organization
Student Association of Interior Designers
Student Chapter/American Planning Association
Student Chapter/American Society of Landscape Architects
Student Chapter/Industrial Designers Society of America

School of Architecture

REGENTS' PROFESSOR:
COOK

PROFESSORS:
PETERSON (AED 162D), BOYLE, ERIBES, McSHEFFREY, MEUNIER, RAPP, SCHLUNTZ

ASSOCIATE PROFESSORS:
CHRISTENSEN, EL DIASTY, McGINTY, McINTOSH, SCHEATZLE, SHEYDAYI, WU, ZYGAS

ASSISTANT PROFESSORS:
BERTELSEN, BURIAN, FIFIELD, FINDLEY, HARDIN, KIM, UNDERWOOD, WOOLSEY

PROFESSORS EMERITI:
ELLNER, HINSHAW, JAKOB, OLIVER, RUMMEL, STRAUB, WHIFFEN

Purpose

The architecture program at Arizona State University offers an integrated curriculum of professional courses and focuses on the design laboratory. The program reflects an awareness of the complex factors affecting the quality of the built environment. It seeks through scholarship, teaching, research, design, and community service to develop the discipline and the knowledge necessary to address the important environmental and design issues faced by society.

In addition to developing knowledge and skills in architectural design, building technology, and professional practice, students are expected to select electives to achieve an emphasis in one of several areas, including solar and energy-conscious design, computer-aided architectural design, architectural administration, urban design, and building technology.

Organization

The School of Architecture's program is organized by the faculty under the direction and administration of the director and standing committees of the faculty.

Degrees and Majors

The faculty of the School of Architecture offer three degrees: the Bachelor of Science in Design with a major in Architectural Studies, the Master of Architecture, and the Master of Science with a major in Building Design.

The six-year program in architecture culminates with the professional degree Master of

Architecture, which is accredited by the National Architectural Accrediting Board.

The professional level program in architecture consists of the final four years of course work, i.e., the final two years of the B.S. in Design degree and the two years required to complete the Master of Architecture degree.

In cooperation with the College of Business, a dual degree program, Master of Architecture/ Master of Business Administration, has been established. Students contemplating dual matriculation are advised to select electives appropriate to this program at the undergraduate level.

The degree Master of Science with a major in Building Design provides opportunities for advanced and specialized studies and research in building science. Areas of emphasis include computer-aided design, passive solar design and energy technology design, and analysis, and advanced architectural administration. Students entering this program typically have the professional Bachelor of Architecture or Master of Architecture degrees or undergraduate degrees in areas such as physics, engineering, or design. For particulars, see the *Graduate Catalog*

Admission

Lower-Division Program. New and transfer students who have been admitted to the university and who have selected Architectural Studies are admitted to the lower division architecture program without separate application to the School of Architecture. Completion of lower division requirements does not assure acceptance to the upper division professional program

Transfer credits for the lower division program are reviewed by the college faculty. To be admissible to this curriculum, transfer courses must be equivalent in both content and level of offering. A review of samples of work is required for studio classes. Consult the college academic advisor for an appointment

Entering lower division students who are not prepared to enroll in some of the required courses are required to complete additional university course work. These additional prerequisite courses do not apply to the Bachelor of Science in Design degree requirements.

Upper-Division Professional Program. Admission to the upper division, professional level program is competitive and limited by available resources. Admission is awarded to those applicants demonstrating the highest promise for professional success, including evidence of ability and prospect for future significant public service.

Transfer students who have completed the equivalent required lower division course work may apply to the upper division program. Prior attendance at Arizona State University is not required for application to the upper division program. Applicants who already hold a bachelor's degree in another field may be accepted to the upper-division program if they have accomplished the lower division requirements.

To be eligible for application to the upper-division program, the following is required

1. Admission to Arizona State University (note that application and admission to Arizona State University is separate from application and admission to the upper division program),
2. Completion of lower division requirements (a minimum of 63 hours or equivalents as approved by the college academic advisor and the faculty of the school;
3. A minimum university cumulative grade point average GPA of 3.00 as well as a 3.00 GPA based only on the required lower division courses or equivalents,
4. Submission of a portfolio (for detailed information about this requirement, see the following section, application procedures .

In an unusual circumstance, when the admission standard deficiency is slight, written evidence of extenuating circumstances is convincing, and promise for success is evident, a student may be granted admission to the upper division on a *provisional* basis

Students not admitted to the upper division program are not dismissed from the school and may reapply or may transfer to other programs Students who intend to reapply should meet with the college academic advisor

Applications for transfer into the upper division professional program are considered only if vacancies occur. Transfer applicants must demonstrate that equivalent course work has been completed, and applicants must be academically competitive with continuing students.

Students with a four-year degree, Bachelor of Science in Design (with a major in Architectural Studies or equivalent degree from another school that offers an accredited professional degree in architecture) should apply directly to the graduate program.

Advisement

Advising for the lower division curriculum is through the college academic advisor. Advising for upper division students is by assigned faculty advisors.

Degree Requirements

The degree Bachelor of Science in Design with a major in Architectural Studies requires a minimum of 134 hours of required and approved course work. Most lower division students pursue option A; however, those who intend eventually to seek an advanced degree in either engineering or building science are encouraged to fulfill the requirements outlined in option B.

The accredited professional degree Master of Architecture requires an additional 56 hours of approved graduate level course work. For detailed information consult the *Graduate Catalog*.

School of Architecture
Lower-Division Requirements
Option A

			Semester Hours
English (6)			
ENG	101	First Year Composition or ENG 105 if qualified	3
ENG	102	First Year Composition or HU elective if ENG 105	3
Literacy and Critical Inquiry (3			
COM	225	Public Speaking or approved communication substitute	3
Numeracy 2)			
MAT	210	Brief Calculus or advanced calculus substitute	3
STP	226	Elements of Statistics or PSY 230, QBA 221, SOC 390	3
CSC	181	Applied Problem Solving with BASIC or CSC 183	3
MAT	119	Finite Mathematics[2] or CSC 180	3
Humanities Fine Arts 13			
APH	100	Introduction to Environmental Design I	2
APH	101	Introduction to Environmental Design II[3]	2
Approved Humanities/Fine Arts Electives[3]			9
Social Behavioral Sciences 9			
ECN	112	Microeconomic Principles or ECN 111 Macroeconomic Principles	3
Approved Social/Behavioral Science Electives			6
Natural Sciences 8)			
PHY	111	General Physics[3]	3
PHY	113	General Physics Laboratory[3]	1
PHY	112	General Physics	3
PHY	114	General Physics Laboratory[3]	1
Studio Courses[3] 12			
AVC	141	Design Graphics	2
AVC	160	Freehand Perspective Drawing I	2
AVC	161	Freehand Perspective Drawing II	2
ADE	221	Design Fundamentals I	3
ADE	222	Design Fundamentals II	3
		Lower Division Minimum Total	63

Transfer credits are reviewed by the college and evaluated for admissibility to this curriculum. To be admissible, transfer courses must be equivalent in both content and level of offering.

This course satisfies a General Studies requirement. See the course description for specific requirement(s) the course fulfills.

Portfolio review is required for transfer studio work. See the college academic advisor for an appointment.

School of Architecture
Lower-Division Requirements
Option B

			Semester Hours
English 6)			
ENG	101	First Year Composition or ENG 105 if qualified	3
ENG	102	First Year Composition or HU elective if ENG 105	3
Literacy and Critical Inquiry 3			
COM	225	Public Speaking or approved communication substitute	3
Numeracy (19)			
MAT	290	Calculus I[2]	5
MAT	291	Calculus II	5
MAT	274	Elementary Differential Equations	3
ECE	105	Introduction to Languages of Engineering[3]	3
ECE	106	Introduction to Computer Aided Engineering[2]	3
Option B Engineering Requirements 2			
ECE	210	Engineering Mechanics I: Statics	2
ECE	312	Engineering Mechanics II Dynamics[4]	3
ECE	313	Introduction to Deformable Solids[4]	2
ECE	383	Probability and Statistics for Engineers[4]	2
Humanities Fine Arts (7			
APH	100	Introduction to Environmental Design I[2]	2
APH	101	Introduction to Environmental Design II	2
Approved Humanities/Fine Arts Electives			3
Social Behavioral Sciences (8			
ECN	112	Microeconomic Principles[3] or ECN 111 Macroeconomic Principles (3	3
Approved Social/Behavioral Science Electives			5
Natural Sciences 8			
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Laboratory I	1

PHY	131	University Physics II Electricity and Magnetism[2]	3
PHY	132	University Physics Laboratory II[2]	1

Studio Courses[5] (12)

AVC	141	Design Graphics	2
AVC	160	Freehand Perspective Drawing I	2
AVC	161	Freehand Perspective Drawing II	2
ADE	221	Design Fundamentals I	3
ADE	222	Design Fundamentals II	3

Lower Division Minimum Total 72

[1] Transfer credits are reviewed by the college and evaluated for admissibility to this curriculum. To be admissible, transfer courses must be equivalent in both content and level of offering.

This course satisfies a General Studies requirement. See the course description for specific requirement(s) the course fulfills.

[3] See prerequisites for ECE 105. These may be completed in high school.

[4] These courses may be taken at the upper division level as approved electives and are not required before admission to the upper division program. However, conflicts in course time can be avoided by taking them before applying to the upper division.

[5] Portfolio review is required for transfer studio work. See the academic advisor for an appointment.

School of Architecture
Upper-Division
Professional Program Requirements

Junior Year

			Semester Hours
Fall (17)			
ADE	321	Architectural Design/Process Determinants	3
ANP	331	Environmental Analysis	3
APH	313	History of Western Architecture I[1,2]	3
ATE	353	Architectural Construction I	3
ATE	361	Building Structures I[3]	3
AVC	301	Architectural Communication I	2
Spring (17)			
ADE	322	Architectural Design/Environmental Determinants	5
ANP	431	Architectural Programming Methods[4]	3
APH	314	History of Western Architecture II[2]	3
ATE	351	Environmental Control Systems I	3
ATE	362	Building Structures II[3]	3
Summer 3			
ARP	484	Clinical Internship	3

Senior Year

Fall 17			
ADE	421	Architectural Design/Human and Behavioral Determinants	5
APH	446	20th Century Architecture I[2]	3
ATE	461	Building Structures III[3]	3
ATE	452	Environmental Control Systems II	3
Approved Professional Emphasis Elective			3
Spring (17)			
ADE	422	Architectural Design Societal Determinants	5
APH	447	20th Century Architecture II	3
ATE	462	Building Structures IV[3]	3
ATE	451	Architectural Construction II	3
Approved Professional Emphasis Elective			3

Upper Division Total 71
B.S. Design Minimum Total 134

These courses may be completed before admission to the upper division. If already completed, a student may substitute an approved professional emphasis elective.

[2] This course satisfies a General Studies requirement. See the course description for specific requirement(s) the course fulfills.

[3] Approved substitute courses are accepted from the College of Engineering and Applied Sciences for option B students.

General Information

Upper-Division Professional Program Application Procedures. Students should write to the college academic advisor for the application form well in advance of the application deadline. For additional information on portfolios, ask for a copy of the *Portfolio Seminar* brochure from the college academic advisor.

Upper-Division Application Deadlines. *April 12* Portfolio and application documents are due in the School of Architecture office by 4.00 P.M.

June 14 If the spring 1991 semester includes transfer course work (i.e., course work taken at an institution other than Arizona State University), a student must submit his or her own transcripts to the School of Architecture no later than June 14. These transcripts may be unofficial copies. A second set of official transcripts must be sent to the university Office of Undergraduate Admissions. Application is not complete until the university receives official transcripts for transfer course work. (For those transfer students whose academic term ends in June rather than May, this deadline may be extended upon the written request of the applicant.)

July 1. Acceptance notices are mailed no later than July 1.

Return of Letter of Acceptance A signed receipt of acceptance of admission must be received by the School of Architecture by the date indicated on the Notice of Acceptance. Alternates may be accepted at a later date if space becomes available.

Matriculation An accepted student is expected to begin his or her upper division professional program at the beginning of the immediate fall term. There is no spring admission to the upper division.

Portfolio Format Requirements. Each applicant is responsible for obtaining the following documents and including them in the portfolio. Application materials are submitted at one time in a presentation binder (portfolio) with plastic sleeves (8 /2 x 11 ' format only). The student's name is to be affixed to the outside Items must appear in the following order:

Page One. Application form, completely filled out with page one visible. (Application forms are available from the college academic advising office.)

Page Two. Application form with page two visible.

Page Three. All high school transcripts. All of these should be put into one sleeve.

Page Four. College transcripts. All college transcripts for both ASU and transfer work should be included through the fall 1990 semester. Copies are acceptable. The academic advisor forwards 1991 ASU transcripts. (Those wishing to transfer spring semester 1991 work are responsible for submitting these transcripts by June 14 so that they may be added to their portfolios The student is also responsible for getting an official transfer transcript sent directly to the Office of Undergraduate Admissions)

Following Pages (usually 10–20 sheets). Sufficient examples of studio and laboratory work to show the depth of the student's design and drawing skills should be included. The student should also include freehand and hardline drawings and examples of two and three dimensional design and graphics, a concise caption for each item that explains the work, and a list of other pertinent information as applicable and the names of other team members, the length of the project, and course and project descriptions.

Students are encouraged to include additional materials, written or pictorial, that provide additional evidence of skills and abilities and of the aptitude and commitment to the major. When any work submitted is not completely original, the source must be given. When work is of a team nature, the applicant's role should be clearly indicated. Original examples or slides must not be submitted. All examples must be photographs or other reproduction graphic media.

Return of Portfolios. Application documents (pages one through five) remain the property of the School of Architecture. However, the remaining portfolio is returned after the admissions review, provided the applicant encloses a self addressed return mailer with sufficient prepaid postage. Portfolios may be claimed in person after July 16. If the applicant provides written permission, another person may claim the portfolio. After one year, unclaimed portfolios are discarded. While care is taken in handling the portfolios, no liability for lost or damaged materials is assumed by the college or the school.

Professional Emphasis Electives. A student, with the approval of his or her advisor, selects required upper-division professional emphasis electives from the following areas:

1. Architectural office management (also courses in the College of Business);
2. Construction technology and administration (also courses in the Department of Construction),
3. Landscape architecture (also courses in the Departments of Planning, Botany, and the School of Agribusiness and Environmental Resources);
4. Structural systems design (also courses in the College of Engineering and Applied Sciences);
5. Architectural history, theory, or preservation (also courses in art history in the College of Fine Arts, or philosophy in the College of Liberal Arts and Sciences),
6. Environmental research, analysis, and programming (also courses in the Departments of Sociology and Psychology);
7. Solar design and technology (also courses in the College of Engineering and Applied Sciences);
8. Energy conservation and adaptive reuse (also courses in the Department of Planning);
9. Urban and regional planning, environmental psychology, and sociology, interior architecture (also courses in the Department of Design);
10. Computer aided design (also courses in the Department of Computer Science);
11. Advanced architectural communication.

General Studies Requirements

The architecture curriculum exceeds the General Studies requirements of the university. For more information about University General Studies re

quirements, see pages 55–59. Specific courses in the curriculum that fulfill the required General Studies distribution requirements are indicated with a letter and number code. See page 59 or 205 for the key.

Courses

Subject matter within the school is categorized in the following instructional areas.

Architectural Administration and Management. AAD courses focus on the organizational and management aspects of architectural practice, including management coordination, administrative procedures, ethics, legal constraints, and the economics of practice.

Architectural Design and Technology Studios. ADE courses require the synthesis of knowledge and understanding gained from other course work and develop an understanding of design theory and design skill through a series of comprehensive design projects. Students apply analytical methods, compare alternative solutions, and develop sophisticated technical and conceptual results.

Architectural Philosophy and History. APH courses develop an understanding of architecture as both a determinant and a consequence of culture, technology, needs, and behavior in the past and present. Studies are concerned with theory as well as the rationale behind methods and results of design and construction. Case studies are both American and international.

Architectural Technology. ATE courses develop knowledge of the technical determinants, resources, and processes of architecture. These studies focus on the science and technology of design and construction, including materials, building systems, acoustics, lighting, structural systems, environmental control systems, computer applications to design and technology, and both passive and active solar systems. Emphasis is on measurable and quantifiable aspects.

Environmental Analysis and Programming. ANP courses develop the ability to analyze and program environmental and human factors as preconditions for architectural design using existing and emerging methods of evaluation and analysis.

Architectural Communication. AVC courses develop the student's understanding of communication theory as it applies to architectural design and practice as well as skills in drawing, graphics, photography, presentation design, and the design process.

Architecture Professional Studies. ARP courses provide students with residency and off campus opportunities, educational experience in group and individual studies relative to specific student interests, and faculty expertise, including summer internships and field trips.

Those courses that are required in the upper division and graduate levels of the professional program are not open to nonmajors or those not admitted to the upper division program.

ARCHITECTURAL ADMINISTRATION AND MANAGEMENT

AAD 551 Architectural Management I. 3 F
Organizational human performance, and market influences on the architecture firm and its projects. Readings, case studies, and analysis of managerial problems and solutions. Lecture discussion. Prerequisite: AAD 560 or instructor approval.

552 Architectural Management II. 3 S
Elements of project and financial management in architectural firms. Decision modeling resource planning, and control. Readings and case studies. Lecture, discussion. Prerequisite: AAD 560 or instructor approval.

553 Construction Contract Administration I. 2) F
Construction contract administration including budget control schedules cash flow changes and claims, and monitoring systems for traditional fast track and design build methods. 2 hours lecture, 3 hours laboratory including field trips. Prerequisite: AAD 560.

554 Construction Contract Administration II. 3) S
Advanced topics and problems in construction contract administration. Prerequisite: AAD 553 or instructor approval.

555 Architect as Developer. 3 F S
Development building real estate, construction funding and acquisition and the sources for capital. Prerequisite: instructor approval.

558 Specifications and Cost Analysis. 3 S
Coordination of working drawings construction specifications and cost estimates. Emphasis on methods office procedures contract conditions bonds and bidding procedure. Prerequisite: graduate evening standing or instructor approval.

560 Professional Practice I. 3 F
Professional practice issues including legal requirements ethics financial and marketing mechanisms, management, client relationships and new developments in practice. Prerequisite: admission to M.Arch. program or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

ARCHITECTURAL DESIGN AND TECHNOLOGY STUDIOS

ADE 221 Design Fundamentals I. 3 F
Exercises in basic visual organization: includes design vocabulary principles of 2D and 3D composition color and aesthetic reactions to design. 1 hour lecture, 6 hours studio. Prerequisite: major in college.

222 Design Fundamentals II. 3 S
App cat on of des gn fundamenta s to env ronmenta de s gn prob ems ntroduces human sca e performance cn tena, funct ona and aesthet c spat al organ zat on, and movement. 1 hour ecture 6 hours studio Prerequ s tes major n co ege; ADE 221 AVC 141, 160

321 Architectural Design Process Determinants. 3 F
Fundamenta s of arch tectura des gn prob em so v ng techn ques and the des gn process Invest gat on ana y s s synthesis, and deve opment of des gn projects Lec ture, studio, and f e d tr ps. Prerequ s te instructor ap prova

322 Architectural Design Environmental Determinants. 5 S
Bu d ng and s te des gn n response to s te, c imate and other env ronmenta determ nants Hous ng and other bu d ng types Lecture, stud o and f e d tr ps Prerequ s te ADE 321

421 Architectural Design Human and Behavioral Determinants. (5 F
Emphas s on the des gn of commun ty faci it es user needs and act vit es. Peop e and the r behavior as a pr mary arch tectura determ nant Lecture stud o and f eld tr ps Prerequ s tes: ADE 322, ARP 484

422 Architectural Design Societal Determinants. 5 S
Comprehens ve deve opment of mu t bu d ng comp exes re ating to commun ty cu tura and urban serv ces Em phas s on soc etal needs and expectat ons Lecture stu d o, and fie d tr ps. Prerequ s te ADE 421.

521 Advanced Architectural Design I. (5 F
Bu ld ng des gn w th n an urban context Lecture, stud o and f e d trips. Prerequ s te ADE 422 or approved equ va ent

522 Advanced Architectural Design II. 5 S
Bu d ng des gn wh ch ntegrates major bu ld ng systems n arge structures and comp exes Lecture stud o and f e d trips Prerequ s te ADE 521

532 Earth Sheltering Techniques. 3 S
Pr nc p es of earth shelter ng for energy conscious bu d ng nc ud ng or entation, structure nsu at on mo sture proof ng and bu ld ng codes Prerequ s te ATE 551

621 Advanced Architectural Design III. 5) F
Se ected top cs in comp ex bu d ngs Lecture, stud o and field tr ps Prerequ s tes: ADE 522 nstructor approva

622 Advanced Architectural Design IV. 5 S
Individual student n t ated f na stud o project emphas z ng a final synthes s of major arch tectura design determ nants Stud o Prerequ s tes: ADE 621 or equ va ent, n structor approva

661 Climatic and Solar Design. 4 F
Laboratory and f e d exper ence n arch tectura synthes s emphas z ng c mat c cr ter a and ana ys s w th emphas s on appropr ate techno ogy and pass ve thermal systems. Prerequ site: f rst profess ona degree or nstructor ap proval

662 Energy Efficient Design and Planning. (4 S
Laboratory and f eld exper ence n energy effic ent des gn emphasizing so ar energy and re ated renewab es n ur ban and inst tut ona comp exes for comfort prototypes Prerequ s te ADE 661.

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

ENVIRONMENTAL ANALYSIS AND PROGRAMMING

ANP 331 Environmental Analysis. (3 F
Ana ys s of natura and human env ronmenta determi nants as the bas s of the programm ng and des gn of the bu t env ronment Emphas s on s te and c mate ana ys s and andscape space theory Prerequ s te profess ona eve stand ng.

431 Architectural Programming Methods. 3 S
Theory and methods of arch tectura programm ng nc ud ng determ nants of arch tecture nformat on gather ng techn ques, program preparation, and methods of eva u at on Prerequ s te profess ona eve stand ng. *[Satisfies General Studies Requirement: L2]*

433 Building Codes and Ordinances. 3 N
Ana ys s of nat ona state and oca bu d ng codes and ord nances re at ve to the r mpact n arch tectura pro gramming, des gn and construct on documentat on

442 Site Planning Principles and Analysis. 3 S
Effects of topography, c mate, energy zoning and and scap ng upon des gn deve opment of externa spaces Programm ng and ana ys s and ntegrat on of arch tectura des gn to the s te and s te to the reg on

475 Computer Programming in Architecture. 3) F S
Computer programm ng for arch tectura prob ems and app cat ons Lecture ab Prerequ s te CSC 183 or equ va ent

477 Computer Applications to Design Problems. (3) F
Exam nat on of gener c m crocomputer software n so v ng arch tectura des gn prob ems Emphasis on the ogic of prob em formulat on Lecture, ab Prerequ s te nstructor approva

530 Computer Graphics in Architecture. 3 N
Fundamenta s of computer graph cs programm ng n arch tecture, ncluding graph cs hardware dev ce inde pendent packages, two and three d mens ona transfor mat ons and data structures 2 hours ecture 3 hours ab Prerequ s te ANP 475 or nstructor approval

535 Building Programming. 3 F
Des gn prob em def n t on nc ud ng c ent nterv ews t erature rev ew user needs analys s, ex st ng bu ld ng eva uat on, and program preparat on Prerequ site th rd profess ona eve in arch tecture or nstructor approva

561 Architectural Information Processing Systems. 3 S
App cat ons of nformat on process ng systems to arch tectura prob ems Ana ys s of comput ng too s w th re spect to assumpt ons and theor es Lecture ab Pre requ s tes graduate stand ng instructor approva

562 Information Systems for Facilities Management. 3 F
Introduct on to database des gn and mp ementation As sessment of faci ty management prob ems from nforma t on system po nts of view Sem nar ab Prerequ s tes ANP 477 or 561, graduate stand ng

576 Community Housing. (3) F
H story pract ces trends and forms of hous ng nc udes growth of pub ic programs, nationa and oca programs zon ng aw hous ng d stribut on p ann ng pr nc p es and po c es, des gn rev ew standards, and pr vate deve op ment pract ce

577 Housing Environments. (3) S
Contemporary housing environments, housing types and lifestyles as determined by user preference density, development and property standards cost community and privacy, security, identity movement and the need for open space

581 Urban Structure and Design. (3 F
The nature and dynamics of urban zation and its relation ship to architecture and urban design including growth, decay social zation, planning processes, and visual perception Case studies Prerequisite: professional level standing

681 Professional Seminar: Societal Influences on Architectural Practice. (2 F S
Examination of societal issues confronting the practice of architecture Seminar Prerequisite: graduate standing or instructor approval

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

ARCHITECTURAL PHILOSOPHY AND HISTORY

APH 100 Introduction to Environmental Design I. 2) F, S
Survey of environmental design including examples and the theoretical, social, technical and environmental forces that shape them *[Satisfies General Studies Requirements HU G H]*

101 Introduction to Environmental Design II. (2 F, S
Survey of environmental design issues responsibilities, and directions. *[Satisfies General Studies Requirements· HU H]*

300 World Architecture I/Western Cultures. 3 F
History and contemporary built environments of Western civilizations Mediterranean Europe and the Americas as manifestations of cultural history and responses to environmental determinants Non architecture majors only *[Satisfies General Studies Requirements G H]*

301 World Architecture II Eastern Cultures. (3 S
History and contemporary built environments of Eastern civilizations Mid East, Central Asia Far East and South Pacific as manifestations of cultural history and responses to environmental determinants *[Satisfies General Studies Requirements G H*

304 American Architecture. 3 N
Architecture in the U S. from earliest colonial times to present Non architecture majors only *[Satisfies General Studies Requirements HU H]*

305 Contemporary Architecture. (3 N
Europe and America from the foundations of the modern movement to the present. Non architecture majors only *[Satisfies General Studies Requirements HU G H]*

311 Survey of Mexican Architecture. 2 N
Overview of history through contemporary examples of Mexican architecture andscape, and urban design *[Satisfies General Studies Requirements HU, H]*

313 History of Western Architecture I. 3 F
Representative buildings and sites with emphasis on their physical and social settings from antiquity through the Middle Ages Prerequisite: standing or instructor approval *[Satisfies General Studies Requirements HU H]*

314 History of Western Architecture II. 3 S
Representative examples of architecture and urban design with emphasis on their social and historical contexts from the Middle Ages to the present Prerequisite: junior standing or instructor approval *[Satisfies General Studies Requirement H]*

348 Theory of Built Environments. 3 N
Focused study of built environmental forms, their theoretical foundations and relations to social processes Prerequisite: sophomore standing *[Satisfies General Studies Requirement· HU]*

411 History of Landscape Architecture. 3 F
The physical record of human attitudes toward the and Selected examples from ancient through contemporary and scape planning and design

414 History of the City. 3 F
The city from its ancient origins to the present day with emphasis on cities of Europe and America during the last five centuries

441 Ancient Architecture. 3 N
Architecture of the ancient Mediterranean world with selective emphasis on major historical complexes and monumental sites Prerequisite: APH 313 *[Satisfies General Studies Requirements. HU H]*

442 Preservation Planning. 3 F
Principles and practices in planning for preservation conservation and neighborhood redevelopment Emphasis on evaluation of historic resources Off campus field practicum required Prerequisite: instructor approval

443 Renaissance Architecture. 3 N
Selected examples of Renaissance architecture and urbanism with emphasis on their historical and cultural settings Prerequisite: APH 314 *[Satisfies General Studies Requirements HU H]*

444 Baroque Architecture. 3 N
Selected examples of Baroque architecture and urbanism with emphasis on relationships between architecture and other arts Prerequisite: APH 314 *[Satisfies General Studies Requirements HU H]*

445 19th-Century Architecture. 3 N
Architecture and urbanism in Europe and North America from the French Revolution to Art Nouveau Emphasis on the challenge of new materials and techniques in the context of revived and traditional architecture Prerequisite. APH 314 *[Satisfies General Studies Requirements HU H]*

446 20th-Century Architecture I. 3 F
Architecture in Europe and America from the foundations of the modern movement to the culmination of the international style Prerequisite may in college *[Satisfies General Studies Requirements HU, G H]*

447 20th-Century Architecture II. 3 S
Developments in architecture since the International style. Prerequisite APH 446 *[Satisfies General Studies Requirements. HU G H]*

681 Architectural Theory. 3 N
An examination of architectural theory. Emphasis on application of theory to practice Seminar Prerequisite in structor approval

682 Architectural Criticism. 3 N
An examination of architecture criticism emphasizing specific methods of criticism and their application for aesthetic judgment Seminar Prerequisite instructor approval

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

ARCHITECTURAL TECHNOLOGY

ATE 351 Environmental Control Systems I. (3 F
Architectural des gn mp cat ons of so ar rad at on heat and mo sture transfer Trends n env ronmenta contro and energy consc ous des gn Pass ve techn ques to heat, coo and ght 2 hours ecture, 3 hours ab Pre requis te· adm ssion to upper d v s on

353 Architectural Construction I. 3) F
Bas c materia s and methods of arch tectura construct on for res dent al scaled systems ncludes effects of zon ng and code requ rements Lecture ab. Prerequ s te adm s s on to upper d v s'on

361 Building Structures I. 3 F
Statics dynam cs and strength of materia s E ast c ty of structural materia s, propert es of sect ons, e astic stress ana ys s of determ nate structures computer app cat ons Pre m nary des gn of s mp e structura systems Lecture ab Prerequ s te adm ss on to upper d v s on

362 Building Structures II. 3 S
Analys s and des gn of wood and masonry structura sys tems and connect ons Latera ana ys s and des gn ut z ng shear wa s, and d aphragms n sma structures. Lec ture ab Prerequ s te ATE 361

451 Architectural Construction II. 3 F
Se ect on and emp oyment of mater a s and systems ac cord ng to the r nature and the techniques of the r use and bas c construct on· cost est mat ng procedures for arch tects. Lecture ab Prerequ s te. ATE 353

452 Environmental Control Systems II. 3 S
Arch tectura design mp cat ons of HVAC systems Heat ng and coo ng loads, psychrometr cs, the refr gerat on cyc e a r/water distribut on contro systems energy per formance standards, and ut ty rates 2 hours ecture 3 hours aboratory and f e d tr ps Prerequ s te ATE 351

461 Building Structures III. 3 F
Ana ys s des gn and deta ng of stee bu ld ngs and frames Latera ana ys s of sma r g d and braced frame systems Lecture, ab Prerequ s te ATE 362

462 Building Structures IV. 3 S
Ana ys s des gn, and deta ng of concrete systems con s der ng cont nu ty, mu t story frames and shear wa s and atera ana ys s Computer app cat on us ng ex st ng programs. Prerequ s te ATE 461

501 Introduction to Solar Energy. 3) S
ntroduct on to theoret ca and pract ca aspects of use of so ar rad at on and nocturna coo ng for contro of bu d ng env ronments

511 Energy Environment Theory. 3 F
H stor cal, contemporary, and pract ca nf uences of so ar and other resource systems on the des gned env ron ment arch tectura andscape urban and reg ona mp cations of resource strateg es other renewab e re sources.

521 Solar Energy Technology. 3 F
Ut zat on of so ar rad at on to meet the therma energy requirements of bu d ngs Prerequ site MAT 290 or equ va ent

522 Desert Habitation Technology. 3 F
Ana ys s of hab tat on approache n nontechno og ca and techno og ca soc et es ar s ng from the nature of des ert areas Prerequ s te. ATE 352

541 Solar Collector and Storage Design. 3) F
Fundamenta understand ng and practica app cat ons of so ar energy col ectors and storage to bu d ngs s empha s zed Prerequ s tes ATE 521 MAT 290

542 Building Thermal System Simulation and Optimization. 3) S
Mathemat ca mode s of bu d ng enve ope and comfort cond t on ng systems w l be developed to s mu ate bu d ng energy systems optim zat on techn ques are also pre sented Prerequ s te ATE 541

544 Solar Thermal Subsystem Design. 3 S
Fundamenta understand ng and pract ca appl cat ons of so ar subsystems such as contro s heat exchangers heat transfer f u ds n bu d ngs s emphas zed Prerequ s te. ATE 541

550 Passive Cooling in Buildings. 3 N
Theory, c ass f cat on and eva uat on of pass ve and ow energy coo ng systems for therma comfort n bu d ngs Prerequ s te ATE 452

551 Passive Heating. 3 F
Theory, c ass f cat on, and eva uat on of ow energy heat ng systems for therma comfort n bu dings Prerequ s tes ATE 452 521

552 Advanced Modeling of Passive Systems. 3 S
Advanced computer a ded eva uation techn ques to deter m ne env ronmenta nf uence on comfort n pass ve and ow energy heated and coo ed bu d ngs. Prerequ s te ATE 551 or nstructor approva

553 Building Systems I. 3 F
Pr nc p es of ght ng day ght ng, and acoust cs and the r app cat on n the des gn of bu ld ngs Prerequ s te ad m ss on to upper d v s on or nstructor approva

554 Energy Conservation in Buildings. 3 S
mpact of natura forces on the des gn of bu' d ngs em phas z ng pre des gn dec s ons and post construct on pract ces lead ng to m n mum energy consumpt on nves t gat on of new energy sources. Prerequ s te ATE 452

557 Construction Documents I. 3 F
Product on of arch tectura work ng drawings, ega status, organ zat on, ayout s te survey p ans sect ons, e eva t ons deta s, schedu es and coord nat on Laboratory, ecture Prerequ s te adm ss on to upper d v s on.

558 Bioclimatic and Energy Parameters for Buildings. 3 S
Ana ys s and eva uat on techn ques for des gn synthes s of energy re ated parameters n s te c mate, human com fort and bu d ng program Prerequ s te ATE 521.

560 Computer-Aided Energy Analysis. 3 N
Advanced and new a gor thms to ana yze environmenta prob ems w th emphas's on energy performance. Se ected top cs Lecture ab Prerequ s te ANP 475 or 477

562 Energy Efficient Systems Evaluation. 3 N
F e d performance data of act ve and pass ve so ar sys tems and components are compared w th fundamenta pr nc p es and formu at ons Prerequ s te ATE 521

582 Building Systems II. 3 S
Des gn of bu ld ng systems nc ud ng e ectrica p umb ng secur ty commun cat ons f re protect on and transporta t on. F e d tr ps 2 hour ecture 3 hours ab Prerequ s tes ATE 452 553

588 Building Structures V. 3 F
New deve opments n gh r se structura systems Effects of w nd and se sm c forces Pre m nary ana ys s des'gn and deta ng of ta bu d ngs us ng code requ rements, and computer app cat ons Lecture, ab Prerequ site ATE 462

Omnibus Courses. See pages 48 49 for omnibus courses that may be offered

ARCHITECTURAL COMMUNICATION

AVC 141 Design Graphics. 2 F, S, SS
Orthographic, para ne axonometr c and perspect ve pro ject on shades and shadows and bas c descr pt ve ge- ometry for des gners. 1 hour ecture, 4 hours stud o Pre requ s te: major in co ege

160 Freehand Perspective Drawing I. 2 F, S SS
Freehand perspect ve draw ng methods app ed to draw- ing ob ects and nter or and exterior env ronments in i ne and tone 1 hour ecture 4 hours stud o Prerequ site major n co ege

161 Freehand Perspective Drawing II. 2 F, S, SS
Cont nuat on of AVC 160 ntroduct on of co or med a and analyt ca and des gn draw ng exerc ses 4 hours stud o Prerequ s tes major n co ege· AVC 160

301 Architectural Communication I. 2) F
Basic graph c sk s draw ng convent ons, va ues, graph c symbols and etter ng, sketch ng, and presentat on vo cabu ary 2 afternoons n aboratory per week Lecture and f e d trip Prerequ s te· adm ss on to upper d v s on

410 Architectural Presentation Techniques. 3 F S
Spec a techn ques of graph c commun cat ons as pre m nary presentat on too s for the des gn profess ona Pre requ s te AVC 301 or nstructor approva

411 Architectural Watercolor Presentation Tech- niques. 2 N
Introduct on of arch tectura presentation techn ques us ng waterco or as a pr mary med a Emphas s on co or com pos t on and techn que Prerequ s te AVC 301 or n structor approva

444 Architectural Photography. 2 3 N
Use of photography as a means of arch tectura study eva uat on, and record Introduct on to 35mm camera and darkroom techn ques Lecture aboratory. Prerequ s te. nstructor approva

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

ARCHITECTURE PROFESSIONAL STUDIES

ARP 451 Architecture Field Studies. 1–6 F, S SS
Organ zed f e d study of arch tecture n spec f ed national and nternat ona ocations Cred t/no cred t May be re 'peated w th approva of d rector

484 Clinical Internship. (3 SS
Ful -t me nternsh p under the superv s on of pract tioners in the Phoen x area or other oca es Credit/no cred t Pre requ s te nstructor approva

684 Professional Internsh p. 2–6 S
Fie d exper ence n an arch tectura f rm spec a z ng in an area d rect y re ated to the student s advanced study In tegrat on of theory and state f the art pract ces Cred t/ no cred t. Prerequ s te nstructor approva

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

Design

PROFESSORS:
WOLF (AED 154B), BUSH, KROEL NGER, REZN KOFF
ASSOCIATE PROFESSORS:
BLEY, KNIGHT, NIELSEN, W TT
ASSISTANT PROFESSORS:
BRANDT, D C CCO, JOHNSON, RATNER, SADLER, VERNON
PROFESSORS EMERITI:
BENZINGER, QUESADA, STREUFERT

Purpose

The Department of Design educates designers for a professional world that needs informed and developed talent The curricula emphasize preparation in building bridges between the academic world and the professions. The facu ty believe that the designers have a responsibility to the public and the communities that they serve the student learns not only the history and theory of the professions and their practical application, but an understanding of systems, functions, scientific, and technical data related to public welfare, safety, and human factors Students integrate aesthetic values into the products and spaces they design and consider the aspirations of the world in which they live. The goal is to create the best design curricula possible and to develop techni cally accomplished and conceptually sophisti cated graduates who continue to evolve as prac ticing professionals. With the help of an interna tional network and a faculty of active design pro fessionals, the aim is to educate creative individu als who will achieve a comprehensive under- standing of both products and interiors as related to the different cultures in which they exist.

Organization

The Department of Design offers three profes- sional programs: Industrial Design, Interior De sign, and Design Science. The programs are or- ganized by the faculty of the department under the direction and administration of the chair.

Degrees and Majors

The faculty of the Department of Design offer the degree Bachelor of Science in Design. Three ma jors are available· Industrial Design, Interior De sign, and Design Science.

Industrial Design. Industrial Design is primarily concerned with how humans perceive and use designed objects. The discipline of industrial design has been defined as the professional service of creating and developing concepts and specifications that optimize the appearance, function, and value of products and systems for the mutual benefit of both the user and the manufacturer This service is often provided in the context of a cooperative working relationship with other members of a development group. The industrial designer's contribution places special emphasis on human characteristics, needs, and interests that require detailed understanding of visual, tactile, safety, and convenience criteria. Industrial designers combine these considerations with practical concern for technical processes, manufacturing requirements, economics, and marketing, including distribution, sales, and service.

Interior Design. The program in Interior Design is accredited by the national accrediting agency, the Foundation for Interior Design Education Research. The five year curriculum emphasizes design process, technical skill development, problem solving, and the management skills needed to work in collaborat on with the allied design professions. The goal is to create high quality environments for human use

Significant changes in the interior design profession over the last two decades are reflected in the program The department is committed to integrating computer technology into each level of the curriculum In doing so, the program offers an excellent environment for experimenting with and testing innovative applications of computer aided design and simulation to interior design.

Design Science. The Design Science major is an individualized upper division program of study for students who are academically above average and who have specific academic and professional goals that are not achievable in the department's two other programs. Design Science majors select either an industrial design emphasis program tota of 132 hours) or an interior design emphasis (program total of 153 hours) and do not necessarily take studio or laboratory courses An internship is a part of each curriculum.

Admission

Lower-Division Program. New and transfer students who have been admitted to the university and who have selected Industrial Design or Interior Design as a major are admitted to the appropriate lower division program. Transfer credits for the lower-division program are reviewed by the college and evaluated as admissible to this curriculum. To be admissible, transfer courses must be equivalent in both content and level of offering A review of samples of work is required for studio classes. Consult the college academic advisor for an appointment.

Entering lower division students who are not ready to take some courses in the curriculum (for example, algebra and trigonometry or a second course in computer programming) are required to take additional courses that do not apply to the Bachelor of Science in Design degree. If these courses are needed, it may take an additional year to complete the lower division program

Completion of lower division requirements does not assure acceptance to an upper division professional program

Upper-Division Program. When students have completed the lower division curriculum requirements, they may apply for acceptance to upper-division programs in Industrial Design, Interior Design, or Design Science. The limited number of spaces available each year are awarded to applicants with the highest promise for professional success. The faculty of the Department of Design retain the right to admit any meritorious student who may be deficient in a published departmental criteria. Such admission requires an extraordinary review of the applicant by the department's admissions committee Should the faculty choose to admit such an applicant, the student is placed automatically on a provisional admission status with stipulations as to what is required to be removed from probation. For detailed information about application requirements, see pages 221 222

Students not admitted to upper division programs are not dismissed from the university and may reapply or may transfer to other programs. Students who intend to reapply should meet with the college academic advisor.

Applicants for admission to the upper division Design Science program follow the same time table as Interior and Industrial Design students. Application is made directly to the department chair. Applications must include a proposed curriculum developed in conjunction with a faculty advisor that is acceptable to the department faculty. Applicants must fulfill lower division program requirements in either Industrial Design or Interior Design.

Advisement

Advising for the lower division curriculum is through the college academic advisor. Advising

for the upper division curriculum is by faculty advisors and the credentials evaluator.

Degree Requirements

The degree Bachelor of Science in Design requires the following minimum number of hours of required and approved courses for its majors.

Bachelor of Science in Design

Major in:	*Semester Hours*
Industrial Design	132
Interior Design	153
Design Science	132 or 153

The program includes required field trips. Students are responsible for these additional costs. Foreign study opportunities are available for honors students. An internship is a required part of the program.

Industrial Design. The curriculum in Industrial Design is divided into a lower division and an upper division program:

	Semester Hours
Lower Division Program	62
Upper Division Program	70
Total	132

The lower-division curriculum balances a foundation in academic subjects such as English, algebra and trigonometry, computers, and physics with departmental courses that include history as well as studio courses in drawing, design fundamentals, human factors, and materials and processes.

The upper division curriculum includes studio and laboratory work in industrial design, graphics, material design, professional practice, and a number of approved program electives. A supervised summer internship is a part of the curriculum.

Upper division studios emphasize projects which promote an interdisciplinary approach to solving problems and which develop the student's intellectual understanding of the philosophy and direction of methods and theories related to industrial design. Problems proceed from small consumer products with simple task functions to larger and more complex problems and systems. Studio projects also emphasize the design processes: problem resolution through concept ideation, dialogue with specialists in related areas, and product development, presentation, and marketing.

Graduates of the program accept entry level positions in industry and firms doing product and packaging design. They may focus on consumer products, transportation, electronics, medical devices, health products, recreational products, or materials application, among others. Students may also choose to continue their education with graduate studies to enrich their design skills, to specialize, or to prepare for college level teaching.

Industrial Design

Lower-Division Requirements[1]

Freshman Year

			Semester Hours
Fall (14)			
ENG	101	First Year Composition	3
		or ENG 105 if qualified	
MAT	117	College Algebra[2]	3
COM	207	Introduction to Communication Inquiry[2]	3
		or COM 222 or COM 225	
DSC	100	Introduction to Environmental Design[2]	2
DSC	160	Visualization for Industrial Design	3
Spring (18)			
ECN	112	Microeconomic Principles[2]	3
ENG	102	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry[2]	3
PGS	100	Introduction to Psychology[2]	3
DSC	101	Contemporary International Design[2]	3
DSC	161	Vocabulary for Industrial Design	3

Sophomore Year

Fall (16)			
PHY	111	General Physics[2]	3
PHY	113	General Physics Laboratory[2]	1
DSC	227	Visual Methods for Problem Solving	3
DSC	242	Materials and Design	3
DSC	260	Industrial Design I	3
DSC	316	20th Century Design I[2]	3
Spring (15)			
DSC	228	Imaging and Visualization	3
DSC	243	Process and Design	3
DSC	261	Industrial Design II	3
DSC	317	20th Century Design II[2]	3
DSC	344	Human Factors in Design	3
		Lower Division Total	63

Transfer credits for the lower division program must be equivalent in both content and level of offering. Samples of studio work must be provided for evaluation. See the college academic advisor for an appointment.

[2] This course satisfies a General Studies requirement. See the course description for specific requirement(s) the course fulfills.

Industrial Design
Upper-Division Requirements
Junior Year

Fall (17)		Semester Hours
DSC 318	History of Graphic Design	3
DSC 327	Presentation Graphics	3
DSC 354	Principles of Product Design	3
DSC 360	Industrial Design II	5
Approved Technology Elective[2]		3
Spring (16		
DSC 328	Graphic Design	3
DSC 355	Material Design	3
DSC 361	Industrial Design IV	5
DSC 483	Pre Internship Seminar	1
Approved Natural Science Elective with Approved Laboratory[1]		4
Summer 3)		
DSC 484	Internship	3

Senior Year

Fall (17)		
ENG 301	Writing for the Professions	3
DSC 460	Design Project I	5
DSC 470	Professional Practice for Industrial Design	3
Approved Numeracy Elective[1]		3
Humanities or Social and Behavioral Science Elective[1]		3
Spring (16		
DSC 461	Design Project II	5
DSC 474	Industrial Design Seminar Studio	3
Approved Program Elective[2]		2
Humanities or Social and Behavioral Science Elective		6
	Upper Division Total	69
	B S Design Minimum Total	132

This course satisfies a General Studies requirement See the course description for specific requirement(s) the course fulfills

[2] A list of courses that fulfill approved program and technology electives is available from the departmental academic advisor

Interior Design. The curriculum in Interior Design is divided into a lower division (first and second year) and an upper division program (third, fourth, and fifth years).

	Semester Hours
Lower Division Program	56
Upper Division Program	97
Total	153

The lower division curriculum balances a foundation in academic subjects such as English, algebra and trigonometry, computer technology, and physics with departmental courses that include history and theory, as well as studio courses in drawing, design fundamentals, and conceptual design.

The upper division curriculum includes studio work in interior design, furniture design, construction methods/structures, codes as related to materials and finishes, human factors, environmental control systems, as well as lecture courses in the history of interior design, decorative arts, and textiles. An eight week supervised summer internship is a part of the curriculum. The fifth year is an interdisciplinary year in which students address real life environmental problems.

Graduates from the program accept entry level professional positions in a variety of settings, including interior design firms, department of space planning, or interior design in architectural firms, public institutions or industry. Students may also choose to continue their education through graduate studies which offer greater enrichment in studio disciplines and which contribute to the possibility for postsecondary level academic appointments, giving the recipients highly sought after academic credentials.

Interior Design
Lower-Division Requirements
Freshman Year

Fall 14		Semester Hours
ENG 101	First Year Composition or ENG 105 if qualified	3
MAT 117	College Algebra	3
DSC 100	Introduction to Environmental Design[2]	2
DSC 170	Visualization for Interior Design	3
Elective		3
Spring (14		
ENG 102	First Year Composition or HU elective if ENG 105	3
MAT 118	Precalculus Algebra and Trigonometry[2]	3
DSC 171	Vocabulary for Interior Design	3
DSC 223	Introduction to Interior Design[2]	2
Social and Behavioral Science Elective		3

Sophomore Year

Fall (13)		
PHY 111	General Physics[2]	3
PHY 113	General Physics Laboratory[2]	1
CSC 181	Applied Problem Solving with BASIC[2]	3
DSC 220	Media for Design Development	3
DSC 231	Concepts for Interior Design	3
Spring (16)		
ARS 102	Art of the Western World II	3
COM 207	Introduction to Communication Inquiry	3

DSC 235 User Needs and Behavior in Interior Design 3
Approved Humanities or Social and Behavioral Science Elective* 3
Natural Science Elective with Laboratory[2] 4
Lower Division Total 57

[1] Transfer credits for the lower division program must be equivalent in both content and level of offering Samples of studio work must be provided for evaluation. See the college academic advisor for an appointment.

[2] This course satisfies a General Studies requirement See the course description for specific requirement(s) the course fulfills

Interior Design
Upper-Division Requirements
Junior Year

			Semester Hours
Fall (17)			
CON	366	Construction Methods	3
DSC	310	History of Interior Design I	3
DSC	340	Interior Codes: Public Welfare and Safety	3
DSC	364	Interior Design Studio I	5
Approved Humanities or Social and Behavioral Science Elective			3
Spring (15)			
DSC	311	History of Interior Design II	3
DSC	341	Interior Materials and Finishes	3
DSC	344	Human Factors in Design	3
DSC	365	Interior Design Studio II	5
DSC	483	Pre Internship Seminar	1
Summer 3			
DSC	484	Internship	3

Senior Year

Fall (17)			
ENG	301	Writing for the Professions	3
DSC	412	History of Decorative Arts in Interiors	3
DSC	442	Specifications and Documents for Interiors	3
DSC	464	Interior Design Studio III	5
Humanities or Social and Behaviora Science Elective			3
Spring (16			
DSC	413	History of Textiles in Interiors	3
DSC	458	Lighting for Interior Design	3
DSC	465	Interior Design Studio IV	5
Social and Behavioral Science Elective			3
Elective			2

Fifth Year[2]

Fall (14)			
DSC	421	Concept and Style in Presentation Documents	3
DSC	446	Furniture Design and Production	3
DSC	457	Acoustics for Interior Design	3
DSC	466	Interior Design Studio V	5
Spring (14)			
DSC	467	Interior Design Studio VI	5
DSC	472	Professional Practice for Interior Design	3
Approved Terminal Project Elective			3
Elective			3
Upper Division Total			96
B S. Design minimum Total			153

[1] This course satisfies a General Studies requirement See the course description for specific requirement(s) the course fulfills

[2] During the fifth year, the student concentrates on research related to the development of a comprehensive project This year is self directed in nature and prepares the student for independent thinking and creative problem solving The fifth-year experience requires high expectations for producing professional work that represents the culmination of the major's academic experience. It should be noted that the fifth year studio sequence is designed to draw majors from the upper division programs of industrial design architecture and planning, thus furthering a real life interdisciplinary problem solving experience

General Information

Upper-Division Application Procedures. Students should write to the academic advisor for the application form well in advance of the application deadline. For general information on portfolios, ask for a copy of the *Portfolio Seminar* brochure from the college academic advisor.

Upper-Division Application Deadlines. *April 12* Portfolio and application documents are due in the department office by 4:00 P.M.

June 14 If the spring 1991 semester includes transfer course work, this is the deadline by which a student must submit his or her own transcripts to the department These transcripts may be unofficial copies. A second set of official transcripts must be sent to the university Office of Undergraduate Admissions. Application is not complete until the university receives official transcripts for transfer course work.

July 1 Acceptance notices are mailed.

July 15 (1) Return a letter of acceptance A signed receipt of acceptance of admission must be received by the department by this date. (2) Alternates are notified of admission status. (3) Portfolios are available for return.

Matriculation. An accepted student is expected to begin his or her upper division professional

program at the beginning of the immediate fall term. There is no spring admission to the upper division.

Portfolio Format Requirements. Each applicant is responsible for obtaining the following documents and including them in the portfolio. Application materials are submitted at one time in a presentation binder (portfolio) with plastic sleeves (8½ x 11" format only). The student's name is to be affixed to the outside. Items must appear in the following order

Page One. Application form, completely filled out with page one visible. Application forms are available from the college Academic Advising Office.)

Page Two Application form with page two visible.

Page Three. All high school transcripts. All of these should be put into one sleeve.

Page Four. College transcripts. All college transcripts for both ASU and transfer work through the fall 1990 semester. Copies are acceptable. The academic advisor forwards spring 1991 ASU transcripts. (Those wishing to transfer spring semester 1991 work are responsible for submitting these transcripts by June 13 so that they may be added to their portfolios. The student is also responsible for getting an official transfer transcript sent directly to the Office of Undergraduate Admissions.)

Page Five Evidence of admission (or readmission) to ASU. This may be a copy of the ASU Certificate of Admission or a Student Information System printout showing enrollment status, obtained at a Registrar's Site.

Following Pages (usually 10–20 sheets). Sufficient examples of studio and laboratory work to show the depth of design and drawing skills should be included. The student should also include freehand and hardline drawings and examples of two and three dimensional design and graphics, a concise caption for each item that explains the work, and a list of other pertinent information as applicable, including names of other team members, the length of the project, and course and project descriptions.

Students are encouraged to include additional materials, written or pictorial, that provide additional evidence of skills and abilities and of aptitude and commitment to the major. When any work submitted is not completely original, the source must be given. When work is of a team nature, the applicant's role should be clearly indicated. Original examples or slides must not be submitted. All examples must be photographs or other reproduction graphic media.

Return of Portfolios. Application documents (pages one through five) remain the property of the department However, the remaining portfolio is returned after the admissions review, provided the applicant encloses a self addressed return mailer with sufficient prepaid postage. Portfolios may be claimed in person after July 16. If the applicant provides written permission, another person may claim the portfolio. After one year, unclaimed portfolios are discarded. While care is taken in handling the portfolios, no liability for lost or damaged materials is assumed.

General Studies Requirements

The Interior Design and Industrial Design curricula meet the General Studies requirements of the university. For more information about University General Studies requirements, see pages 55 59. For a key to the letters and numbers on each list of degree requirements see pages 59 or 205.

DESIGN

DSC 100 Introduction to Environmental Design. (2) F, S
Survey of environmental design including historic examples and the theoretical, social, technical, and environmental forces that shape them *[Satisfies General Studies Requirements. HU, G H]*

101 Contemporary International Design/Theory. (3 S
Survey of contemporary European American, and Asian design in light of historical events economic forces, cultural values, and aesthetic ideals 3 hours lecture. Prerequisite DSC 100 *[Satisfies General Studies Requirements HU, G]*

160 Visualization for Industrial Design. (3) F
Drawing as related to basic form description and color relationships 1 hour lecture 2 hours studio Prerequisite. major in college

161 Vocabulary for Industrial Design. 3) S
Forms in space, color systems color schemes Contemporary drawing media two and three dimensional models. 1 hour lecture 2 hours studio Prerequisite DSC 160 or equivalent

170 Visualization for Interior Design. 3 F
Development of an understanding of drawing space and product· sequential development of two and three dimensional drawing skills 1 hour lecture, 4 hours lab Prerequisite major in college

171 Vocabulary for Interior Design. 3) S
Projects in the vocabulary of design color composition, character and form as related to design Two and three dimensional graphic representation. 1 hour lecture 4 hours lab Prerequisite DSC 170

220 Media for Design Development. (3 F
Graphic representation methods used to describe and analyze space, emphasis on quick presentation techniques. 6 hours studio Prerequisite DSC 171

223 Introduct'on to Interior Design 2 S
nter ors ssues, theor es and ph osoph es Emphas s on subject ve and ob ect ve ana ys s of prob ems of des gn and the r so ut ons *[Sat sf es Genera Stud es Requ re ment· HU]*

226 Color Sketching. 3 F S
Fe t markers· qu ck representat ona and concept com mun cat on sketch ng Forms n space ght and shade Mater a ref ectance propert es 6 hours stud o Prerequ s tes DSC 161 or equ va ent, ndustr a Des gn ma or

227 Visual Methods for Problem Solving. 3 F
ntroduct on to conceptua des gn act v ty based on the m nd eye med a feedback oop Graph c anguage used to represent conjecture ana ys s synthes s of ob ects and the r contexts. Se nar st d o Prerequ s te DSC 161 or equ va ent

228 Imag ng and Visualization. 3 S
Des gn act v t es stress ng graph c anguage abstract o pract ced for presentat on Structure of cr t c sm nc ud ng descr pt on nterpretat on, and eva uat on are d scussed Sem nar, stud o Prerequ s te DSC 227

231 Concepts for Interior Design. 3 F
Conceptua des gn deve opment sca e and proport on ght, texture form vo ume and spat a h erarchy pas sage and repose. 1 hour ecture 4 hours ab Prerequ s te· DSC 171

235 User Needs and Behav'or in Interior Design. 3 S
App cat ons of conceptua des gn to ssues of program n ng and space p ann ng user needs and behav or 1 hour ecture 4 h urs ab Prerequ s te DSC 231

242 Materials and Design. 3 F
Mater a s app cat on n des gn ntroduct on to character st cs and propert es of meta s organ c mater a s nc ud ng p ast cs and n rgan c mater a s 3 hours ecture

243 Process and Design. 3 S
nf ue ces of nd str a process ng on des gn ntroduc t on to bas c mater a s pro ess ng and post form ng proc esses Emphas s on appeara e enha cement and de gn constra nts of mater a process ng 3 hour ecture Prerequ s te DSC 242

260 Industrial Design I 3 F
ntroduct on to the method and process of the ndustr a des gner Determ nants necessary n sma product de gn 1 hour ecture 2 hours stud o Prerequ s te DSC 161 or equ va ent

261 Industrial Design II. 3 S
ssues of phys ca form deve opment re ated to product a d des gn form deve opment propert es of paper f bers wood meta a d p ast s 1 hour ecture 2 hours stud o Prerequ s te DSC 260 or equ va ent

310 History of Inter'or Design I. 3 F
The des gn of nter or spaces as express n of cu tura n fuences to 1835. Pre equ s te ARS 102 or nstructor approva *[Sat sf es Genera Stud es Requ rements HU H]*

311 History of Interior Design II. 3 S
Des gn of interiors as an expre s on of cu tura nf uences rom 1835 to the present Prerequ s te DSC 310 or n tructor approva *[Sat sf es Genera Stud es Requ re ment H]*

316 20th-Century Design I. 3 F
Moder European and Amer can des gn from 1900 to 1940 Emphas s on transportat'on product furn ture ex b tion and graph c des gn *Sat sf es Genera Stud es Requ rements HU H]*

317 20th Century Design II. 3 S
Modern European As an and Amer can des gn s nce 1940 Emphas s on transportat on product, furn ture ex h b t on and graph c des gn *[Sat sf es Genera Stud es Requirements HU H]*

318 History of Graphic Design. 3 F
Survey of deve opment n the graph c arts nnovat ve pr nt ng methods aesthet c va es and soc a and u tura e v ronments that shape them *[Sat sf es Genera Stud es Requ rement HU]*

327 Presentation Graphics. 3 F
Methods for portfo o a d profess na prod ct presenta t on us ng graph c med a for nformat on tra sfer are stud ied Aesthet c udgement rgan zat on and craftsman sh p are stressed. Sem nar stud o Prerequ s te DSC 228

328 Graphic Design. 3 S
Packag ng app cat ons and p ann ng are nvest gated and app ed to the deve opment of an dent ty fo a product ne structured as a system Lab Prerequ s te. DSC 327

340 Interior Codes: Public Welfare and Safety 3 F
Codes and regu at ons as performance cr ter a for nter or des gn

341 Interior Mater als and Finishes. 3 F
Genera ana ys s of qua ty contro measures re at ng to nter or des gn mater a s f n she and performance c te r a Prerequ s te DSC 340

344 Human Factors in Design. 3 F
Man mach ne env ronment systems human character s t cs and behav or app ed to des gn of products systems a d the r operat ng env ronment

354 Princ ples of Product Design. 3 F
nf ue ces of phys ca and mechan ca concepts n prod uct des gn mechan sms k emat s and fasten ng sys tems Concepts of ana ys s for product des gn nf u ences of concepts on aesthet cs 3 hour ecture Pre requ s tes MAT 117 PHY 111

355 Material Design. 3 S
Mo d des gn for part requ rement mo ded ho es threads nsert , fasten ng and jo n ng, deco at ng extrus on de s gn re nforced p ast cs Prerequ s te DSC 354

360 Industrial Design III. 5 F
Methods of v sua th nk g conceptua zat on and dea t n re ated to bu d ng sk eve s n profess ona des gn presentat on techn ques 10 hours stud Prerequ s te department approva

361 Industrial Design IV 5 S
Emphas s on deve op ng deas nto a comp ete funct ona p oduct nc ud ng survey and app cat on of aesthet cs human factors mater a s and manufactur ng 10 hours stud o Prerequ te DSC 360

364 Interior Design Stud o I. 5 F
Stud o prob ems n nter or des gn re ated to behav ora response n pe sona and sma group space 10 hours stud o P erequ s te department approva

365 Interior Design Studio II. 5 S
Stud o prob ems n nter or de gn w th emphas s o s sues of pub c and pr vate use of nter or p aces of assem b y 10 h urs tud o Prerequ s te depart ent approva

367 Electronic Packaging. 3 N
ndustr a des gn prob ems n packag ng e ect on c de v ces. Empha s s p aced on packag ng d sp ays and contro s Prerequ s te nstructor approva

412 History of Decorative Arts in Interiors. (3) F
The des gn of decorative arts as an express on of cu tura nf uences and as an extens on of nter or spaces Pre requ s te. DSC 311 or nstructor approva *[Sat sfies Genera Stud es Requirement HU]*

413 History of Textiles in Interior Design. 3) S
Cu tura and h stor cal express on of text es as re ated to nter ors May nc ude f e d tr ps. Prerequ s te DSC 412 or nstructor approva

421 Concept and Style in Presentation Documents. 3 F
Methods of ana yz ng portfo io des gn for nter ors Form ng presentat on concepts and estab sh ng a communica t ons sty e Prerequ s te senior stand ng

442 Specifications and Documents for Interiors. 3) F
Contract spec f cat ons, documents, schedu es and b d d ng procedures for nter or des gn Prerequ s tes DSC 341, 365

446 Furniture Design and Production. 3 F
Des gn construct on cost est mat ng and nsta at on n nter or furn ture and m lwork 1 hour lecture, 4 hours stu d o Prerequ s te DSC 465

455 Environmental Control Systems. 3 N
Methods of spec fy ng and construct ng systems that con trol the sensory nput from the amb ent env ronment. Lec ture and f e d tr ps Prerequ s tes MAT 117, 118 PHY 111 113, sen or stand ng

457 Acoustics for Interior Design. 3 F
Phys ca propert es of sound. Stud es perta n ng to sound absorb ng mater a s construct ons and room acoust cs Prerequ s tes MAT 118 PHY 111, 113 sen or stand ng.

458 Lighting for Interior Design. 3 S
L ght as an aspect of nterior des gn Eva uat on of ght sources for d str bution co or, and cost Prerequ s te sen or stand ng

460 Design Project I. 5 F
Complete ana ys s of the product un t as an e ement of mass product on featur ng market ng, techno ogy, human factors and v sua des gn Emphas s on profess ona standards 10 hours stud o. Prerequ s te: DSC 361

461 Design Project II. 5 S
Product des gn w th emphas s n systems nteract on Cu m nat on of des gn process and techn que nd v dua proj ect d rect on s encouraged. 10 hours stud o Prerequ s te DSC 361

464 Interior Design Studio III. 5 F
Stud o prob ems n nter or des gn re ated to commerc a spaces 10 hours stud o Prerequ s te: department ap proval

465 Interior Design Studio IV. 5) S
Stud o prob ems n nter or des gn related to health and educat ona fac t es 10 hours stud o Prerequ s te de partment approva

466 Interior Design Studio V. 5) F
Advanced nter or des gn prob em so v ng design theory, and cr t c sm Thes s project deve opment based upon the major s concentrat on 10 hours stud o Prerequ site department approva

467 Interior Design Stud o VI. 5 S
Advanced ser es of spec a zed projects or cont nuat on of thes s project based upon the major's concentrat on 10 hours stud o Prerequ s te department approval

470 Professional Practice for Industrial Design. (3) F
Business procedures management techniques account ng systems eth cs and ega respons b t es of the de s gn profess ons. May be repeated for cred t Prerequ s te sen or stand ng

472 Professional Practice for Interior Design. 3 S
Business procedures, project contro fee structures, pro fess ona product ab l t es Prerequ s te sen or stand ng

474 Industrial Design Seminar Studio. 3 S
Large sca e nterd sc p nary c ass project nvo v ng project p ann ng and control, design prototype deve opment fea s b l ty study and report ng Sem nar, stud o Prerequ s tes: sen or stand ng, nstructor approva

483 Pre-Internship Seminar. (1 S
Preparat on of nternsh p mater a s that produce and en hance a successful nternsh p experience Sem nar Pre requ s te third year major n the department

484 Internship. 3 SS
Fu time summer nternsh p under superv s on of pract t oners n the Phoen x area or other oca es Prerequ s te nstructor approval

520 Design Forecasting: Methods and Applications. 3) N
Projected app cat ons in des gn product on, p ann ng, and dec s on mak ng processes Lecture, sem nar Prerequ s tes: DSC 310 311 or equ va ent

522 Facilities Planning and Management I. (3) N
The fac ty management process n large sca e organ za t ons Plann ng ong range forecast ng and product v ty Project management methodo og es us ng m cro based software programs

523 Facilities Planning and Management II. 3) N
The format on of fac l t es po c es procedures, and stan dards The fac l t es database space a oca t ons and management process Eva uat on of programm ng crite r a

524 Illumination and Acoustics. 3 N
Research and laboratory nvest'gat on of advanced l um nat on and acoustics ssues of bu d ng des gn Emphasis on human factors and performance aspects Prerequ s tes DSC 457 458; or equ valent.

525 Design Methodologies. 3) N
Pract ca exerc ses and stud es n prob em so v ng strate g es; prob em def n t on and support ng theory for the de signer. Lectures, sem nars ab

527 Modern Design Theory. (3 N
Aesthet c, pol t ca econom c, and socia theor es that have shaped modern des gn theory as the bas s for de s gn ph osoph es. Lectures, sem nars Prerequ s te DSC 525 or equ valent

529 Design Criticism. 3 N
Cr t ca methods app ed to des gn as mater a cu ture and human express on, eva uat on of ach evement versus n tent on Lecture, sem nar. Prerequ s te. DSC 527 o equ va ent

544 Human Factors Systems and Documentation. 3) N
Advanced top cs associated w th theory and methods o human factors in des gn. nd v dua projects stress ng prob em organ zat on evaluat on, and documentat on Lectures sem nars ab Prerequ s te DSC 344 or equ va ent

552 Computer Simulation in Design. 3 S
The use of computer graph cs as a med um to deve op and present mages of the env ronment for ana ys s and percept on Lecture lab

553 Computer Imaging and Visual Perception. 3 S
ssues and app cat ons of computer s mu ation as a too for descr b ng and test ng human nterface w th the env - ronment Lecture, ab

558 Daylighting. (3) SS
Day ghtng as a des gn determ nant, concepts, tech niques, methodo ogy, exper ments, and case stud es Lecture, studio

580 Practicum: Methods of Teaching Design. 3 N
Background and deve opment of des gn educat on theo r es. Concepts of stud o teach ng methods Comprehen s ve student project deve opment and eva uat on meth ods.

591 Seminar: Graduate Design. 3 N
Des gn cr t c sm, human env ronment prob ems des gn educat on socio ogy of des gn, occupat ona safety and hea th human factors Part c pant presentat ons. Lec ture, sem nar

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered.

Also consu t Off Campus Academ c Services brochures for special course offer ngs

Planning

PROFESSORS:
STEINER (AED 158A LAI
ASSOCIATE PROFESSORS:
K M, W LL AMS
ASSISTANT PROFESSORS:
COOK, PIHLAK
PROFESSOR EMERITUS:
ELMORE

Purpose

The faculty of the Department of Planning offer a curriculum that provides an education for careers in urban and regional development, landscape architecture, and urban design. The goal of the faculty is to advance the profession of planning through scholarship, teaching, research, and com munity service.

Planners work on projects that range in scale from site and landscape development to the design of entire communities and the formulation of policies that shape urban and regional growth. Planning graduates work for both private firms and government agencies. Their work typically involves fields such as land use planning, hous ing, natural resource management, urban trans portation, development controls, and environ mental impact assessment.

Organization

The Department of Planning offers two under graduate professional programs: Urban Planning (with a concentration in landscape architecture or urban planning) and Housing and Urban Devel opment In addition, a professional graduate pro gram in environmental planning is offered. The programs are organized by the faculty of the de partment under the direction and administration of the chair.

Degrees and Majors

The faculty of the Department of Planning offer the undergraduate degree Bachelor of Science in Design and the graduate degree Master of Envi ronmental Planning. The Bachelor of Science in Design includes the following majors and con centrations: the major in Urban Planning with a concentration in landscape architecture or urban planning and the major in Housing and Urban Development.

Urban Planning (with Concentrations in Landscape Architecture or Urban Planning). The B.S. in Design with a major in Urban Plan ning requires four years of study. Following two years of preparatory work, students take two years of courses that include site planning, land scape architecture, urban design, comprehensive planning, socioeconomic and environmental analysis, computer and analytical methods, plan ning law, and public policy formulation and ad ministration. An internship is required between the third and fourth years Many students con tinue to specialize in planning at the graduate level Students select from two concentrations: landscape architecture and urban planning.

Students in the landscape architecture concen tration explore the reasons for and the techniques involved in the analysis, planning, and design of the environment, both natural and built. Students in the urban planning concentration are exposed to the theories, methods, and interdisciplinary approaches of the profession of urban planning.

Housing and Urban Development. This major familiarizes students with housing technology and housing planning and development in both the public and private sectors. Students inter ested in this upper division program should con tact the department chair for more information.

Master of Environmental Planning. The De partment of Planning offers a concentration in urban planning with elective areas in urban plan ning and urban design under the Master of Envi ronmental Planning degree (M.E.P.). The M.E.P. is a professional planning degree This concen-

tration is a two-year program and includes a three-hour summer internship or approved elective and a six-hour thesis or research project, for a total of 54 semester hours. For further information, see the *Graduate Catalog*.

Admission

Lower-Division Program. New and transfer students who have been admitted to the university and who have selected a program in the Department of Planning as a major are admitted to the lower-division program. Transfer credits for the lower-division program are reviewed by the college and evaluated for admissibility to this curriculum. To be admissible, transfer courses must be equivalent in both content and level of offering. A review of samples of work is required for studio classes. See the college academic advisor for an appointment.

Completion of lower-division requirements does not assure acceptance to the upper-division professional program. Admission to the upper division is competitive and limited to the space available. Admission requires formal application and acceptance.

Upper-Division Program. Admission to the upper-division programs of the Department of Planning is limited to applicants who have completed the lower-division program requirements and who are determined by the admissions committee to have the best potential for academic success. Spaces in the program are limited by available facilities, faculty, and qualified applicants. A lower-division program GPA of 3.00 may be required. For detailed information about application requirements, see pages 228–229.

Students not admitted to upper-division programs are not dismissed from the university and may reapply later or may transfer to other programs. Students who plan to reapply should meet with the college academic advisor.

Applications for admission to the upper-division Housing and Urban Development program are made directly to the department chair. Applications must include a proposed curriculum developed in conjunction with a faculty advisor and acceptable to the department faculty.

Advisement

Advising for the lower-division curriculum is through the college academic advisor. Advising for the upper-division curriculum is by the department chair and faculty advisors.

Degree Requirements

The degree Bachelor of Science in Design requires the following minimum number of hours of required and approved courses for its majors.

Bachelor of Science in Design

	Semester Hours
Lower-Division courses	65
Upper-Division courses	
Core	34
Approved Electives	32
Internship	3
Total	134

Department of Planning
Lower-Division Requirements

			Semester Hours
English (6			
ENG	101	First Year Composition .... or ENG 105 if qualified	3
ENG	102	First Year Composition .. .. or HU elective if ENG 105	3
Literacy and Critical Inquiry (6			
Literacy and Critical Inquiry Electives			6
Numeracy (6)			
MAT	118	Precalculus Algebra and Trigonometry[2]	3
Approved Statistics or Quantitative Reasoning[2]			3
Humanities and Fine Arts (10)			
PUP	100	Introduction to Environmental Design I[2].	2
PUP	101	Introduction to Environmental Design II[2]	2
Approved Humanities and Fine Arts Elective[2]			3
Approved Humanities and Fine Arts Elective[2] or Social and Behavioral Science Elective			3
Social and Behavioral Sciences (6)			
ECN	112	Microeconomic Principles[2] 3	
Approved Social and Behavioral Science Elective[2]			3
Natural Sciences (8)			
Approved Natural Science Lab (S1)[2]			4
Approved Natural Science Lab (S2)[2]			4
Electives (10)			
Electives			11
Design Communication Courses[3] (12)			
AVC	141	Design Graphics 2	
AVC	160	Freehand Perspective Drawing I. 2	
AVC	161	Freehand Perspective Drawing II 2	
ADE	221	Design Fundamentals I	3
PUP	322	Planning Methods Using Computers[3]	3
Lower Division Minimum Total 65			

[1] Transfer credits are reviewed by the college and evaluated for admissibility to this curriculum. To be admissible, transfer courses must be equivalent in both content and level of offering.

[2] This course satisfies a General Studies requirement See the course description for specific requirement(s) the course fulfills.

[3] Portfolio review is required for transfer studio work. See the college academic advisor for an appointment

Department of Planning
Upper-Division
Professional Program Requirements
Junior Year

			Semester Hours
Fall (17)			
PLA/PUP	361	Landscape Design I/ Planning Design I (Site Planning 5	
PUP	301	Introduction to Urban Planning ..... or approved concentration elective if previously taken	3
PLA	301	Introduction to Landscape Architecture . . . . or approved concentration elective if previously taken	3
Approved Concentration Electives[2]			6
Spring (17)			
PLA/PUP	362	Landscape Design II/Planning Design II Urban Design 5	
PUP	264	Planning Communication	3
PUP	446	Urban Design	3
PUP	424	Planning Research Methods . .	3
Approved Concentration Electives[2]			3
Summer (3)			
PLA/PUP	484	Internship or approved elective	3

Senior Year

Fall 17)			
PLA/PUP	461	Landscape Design III Planning Design III Urban Planning	5
PUP	494	Special Topics Proposal Writing ..1	
PUP	432	Planning and Development Control Law	3
Approved Concentration Electives[2] 8			
Spring (15)			
PLA/PUP	462	Landscape Design IV/ Planning Design IV (Independent Project	5
PUP	494	Special Topics Professional Practice 1	
Approved Concentration Electives[2] 9			
Upper Division Minimum Total 69			
B.S. Design Minimum Total ... .134			

[1] This course satisfies a General Studies requirement See the course description for specific requirement s) the course fulfills

[2] Courses that fulfill approved concentration electives for the concentrations should be selected in consulta tion with departmental advisors

Major: Urban Planning

Concentration: Landscape Architecture (PLA). Students in the landscape architecture concentration explore the reasons for and the techniques involved in the analysis, planning, and design of land and the exterior environment, both natural and built. Students may fulfill this concentration's requirements by taking a minimum of 32 semester hours of electives approved by the faculty advisor for the landscape architecture concentration.

Major: Urban Planning

Concentration: Urban Planning (PUP). The concentration in urban planning exposes the student to the theories, methods, and interdisciplinary concerns of the urban planning field. Students may fulfill this concentration's requirements by taking a minimum of 32 semester hours of electives approved by the faculty advisor for the urban planning concentration.

General Information

Upper-Division Application Procedures. Students should write to the college academic advisor for the application form well in advance of the application deadline. For additional information on portfolios, ask for a copy of the *Portfolio Seminar* brochure from the college academic advisor.

Upper-Division Application Deadlines. *April 12* Portfolio and application documents are due in the department office (AED 158) by 4:00 P.M.

June 14 If the spring 1991 semester includes transfer course work, this is the deadline by which a student must submit his or her transcripts to the department. These transcripts may be unofficial copies. A second set of official transcripts must be sent to the university Office of Undergraduate Admissions. The application is not complete until the university receives official transcripts for transfer course work.

July 1 Acceptance notices are mailed by this date.

July 16. (1) The letter of acceptance must be returned. A signed receipt of acceptance of admission must be received by the department by this date. (2) Alternatives are notified of admission status. (3) Portfolios are available for return.

Matriculation An accepted student is expected to begin his or her upper division professional program at the beginning of the immediate fall term. There is no spring admission to the upper division.

Portfolio Format Requirements. Each applicant is responsible for obtaining the following documents and including them in the portfolio. Application materials are submitted at one time in a presentation binder (portfolio) with plastic sleeves (8 x 11' format only). The student's name is to be affixed to the outside. Items must appear in the following order:

Page One Application form, completely filled out with page one visible. (Application forms are available from the college Academic Advising Office.)

Page Two Application form with page two visible.

Page Three. All high school transcripts. All of these should be put into one sleeve.

Page Four College transcripts. All college transcripts for both ASU and transfer work should be included through the fall 1990 semester. Copies are acceptable. The academic advisor forwards spring 1991 ASU transcripts. (Those wishing to transfer spring semester 1991 work are responsible for submitting these transcripts by June 14 so that they may be added to their portfolios. The student is also responsible for getting an official transfer transcript sent directly to the Office of Undergraduate Admissions.)

Page Five Evidence of admission (or readmission) to ASU. This may be a copy of the ASU Certificate of Admission or a Student Information System printout showing enrollment status, obtained at a Registrar's Site.

Following Pages usually 10–20 sheets). Sufficient examples of studio and laboratory work to show depth of design and drawing skills should be included. The student should also include freehand and hardline drawings and examples of two- and three-dimensional design and graphics, a concise caption for each item that explains the work, and a list of other pertinent information as applicable, including names of other team members, the length of the project, and course and project descriptions.

Students are encouraged to include additional materials, written or pictorial, that provide additional evidence of skills and abilities, and of aptitude and commitment to the major. When any work submitted is not completely original, the source must be given. When work is of a team nature, the applicant's role in the project should be clearly indicated. Original examples or slides must not be submitted. All examples must be photographs or other reproduction graphic media.

Return of Portfolios. Application documents (pages one through five remain the property of the department. However, the remaining portfolio is returned after the admissions review, provided the applicant encloses a self-addressed return mailer with sufficient prepaid postage. Portfolios may be claimed in person after July 16. If the applicant provides written permission, another person may claim the portfolio. After one year, unclaimed portfolios are discarded. While care is taken in handling the portfolios, no liability for lost or damaged materials is assumed.

General Studies Requirements

The curriculum for majors in Urban Planning meets the General Studies requirements of the University. For more information about University General Studies requirements, see pages 55 59. For a key to the letters and numbers on each list of degree requirements, see page 59 or 105.

Inquiries

For further information on the lower division or upper division programs in planning, contact the College Academic Advisor, College of Architecture and Environmental Design, Arizona State University, Tempe, Arizona 85287 1605

URBAN PLANNING

PUP 100 Introduction to Environmental Design I. 2) F, S
Survey of environmental design includes historic examples and the theoretical social technical and environmental forces that shape them 2 hours lecture *[Satisfies General Studies Requirements HU G H]*

101 Introduction to Environmental Design II. 2) F S
Survey of environmental design issues responsibilities and directions 2 hours lecture *[Satisfies General Studies Requirements: HU H]*

264 Planning Communication. 3 S
Communication techniques for urban planning and landscape architecture presentations. Prerequisites ADE 221 AVC 141, 160

300 The Planned Environment. (3 F
Aesthetic, social, economic political and other factors influencing urban development in the 20th century

301 Introduction to Urban Planning. 3 F S SS
Theoretical and practical aspects of city planning Interrelationships among physical planning environment government and society *[Satisfies General Studies Requirement L1]*

320 Theory of Built Environments. (3) N
Focused study of built environmental forms their theoretical foundation and relation to social processes 3 hours lecture Prerequisite sophomore standing *[Satisfies General Studies Requirement HU]*

322 Planning Methods Using Computers. (3) F
Planning methods using database, word processors, spreadsheets CAD and mapping packages on microcomputers

361 Planning Design I. (5 F
Site Planning Analysis of natural and cultural features site systems and implications on site planning and design. Studio Prerequisite. department major or instructor approval

362 Planning Design II. (5 S
Urban Design: Analysis of urban form and design implications within an urban context Studio Prerequisite PLA/PUP 361 or instructor approval

412 History of the City. 3 N
The city from its ancient origins to the present day Emphasis on European and American cities during the last five centuries *[Satisfies General Studies Requirement H]*

424 Planning Research Methods. (3) F
Tools useful for urban planning research; emphasis on research design and survey methods Prerequisite PUP 301 or instructor approval

432 Planning and Development Control Law. 3 F
Case studies on police power eminent domain, zoning subdivision controls, exclusion preservation, urban redevelopment and aesthetic and design regulation

433 Building Codes, Zoning Ordinances, and Subdivision Regulations. (3 F
Analysis of national, state and local building codes, zoning ordinances and subdivision regulations relative to local planning and development

442 Environmental Planning. 3) N
Environmental planning problems, including flood plains, water quality and quantity, soil and hazardous waste, air quality, lands design and noise Field trips Prerequisite PUP 301 or instructor approval

444 Preservation Planning. (3 N
Principles and practices in planning for preservation, conservation and neighborhood redevelopment. Emphasis on evaluation of historic resources Off campus field practicum required Prerequisite instructor approval

446 Urban Design. (3) S
Analysis of the visual and cultural aspects of urban design. Theories and techniques applied to selected study models

461 Planning Design III. 5 F
Urban Planning Collection and analysis of economic social and environmental data relevant to urban planning development of and use plans Studio Prerequisite PLA/PUP 362 or instructor approval

462 Planning Design IV. (5) S
Independent Project Students select and develop projects relating to topics of individual interest or designed specialization Studio Prerequisite. PLA/PUP 461 or instructor approval

484 Internship. 3) F S SS SS1 only)
Full time internship under the supervision of practitioners in the Phoenix area or other local Credit/no credit Prerequisite department major or instructor approval

520 Planning Theories and Processes. (3) S
Review of past and current theoretical developments related to social change perspectives, the role and ethics of planners Prerequisite instructor approval.

532 Advanced Urban Planning Law. (3) S
Advanced study on selected issues in planning law, such as urban design controls, exclusionary practices, compensable regulation, and tax policy. Prerequisite: PUP 432 or instructor approval.

544 Urban Land Use Planning. (3) N
Theory and methods of urban land use planning, including the rational planning process, comprehensive, functional, and neighborhood plans. Prerequisite: PUP 301 or instructor approval.

572 Urban Planning Practicum I. (5) F
Comprehensive planning workshop dealing with actual problems in an Arizona community. Data gathering and analysis; formulation and recommendation of alternative plans and policies. Prerequisite: PUP 520 or instructor approval.

574 Urban Planning Practicum II. (5) N
Applied workshop emphasizing large-scale, physical project planning by either a public agency or private enterprise. Prerequisite: PUP 572 or instructor approval.

584 Internship. (3) F, S, SS (SS1 only)
Internship under the supervision of practitioners in the Phoenix area or other locales. Credit/no credit. Prerequisite: admission to regular graduate student standing or instructor approval.

622 Urban Statistical Analysis. (3) S
Quantitative analysis in the urban context, demographic analysis, data processing, planning application, and urban systems. Prerequisite: PUP 424 or instructor approval.

642 Land Economics. (3) S
Economic determinants for urban and regional planning; analytical techniques, elementary market analysis, and feasibility studies; economic incentives in urban planning. Prerequisite: instructor approval.

644 Public Sector Planning. (3) N
Urban fiscal problems and public goods provision in state and local governments. Prerequisites: one course in microeconomics; instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

HOUSING AND URBAN DEVELOPMENT

PUD 442 Construction Administration II: Commercial. (3) N
Emphasis on field observation of construction, shop drawings, reports, and materials testing. Meetings, records, field orders, schedules, arbitration of disputes, architect's responsibilities to client during construction, applications for payment, and project closeout.

LANDSCAPE ARCHITECTURE

PLA 301 Introduction to Landscape Architecture. (3) S, SS
The relevance of landscape architecture to the creation of humanized environments, with emphasis on natural factors.

310 History of Landscape Architecture. (3) N
Physical record of human attitudes toward the land. Ancient through contemporary landscape planning and design. *[Satisfies General Studies Requirement: H]*

359 Resort and Recreational Design. (3) F
Interrelationships of social, economic, and physical aspects of total tourist resort design; emphasis on physical development of tourist centers and resort areas.

361 Landscape Design I. (5) F
Site Planning: Analysis of natural and cultural features; site systems and implications for site planning and design. Studio. Prerequisite: department major or instructor approval.

362 Landscape Design II. (5) S
Urban Design: Analysis of urban form and design implications within for urban context. Studio. Prerequisite: PLA/PUP 361 or instructor approval.

432 Plant Materials. (3) N
Natural components of landscape design; characteristics, applications, selection, and use. Field trips.

442 Landscape Construction and Materials. (3) F
Characteristics of materials and methods used in landscape architectural construction.

444 Landscape Architecture Site Preparation. (3) N
Landscape construction drawings focusing on site transformations. Topics include grading, earthwork computations, roadway alignments, and layout. Prerequisite: admission to department's professional level or instructor approval.

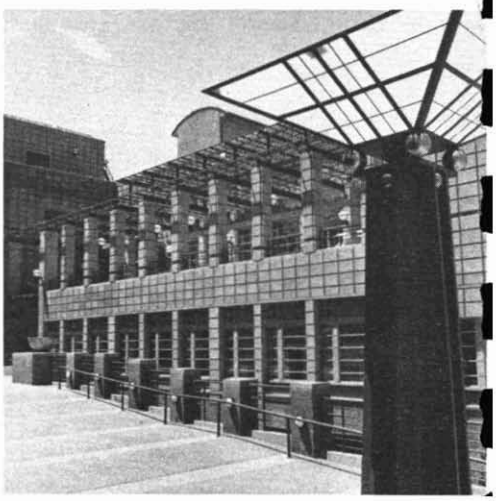
446 Landscape Structures and Systems. (3) N
Landscape construction drawings for structures and systems, including wood construction, retaining walls, irrigation systems, planting, specifications, cost estimating, contract administration. Prerequisite: PLA 444 or instructor approval.

461 Landscape Design III. (5) F
Urban Planning: Collection and analysis of economic, social, and environmental data relevant to urban planning; development of land use plans. Studio. Prerequisite: PLA/PUP 362 or instructor approval.

462 Landscape Design IV. (5) S
Independent Project: Students select and develop projects relating to topics of individual interest or desired specializations. Studio. Prerequisite: PLA/PUP 461 or instructor approval.

484 Internship. (3) F, S, SS (SS1 only)
Full-time internship under the supervision of practitioners in the Phoenix area or other locales. Credit/no credit. Prerequisite: department major or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



College of Business

John Kraft, Ph.D.
Dean

Purpose

The primary objective of the College of Business is to prepare students for positions of responsibility in the business community. The undergraduate and graduate degree curricula are designed to provide: (1) a background of general education helpful to informed, thinking citizens; (2) a mastery of basic business tools and skills and an understanding of business procedures; and (3) a specialized and professional knowledge of a selected field of business. To attain these objectives in the undergraduate program, the curriculum has been devised so that the student completes 50% of work in general education and other non-business courses and 40% in courses offered by the College of Business, with the remaining 10% selected from either area by the student in consultation with his or her advisor.

The college is a member of the American Assembly of Collegiate Schools of Business (AACSB), the official accrediting organization in the field of business administration. The undergraduate and graduate programs and the School of Accountancy of the College of Business are accredited by this organization.

The college is host to a chapter of Beta Gamma Sigma, a national society that recognizes high academic achievement in AACSB accredited schools. Election to Beta Gamma Sigma is the highest scholastic honor a student in business administration can earn.

In addition to the regular degree curricula, other programs of study in the college are designed to meet special needs. Evening and continuing education courses are conducted for qualified persons who are regularly employed and who otherwise would be unable to enroll in college courses Short courses and institutes on a noncredit basis are organized in cooperation with various business groups for the furtherance of in service training of employed personnel.

Organization

The courses offered by the College of Business are organized into groups so that a related sequence may be established for the various subject fields. For administrative purposes, these fields are organized into the following academic units: Accountancy; Decision and Information Systems; Economics; Finance; General Business; Management; Marketing; and Purchasing, Transportation, Operations.

The School of Health Administration and Policy offers a master's degree program designed to prepare qualified individuals for management careers in hospitals, group practices, health maintenance organizations, consulting firms, long term facilities, and other health services organizations.

The Center for Business Research collects, analyzes, and disseminates information on the economy and business climate of Arizona. Analyses of gross state product, prices, income, employment, real estate activity, and demographic data for Arizona are made available to businesses and the general public The center coordinates interdisciplinary sponsored research efforts that provide useful information to business and a learning experience for students and faculty researchers.

The Economic Outlook Center serves as the economic forecasting unit of the college and is responsible for the publication of *Arizona Blue Chip* and *Western Blue Chip* monthly newsletters. The center sponsors seminars and workshops on the national and regional economies.

The Center for Advanced Purchasing Studies (CAPS) is a national affiliation agreement between the College of Business at ASU and the National Association of Purchasing Management.

CAPS conducts in depth research into the problems facing the purchasing profession today and the requirements of the future.

The Center for Office Automation Research (COAR) provides computer systems and management technology research support to businesses, government agencies, and other organizations. Organizations seeking information on the latest management technology issues such as computer systems development, desktop publishing, presentation graphics, image-processing technologies, executive information systems development, white collar productivity, ergonomic office design, and telecommunications may use COAR's ergonomically designed research laboratory in the College of Business. In addition to the COAR Research Laboratory, organizations may participate in COAR activities through published reports, electronic database services, electronic mail services, seminars, audio and video teleconferences, and on site training and development programs.

The Center for Financia System Research serves the national financial, policy making, and academic communities through research, publications, conferences, and educational programs The focus of such activities is on the changing nature of the domestic and international financial systems. Specific areas such as the interaction between financial markets, deposit insurance reform, the deregulation of financial institutions, the financing of mergers and acquisitions, and the effect of government policy on financial markets have received recent attention

The Decision Systems Research Center (DSRC) serves as the focal point for research regarding the collection, storage, analysis, and utilization of data in computer based information systems in business and governmental organizations. The DSRC advances and monitors the state of the art in the management of data, information, decision, and planning analysis. The center provides a forum for the discussion and exchange of ideas to its members through discussion groups, technical reports and papers, and technical conferences. Members include representatives from leading business and government organizations and academic professionals in the decision sciences and information systems.

The Center for Executive Development serves the needs of the community with continuing education programs designed for business persons and is open to government officials and the general public.

The Joan and David Lincoln Center for Ethics conducts research and offers educational programs on ethical issues in business, government, and the professions.

The First Interstate Center for Services Marketing provides research, specialized education and training, and management assistance for the professions and to firms engaged in banking, insurance, health care, tourism, and transportation.

The Hahn Center for Entrepreneurship and Innovation provides hands on experience and interdisciplinary course work for students together with applied research and advice and assistance for entrepreneurs.

The Arizona Real Estate Center collects and analyzes data concerning the multifaceted real estate market to provide insight into solutions for problems confronting the real estate industry.

The Dean's Council of 100, a group of 100 distinguished business and professional leaders, provides a liaison between the college and the business community and develops private support for the priority needs of the college.

The Economic Club of Phoenix, a subsidiary of the Dean's Council of 100, provides programs that foster discussion of economic and business issues among the academic, business, labor, and public sectors of Phoenix

The Council of Emeritus Advisers, founded by the ASU College of Business and Dean's Council of 100, is a select group of retired executives who advise the dean and invite nationally known experts to Arizona as visiting scholars, lecturers, and speakers.

Admission

The Preprofessional Program. Each student admitted to the College of Business is designated as a preprofessional business program student. The student follows the freshman and sophomore sequence of courses listed in the four year curriculum outline and the recommendations of an academic advisor in completing the prescribed background and tool courses in preparation for the subsequent professional program. Preprofessional program students are not allowed to register for 300 and 400 level business courses

The Professional Program. The junior and senior years constitute the professional program of the undergraduate curriculum

To be admitted to the professional program, the student must have completed

1. At least 56 semester hours with a minimum cumulative grade point average (GPA) of 2.50;
2. ACC 211, 212; CIS 200; ECN 111, 112; ENG 101, 102, MAT 119, 210, QBA 221;

with a grade of "C" or better and a minimum cumulative GPA of 2.50 in these courses,
3. At least 32 semester hours in General Studies, including COM 100 or 230 or 259; ECN 111, 112; ENG 101, 102; MAT 119, 210, and a laboratory science class.

Failure to meet the requirements for admission to the professional program results in the student's ineligibility to enroll for 300 and 400 level courses in the College of Business.

To be accepted for credit as part of the professional program in business, all courses transferred from other institutions must carry prerequisites similar to those of the courses they are replacing at Arizona State University.

Non-business Students. A non-business student is permitted to register for selected 300 and 400 level business courses only if:
1. At the time of registration, the student has junior standing (56 semester hours completed),
2. The student has a minimum cumulative GPA of 2.00 and a minimum GPA of 2.00 for all business courses completed at ASU.

Non business majors are limited to a maximum of 15 semester hours of selected upper division business courses (excluding economics courses).

Unclassified Undergraduate Students. An unclassified undergraduate business student is permitted to enroll in selected 300 and 400 level business courses only during on line registration and only if
1. The student has an ASU cumulative GPA of at least 2.50; and
2. An ASU cumulative business GPA of at least 2.50 at the time of on line registration, or
3. The student has never attended ASU, in which case he or she is given a one semester period to register during on line registration and to establish a GPA at ASU.

Unclassified undergraduate business students are limited to a maximum of 15 semester hours of selected upper division business courses (excluding economics courses). Unclassified undergraduate students in other colleges are not permitted to register for 300 and 400 level business courses.

Nondegree Graduate Students. A nondegree graduate business student not declaring a degree program is permitted to enroll in selected 300- and 400-level business courses only during on line registration and only if:
1. The student has an ASU cumulative GPA of at least 2.50, and
2. An ASU cumulative business GPA of at least 2.50 at the time of on line registration, or
3. The student has never attended ASU, in which case he or she is given a one semester period to register during on line registration and to establish a GPA at ASU.

Nondegree graduate business students are limited to a maximum of 15 semester hours of selected upper division business courses (excluding economics courses). Nondegree graduate students in other colleges are not permitted to register for 300 and 400 level business courses.

Advisement

The student should follow the sequence of courses suggested in the four year curriculum outline below and the recommendations of the academic advisor in completing the prescribed background and tool courses in preparation for the subsequent professional program.

Each student, upon entering the professional program in the College of Business, is assigned a faculty advisor upon the basis of the subject matter field in which the student is primarily interested. The student, in consultation with a faculty advisor, selects the necessary upper division business courses to complete the major.

Four-Year Curriculum Outline
Pre-Professional Business Program

		First Semester	Semester Hours
ENG	101	First Year Composition	3
ECN	111	Macroeconomic Principles	3
MAT	119	Finite Mathematics	3
		Laboratory Science	4
		PGS or SOC	3
			16
		Second Semester	
ENG	102	First Year Composition	3
ECN	112	Microeconomic Principles	3
MAT	210	Brief Calculus	3
		PGS or SOC	3
		General Studies	3–4
			15 16
		Third Semester	
ACC	211	Introductory Financial Accounting	3
QBA	221	Statistical Analysis	3
		COM 100, 230, or 259	3
		General Studies	6–7
			15 16

Fourth Semester

ACC	212	Introductory Managerial Accounting	3
CIS	200	Computers in Business	3
		General Studies	9 11
			15 17

Professional Business Program[1]

Fifth Semester

FIN	300	Fundamentals of Finance[2]	3
GNB	301	Administrative Communication	3
MKT	300	Principles of Marketing	3
MGT	301	Management and Organization Behavior[3]	3
OPM	301	Operations and Logistics Management	3
		General Stud'es	1 2
			16–17

Sixth Semester

BLW	305	Legal Environment of Business	3
		Major	6
		General Studies	7 8
			16–17

Seventh Semester

Major	6
General Studies	4–5
Electives	6
	16–17

Eighth Semester

MGT	463	Strategic Management	3
		Major	6
		General Studies	5
		Electives	3
			17
	Total		126

[1] Professional program students *only* may register for 300 and 400 level business courses.

[2] This is a prerequisite for the major See the departmental *Advisement Guide*

[3] The prerequisite for this course is the completion of 108 hours including *all* other business core courses.

Transfer Credit. Students planning to take their first two years of work at a community college or another four year college should take only those courses in business and economics that are offered as freshman or sophomore level courses at any of the three state supported Arizona universities These lower division courses are numbered 100 through 299 at the three Arizona universities *A maximum of 30 hours of business and economics courses from community colleges are accepted toward a bachelor's degree in business administration*

Professional business courses taught in the junior or senior year in the three state universities may not be completed at a two year college for *transfer credit in the business core or major.* The introductory course in the legal environment of business is accepted as an exception to this policy, but only lower division credit is granted. Such courses may be utilized in the free elective category *subject to the 30 hour limitation* Courses taught as vocational or career classes at the community colleges that are not taught in the colleges of business at any one of the three state universities are not be accepted for credit toward a bachelor's degree. Courses taught in the upper division business core at the three state universities *must be completed at the degree granting institution* unless transferred from an accredited four year school. Normally, upper division transfer credits are accepted only from AACSB accredited schools.

The following general pattern of courses is recommended for students completing their first two years of work in a community college and who plan to transfer to Arizona State University without the loss of credit:

	Semester Hours
Preprofessional Courses	30
Accounting	6
Economics	6
Statistical Analysis	3
Computers in Business	3
Lower Division Business Electives	12
General Studies	34
English	
Mathematics	
Science	
Humanities and Fine Arts	
Social and Behavioral Sciences	

Incomplete. A mark of incomplete ("I") is granted only in cases in which the student can complete the course outside the classroom (e.g., final examination or term paper) with the same instructor or an instructor designated by the department chair.

Degrees

Majors

The College of Business awards the Bachelor of Science degree upon successful completion of a four year curriculum of 126 semester hours as prescribed above. Students may select one of the *following 10 majors. Each major is administered* by the academic unit indicated.

MAJOR FIELD	DEGREE	SCHOOL/DEPARTMENT
Accountancy	B.S.	Accountancy
Computer Information Systems	B.S	Decision and Information Systems
Economics	B S	Economics
Finance	B.S.	Finance
Management	B.S.	Management
Marketing	B.S.	Marketing
Operations/Production Management	B.S	Purchasing, Transportation, Operations
Purchasing/Materials Management	B.S.	Purchasing, Transportation, Operations
Real Estate	B.S	Finance
Transportation	B.S.	Purchasing, Transportation, Operations

Master's Degrees

The Master of Business Administration degree, the Master of Health Services Administration degree, the Master of Accountancy degree, the Master of Science degree with a major in Decision and Information Systems, the Master of Taxation, and the Master of Science degree in Economics are awarded upon successful completion of programs detailed in the *Graduate Catalog*.

Master of Business Administration. This general program is designed to meet the needs of students who seek broad, integrated graduate course work in the various functional fields of business. The program of study emphasizes the managerial responsibility of policy formulation, problem solving, and decision making. Students with undergraduate backgrounds in general education or technical sciences and those with bachelor's degrees in business administration find the program well suited to their needs.

The College of Business and the College of Liberal Arts and Sciences have defined a program whereby outstanding students may obtain a Bachelor of Arts or Bachelor of Science within the College of Liberal Arts and Sciences and a Master of Business Administration in five years of study. While obtaining the baccalaureate degree, the capable student also begins the M.B.A. degree.

Master of Health Services Administration. This program is designed to prepare qualified individuals seeking careers as administrators of hospitals and health care organizations and as consultants to health management firms, accounting firms, and policy makers in state and federal agencies. This preparation is carried out by providing the students with selected theories, tools and techniques the understanding, analysis, and application that are essential for effective health services administration.

The program consists of a minimum of 51 semester hours. 15 hours of business administration, 27 hours of health services administration, and nine hours of electives. Students serve internships and residencies in major organizations throughout the United States and abroad. During the course of their training, students act as consultants to major health care organizations throughout the United States. This is accomplished through the program's innovative Graduate Technical Assistance Program (GTAP).

Master of Accountancy. This program is designed to provide professional competency in a variety of fields in accounting. In addition to a broadly oriented degree program, the student may choose to specialize in accounting information systems/electronic data processing auditing.

Master of Science with a Major in Decision and Information Systems. This is a specialized program that stresses the application of decision and information systems to business, economic, governmental, and social issues. It includes substantial familiarization with computer based systems and quantitative methods to facilitate managerial planning, decision analysis, and control. The program of study consists of a minimum of 30 semester hours with six hours in required study and 24 hours in electives to support an area of specialization.

Master of Science in Economics. This is a specialized program for students who desire to teach in community colleges, to prepare for research positions in business and government, or to take additional graduate work in economics. The master's program in Economics requires graduate work in macroeconomic analysis, microeconomic analysis, and quantitative methods.

Master of Taxation. This is a specialized program to equip persons with the highly technical and demanding skills required to administer the tax laws in both the private and public sectors of the economy.

Doctoral Degrees

The Doctor of Philosophy degree (Ph.D.) in Business Administration prepares individuals to teach and conduct scholarly research in a specialized area of concentration in the field of business administration and prepares individuals for positions in business or government for which the required educational background is doctoral level study. Prerequisites for the Ph.D. degree program include computer skills and mathematical competence through linear algebra and calculus. The program of study includes graduate study in economics, behavioral sciences, and quantitative statistical analysis. The advanced program is composed of an area of concentration and supporting course work that best prepares students for conducting scholarly work in their areas of interest. The degree is granted upon the completion of an approved program of graduate study, the successful completion of comprehensive written and oral examinations, and the submission of an acceptable original research project presented in a dissertation.

Doctor of Philosophy in Economics. The degree is awarded upon the successful completion of the program as described in the *Graduate Catalog*. Primary objectives of this degree program are to prepare persons for research positions in public agencies and private business organizations and for teaching and research in institutions of higher learning. The degree is granted upon the completion of an approved program of graduate study, the successful completion of comprehensive written and oral examinations, and the submission of an acceptable original research project presented in a dissertation.

Graduation Requirements

Bachelor of Science. Students seeking a Bachelor of Science degree in the College of Business must satisfactorily complete a curriculum of 126 semester hours as indicated below.

	Semester Hours
Business Core Curriculum	33
Major	18–21
General Studies Requirements	63
Electives	9–12
Total	126

Business Core Requirements. To obtain an understanding of the fundamentals of business operation and to develop a broad business background, every student seeking a Bachelor of Science degree in the College of Business must complete the following courses:

			Semester Hours
ACC	211	Introductory Financial Accounting	3
ACC	212	Introductory Managerial Accounting	3
BLW	305	Legal Environment of Business	3
CIS	200	Computers in Business	3
FIN	300	Fundamentals of Finance	3
GNB	301	Administrative Communication	3
MGT	311	Management and Organization Behavior	3
MGT	463	Strategic Management	3
MKT	300	Principles of Marketing	3
OPM	301	Operations and Logistics Management	3
QBA	221	Statistical Analysis	3
		Total	33

Major Requirements

A major consists of a pattern of 18–21 semester hours in related courses falling primarily within a given subject field. Majors are available in Accountancy, Computer Information Systems, Economics, Finance, Management, Marketing, Operations Production Management, Purchasing/Materials Management, Real Estate, and Transportation.

General Studies Requirements

All students in the College of Business are required to complete a total of 63 semester hours of combined University General Studies courses. These General Studies and required College of Business courses are enumerated in *Policy Statement 63* of the College of Business. Students, in consultation with their advisors, *must select all General Studies courses from this list.* Any exceptions must be approved by the Office of the Dean, Undergraduate Programs, in the College of Business, before enrollment in the course.

General Studies courses are regularly reviewed. For specific requirements and to determine whether a course meets one or more General Studies course credit requirements, see the listing of courses, pages 60–87. General Studies courses are also identified following course descriptions according to the following key:

Key to General Studies Credit Abbreviations

L1 Literacy and Critical Inquiry Core Courses (Intermediate level)
L2 Literacy and Critical Inquiry Core Courses (Upper division)
N1 Numeracy Core Courses (Mathematics)
N2 Numeracy Core Courses (Statistics and Quantitative Reasoning)
N3 Numeracy Core Courses (Computer Applications)
HU Humanities and Fine Arts Core Courses
SB Social and Behavioral Science Core Courses
S1 Natural Science Core Courses (Introductory
S2 Natural Science Core Courses (Additional Courses
G G obal Awareness Courses
H Historica Awareness Courses

Specific courses from the following areas must be taken to obtain the designated *minimum* number of semester hours required for graduation:

	Semester Hours
Humanities and Fine Arts	8

At least one course in humanities and fine arts or social and behavioral sciences must be upper division

Social and Behavioral Sciences	15

This must include one course with a PGS prefix and one course with a SOC prefix ECN 111 and ECN 112 are *required* At least one course in social and behavioral sciences or humanities and fine arts must be upper division

Science and Mathematics	14

This must include two laboratory sciences (eight hours), MAT 119 and 270 or a more advanced course

Global Awareness and Historical Awareness Courses

General Studies requirements must include one approved global awareness course and one approved historical awareness course selected from *Policy Statement 63*

First-Year Composition Requirement

All students must complete ENG 101 and 102 or ENG 105 with a grade of "C" or better See page 85 for details

Other General Studies Courses

Additional general courses that provide breadth and cultural background must be taken to bring the student's total General Studies credits up to the 63 hour minimum (see *Policy Statement 63*) All students must complete one of the following communication courses COM 100, 230 259 as part of the General Studies requirement

Total	63

Elective Courses. Sufficient elective courses are to be selected by the student to complete the total of 126 semester hours required for graduation Free electives by business majors are restricted to a maximum of six semester hours of ASU business courses.

Pass Fail. Students majoring in business may not include among the credits required for graduation any courses taken at this university on a pass fail basis.

Additional Graduation Requirements

In addition to completion of the pattern of courses outlined above, to be eligible for the Bachelor of Science degree in the College of Business, a student must:

1 Have completed at least 30 semester hours, including 24 in professional business courses (numbered 300 or above) after admission to the professional program.
2 Have attained a cumulative GPA of 2.00 or higher
   a. for all business courses taken at this university, and
   b for all courses for his or her major taken at this university.
3 Have earned a minimum of 51 semester hours in traditional courses designed primarily for junior or senior students and completed in an accredited, four year degree granting institution.

A student may, by formal application to the registrar, request that a grade of "D" or "E" in lower division courses not be included in his or her college GPA after the course has been repeated in residence with a passing grade and before completion of the student's first baccalaureate degree.

Exceptions. Any exception to the above requirements must be approved by the Standards Committee of the College of Business.

Application for Graduation. A professional program business student must apply for graduation during the semester in which the student completes 87 semester hours

Academic Standards

Probation. All students, freshman through senior, must maintain a minimum GPA for all courses completed at ASU of 2.00 and a mini

mum GPA for all College of Business courses completed at ASU of 2.00 or be placed on proba tion. During any semester in which the student is on probation, the student is not eligible to register early or to participate in on line registration, nor is the student permitted to enroll in summer sessions courses in this college until the probation ary period has expired and the student has been restored to good standing

Disqualification. A student who has not achieved a minimum cumulative GPA of 2.00 in all courses completed at ASU and in all College of Business courses completed at ASU is dis qualified if:

1 During any semester in which the student is on probation the student.
   a. obtains a semester GPA below 2.50, or
   b receives a grade below "C" in one or more courses, *or if*
2. At the end of two consecutive semesters on probation, the student has not achieved a minimum cumulative GPA of 2.00 in all courses completed at ASU and a minimum GPA of 2.00 in all College of Business courses completed at ASU

Students who have been academically disquali fied are not permitted to enroll in summer sessions courses in this college until the disqualifica tion period has expired and the students are rein stated.

Reinstatement. The College of Business does not accept an application for reinstatement until the disqualified student has remained out of this college for at least a 12 month period. Merely remaining in a disqualified status for the above period of time does not, in itself, constitute a ba sis for reinstatement. Evidence of ability to do satisfactory academic work is required

Academic Dishonesty. The faculty of the College of Business have adopted a policy on academic dishonesty A copy of the policy may be obtained in the Office of the Dean, Under graduate Programs.

Student Appeal Procedure on Grades. The faculty of the College of Business have adopted a policy on the student appeal procedure on grades. A copy of the policy may be obtained in the Office of the Dean, Undergraduate Pro grams

Special Programs

Asian Studies. Students in the College of Busi ness may pursue a program with emphasis in Asian studies. As part of the Bachelor of Science degree requirements in business, at least 30 up per-division semester hours of the program must be in Asian studies content courses. Reading knowledge of an Asian language is required. The Asian studies content program must be approved by the Center for Asian Studies (see page 108). Fulfillment of the requirements is recognized on the transcript as a bachelor's degree with a desig nation of the Asian studies discipline. It is pos sible to complete the certificate program in Inter national Business Studies and the Asian studies emphasis concurrently.

Certificate in International Business Stud ies. See page 250 for the requirements of this certificate.

Honors Program. The College of Business Honors Program provides opportunities for supe rior students to interact with other such students and faculty both inside and outside the classroom. The program focuses on students in the profes sional business program. However, freshmen and sophomores are offered honors breakout sections in core courses and may attend selected events such as seminars with top business leaders and student and faculty luncheons.

At the professional program level, each aca demic unit in the college offers a special upper division course every third semester open only to honors students. In addition, a senior omnibus course, featuring lectures by faculty and local and national experts and business leaders, is offered every semester. Through the omnibus course, students complete a thesis and receive honors credit for HON 493 Honors Thesis and MGT 463 Strategic Management.

To graduate with an honors degree from the College of Business, professional program busi ness students must:

1. Take at least one of the department offered courses,
2. Take the senior omnibus course, completing a thesis approved by the director the the Hon ors Program;
3. Have a minimum of six hours of upper divi sion honors classes outside the college; and
4. Graduate from the University Honors Col lege.

A special academic advisor within the College of Business is assigned to honors students to as sist in course selection, to monitor progress to ward the honors degree, and to be actively in volved in 'ob placement upon the completion of the degree

Latin American Studies. Students in the Col lege of Business may pursue a program with em phasis in Latin American area studies. At least 30

upper division semester hours of the program must be in Latin American content courses, including 15 semester hours of Latin American content courses in the College of Business listed on page 250 under International Business Studies (except ECN 365) and 15 semester hours of Latin American content courses in other disciplines. A reading knowledge of either Spanish or Portuguese is required, a reading knowledge of both is recommended. The Latin American content program must be approved by the Center for Latin American Studies (see page 109). Fulfillment of the requirements is recognized on the transcript as a bachelor's degree with a designation of the Latin American studies discipline. It is possible to complete the certificate program in International Business Studies and the Latin American emphasis concurrently.

Mexican-American Business Administration Undergraduate Emphasis. The objective of this program is to provide educational opportunities for Mexican Americans and other interested students who are preparing for leadership positions in local, regional, national, and international firms.

The student may enroll in any major offered by the College of Business. The candidate's degree in business administration, combined with directed linguistic and cultural studies, provides the student with a unique educational experience and a broad background in business and the liberal arts. Interested students should contact the Undergraduate Programs Office.

Pre-Law Studies. Pre law students may pursue a program of study in the College of Business. Courses in accounting, economics, finance, insurance, labor relations, and statistics are recommended for any student planning to enter the legal profession.

The admission requirements of colleges of law differ considerably. The students should communicate with the dean of the law school they hope to attend and plan a program to meet the requirements of that school. Most law schools, including Arizona State University's, require a baccalaureate degree for admission, although some permit admission upon completion of three years of college work.

Students who plan to take a bachelor's degree before entering law school may follow any field of specialization in the College of Business. Within the College of Business are faculty members who are lawyers and who serve as advisors for students desiring a pre law background.

Certificate in Quantitative Business Analysis. See page 242 for the requirements of this certificate.

Assessment and Development in Business Communication. The critical business analysis and related oral and written business communication competencies of all professional business majors are assessed. After this assessment of their critical analyses of business situations, business writing, and videotaped oral presentations, students are given a set of prescriptive developmental activities. After completing these activities, students are again assessed to make sure that all business graduates have established appropriate analytical business communication competencies.

School of Accountancy

PROFESSORS:
FLAHERTY (BA 267A), BOATSMAN, BOYD, FRITZEMEYER, HAR ED, MD EKE, JOHNSON, McKENZIE, PANY RECKERS, RENEAU SCHULTZ SM TH, TIDWELL, W LKINSON

ASSOCIATE PROFESSORS:
GOLEN KAPLAN KNEER, O'DELL, SHR VER, WYNDELTS

ASSISTANT PROFESSORS:
AHN, ANDERSON CHRIST AN GRASSO GUPTA, M TTELSTAEDT, MOECKEL, PEI, REG ER

LECTURERS:
JONES, MAGILL

PROFESSORS EMERITI:
HUIZINGH, HUNTINGTON SANDERS

The major in Accountancy includes the essential academic training for: (1) those wishing to prepare for professional careers in public accounting, 2) those seeking positions as controllers, heads of accounting divisions, cost accountants or internal auditors; (3) those wishing to serve in any of the numerous accounting positions offered in federal, state, and local governments; and (4) those planning to operate their own businesses.

A major in Accountancy consists of the following 21 semester hours:

			Semester Hours
ACC	321	Intermediate Accounting	3
ACC	322	Intermediate Accounting	3
ACC	331	Cost Accounting	3
ACC	347	Accounting Information Systems	3
ACC	351	Income Tax Accounting	3
ACC	481	Auditing Theory and Practice	3
ACC	483	Advanced Accounting	3

As part of their General Studies requirements, all Accountancy majors must complete COM 100 Introduction to Human Communication or COM 230 Small Group Communication, COM 259 Communication in Business and the Professions; ENG 301 Writing for the Professions, PHI 103 Principles of Sound Reasoning; and PHI 306 Applied Ethics.

ACCOUNTANCY

ACC 211 Introductory Financia Accounting. (3 F S SS
Theory and practice of accounting applicable to the accumulation external reporting and external uses of financial accounting information Prerequisite sophomore standing

212 Introductory Managerial Accounting. 3 F S SS
Selection and analysis of accounting information for internal use by management Prerequisites ACC 211; sophomore standing

301 Management Uses of Accounting. 3 N
Uses of accounting information for managerial decision making budgeting and control Prerequisites ACC 212 non Accountancy major

315 Financial Accounting and Reporting. 3 N
Accounting theory and practice related to uses of financial statements by external decision makers Prerequisites ACC 212 non Accountancy major

321 Intermediate Accounting. 3 F S SS
Accounting theory and practice applicable to determination of asset values and related problems of income determination Prerequisites ACC 212· professional program business student

322 Intermed ate Accounting. 3 F S
Accounting theory and practice applicable to liabilities and owner's equity Special problem areas related to income determination and financial reporting Prerequisites ACC 321 grade of C" or higher , professional program business student

331 Cost Accounting. 3 F, S
Cost accumulation systems for product costing cost behavior concepts for planning and control with the integration of quantitative methods Prerequisites: ACC 212 MAT 119 210, QBA 221 professional program business student

347 Accounting Information Systems. 3 F, S
Information requirements and transaction processing procedures relevant to integrated accounting systems emphasizing systems analysis and design controls and computer processing Prerequisites· CIS 200, professional program business student

351 Income Tax Accounting. 3 F S
Federal income taxation of individuals partnerships, corporations and fiduciaries Estate and gift tax. Basic tax planning and research Prerequisites ACC 212 professional program business student

432 Problems in Managerial Accounting. 3 N
Cases and computer applications in decision making planning and control and capital budgeting Prerequisites ACC 331 grade of "C" or higher professional program business student majoring in Accountancy

452 Advanced Taxation. 3 F S
Advanced problems in business and fiduciary income tax, estate and gift tax planning and research Prerequisites ACC 351 grade of C or higher , professional program business student majoring in Accountancy

467 Management Advisory Services. 3 N
Concepts and methods of providing advisory services with respect to accounting information systems and financial analysis Administration of consulting practices. Prerequisites. ACC 347 grade of C" or higher , professional program business student majoring in Accountancy

475 Accounting in Public-Sector Organizations. (3 N
Principles of accounting and reporting budgeting and financial control systems applied in governmental units and other non business organizations Prerequisites ACC 301 or 331 grade of C or higher professional program business student majoring in Accountancy

481 Auditing Theory and Practice. 3) F S
Concepts, standards and methods in audit judgment formulation internal control evaluation, program development and sampling techniques Ethical and legal considerations Prerequisites: ACC 322 347 grades of C" or higher PH 306, professional program business student majoring in Accountancy

483 Advanced Accounting. 3 F S
Accounting theory related to business combinations consolidated financial statements foreign operations partnerships and non business organizations Prerequisites: ACC 322 grade of C or higher professional program business student majoring in Accountancy

495 Contemporary Accounting Theory. 3 F S
Theory of financial accounting and reporting requirements for profit oriented enterprises Prerequisites· ACC 483 grade of 'C or higher , professional program business student maoring in Accountancy

502 Financial Accounting. 3 F S
Financial accounting concepts and procedures for external reporting Prerequisites calculus computer literacy graduate degree program student

503 Managerial Accounting. 3 F, S
Managerial accounting concepts and procedures for internal reporting Prerequisites ACC 502 ECN 502, QBA 502.

511 Tax Planning for Management. 3 A
Economic implications of selected management decisions involving application of federal income tax laws Recognition of tax hazards and tax savings Prerequisite ACC 503 or equivalent

515 Professional Practice Seminar. 3 F S
History structure environment regulation and emerging issues of the accounting profession

521 Tax Research. (3) F S
Tax research source mater a s and techn ques Appl ca t on to bus ness and nvestment dec s ons Prerequ s te ACC 351.

533 EDP Auditing. (3 S
Ana ys s of EDP aud t techn ques and evaluat on meth ods. Emphas s on current top cs such as d str buted proc ess ng and m crocomputers Prerequ s te ACC 481

541 Managerial Accounting Controls. 3 F
mpact of interna report ng systems on organ zationa de c s ons and human behav or Design mp ementat on and eva uat on prob ems Prerequ s te. ACC 331 or 503

551 Advanced Accounting Theory. 3 N
Account ng measurement theor es, ncome determ nat on and f nanc a report ng a ternat ves.

571 Taxation of Corporations and Shareholders. 3 F, S
Tax aspects of the format on operat on reorgan zat on and l qu dat on of corporat ons and the mpact on share holders. Prerequis te: ACC 351

573 Taxation of Partners and Partnerships. 3 A
Tax aspects of the def n t on, format on operat on qu da t on and term nat on of a partnersh p Tax plann ng s em phas zed Prerequ s te· ACC 351

575 Estate and Gift Taxation. 3 A
Tax treatment of wea th transfers at death and dur ng fe t me, w th emphas s on tax p ann ng Prerequ s te ACC 351

577 Taxation of Real Estate Transactions. 3 A
Income tax aspects of acqu s t on operat on d sposa of rea estate, synd cat ons nsta ment sa es, exchanges dea er nvestor ssues, a ternat ve f nanc ng p ann ng Prerequ s te ACC 521 or nstructor approva

579 Multinational Taxation. (3 N
Taxat on of mu t nat ona bus nesses, fore gn nd v dua s subject to U S ncome tax and U S c t zens w th fore gn res dency

582 Auditing Theory and Practice. 3 N
Funct on and respons b ty of the auditor n modern soc ety Advanced top cs n aud t ng theory and methods. Contemporary ssues n a d t ng Prerequ te ACC 481

585 Analytical Methods in Accounting. (3 N
App cation of quantitat ve techn ques to account ng prob ems Prerequ s tes. ACC 503 MAT 210 or equ va ent

586 Problems in Financial Accounting. 3 A
Problems n controvers a areas Externa report ng re qu rements for se ected ndustr es nf uence of govern ment regu at on.

587 Computerized Accounting Systems. 3 F
Des gn and evaluat on of computer-based account ng n format on system Deve opment of computer based f nan c a mode s for plann ng and contro . Prerequ s te ACC 347

591 Seminar in Selected Accounting Topics. 3 F S

791 Doctoral Seminar in Accounting. 3 F S

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

Decision and Information Systems

PROFESSORS:
BURDICK BAC 549 , ECK HERSHAUER, KAZMIER, K RKWOOD MAYER PHILIPPAK S WOOD .

ASSOCIATE PROFESSORS:
BROOKS, HUSTON KEEFER KEIM, O'LEARY, ROY, ST LOUIS, VERDIN

ASSISTANT PROFESSORS:
CARROLL, CHING GOUL KULKARNI RAM REZ, REISER, WILSON

PROFESSOR EMERITUS:
McCREADY

BUSINESS

The major in Computer Information Systems prepares students for professional careers involving the analysis, conf guration, programming, and da tabase aspects of the design and implementation of computerized business information systems. The course work prepares the student for a career in business computer information systems and for admission to graduate programs in computer in formation systems or management information systems.

The major in Computer Information Systems consists of a minimum of 18 semester hours. The following 15 hours must be included

			Semester Hours
CIS	235	Computer Information Systems I	3
CIS	330	Interactive Business Systems	3
CIS	335	Computer Information Systems II	3
CIS	420	Business Database Concepts	3
CIS	440	Systems Analysis and Design	3

To complete the major, the student selects three hours of upper division credit approved in advance by the student's faculty advisor.

All Computer Information Systems majors must complete CSC 100 Introduction to Com puter Science I, which may be counted in the business core in place of CIS 200

Admission. To be admitted to the Computer Information Systems major, a student must have completed the following courses with a minimum GPA in these courses of 2.50: CSC 100, MAT 119, MAT 210 or higher level; and QBA 221.

Certificate in Quantitative Business Analysis

The program of study leading to the Certificate in Quantitative Business Analysis prepares students to use quantitative analysis methods in business practice and provides a background for graduate studies in quantitatively oriented business fields. This program is not a substitute for the listed areas of business specialization; rather, the courses required for the certificate add quantitative strength to the student's chosen field of specialization.

Students are required to complete the Bachelor of Science degree in business administration at Arizona State University and to complete a minimum of 14 semester hours of approved course work, including the following eight hours:

		Semester Hours
MAT 242	Elementary Linear Algebra	2
QBA 321	Intermediate Business Statistics	3
QBA 391	Intermediate Management Science	3

To complete the certificate, the student selects an additional six hours of quantitative courses approved in advance by the advisor for the certificate program.

The student must also complete the following courses with a minimum GPA of 2.50: MAT 119, 210 or 270, 242; CIS 200, QBA 221, 321, 391, and an additional six hours of approved electives.

CSC 100 may be counted in the business core in place of CIS 200.

Courses taken as part of an approved program of study for the certificate do not count against the college restriction on business free electives.

COMPUTER INFORMATION SYSTEMS

CIS 200 Computers in Business. 3 F S
Uses of computers in processing business data. Introduction to business programming. Not open to students with credit in a higher level CSC class. Prerequisite: MAT 210. Prerequisite or corequisite: ACC 212. *[Satisfies General Studies Requirement. N3]*

235 Computer Information Systems I. 3 F, S
Development of computer generated business reports from business data files. Use of a high level file oriented language. Prerequisites: CSC 100; MAT 119, 210 or 270; QBA 221.

300 Computers in Business II. 3 N
Introduction to information systems in business. Use of computers for business problem solving. Prerequisites: CIS 200; F N 300, professional program business student.

307 Systems Modeling. 3 N
Procedures for investigating and analyzing decision systems. Use of specific languages as tools of analysis and simulation. Prerequisites: CSC 100, MAT 119, 210 or 270; professional program business student.

330 Interactive Business Systems. 3 F, S
Algorithms, data structures, dialogue and representation techniques, program generators for interactive applications. Prerequisite: CSC 100.

335 Computer Information Systems II. 3 F, S
Overview of business software concepts and recent developments. Business applications of the computer via high level procedure oriented languages. Prerequisites: ACC 212, CIS 235.

420 Business Database Concepts. 3 F S
Overview, applications and management of business database systems and methods. Prerequisite: CIS 330. Prerequisite or corequisite: CIS 335.

430 Advanced Topics in Information Systems. 3 N
Applications development and advanced programming concepts. Program structure and design. Software development cycle. Prerequisites: professional program business student, instructor approval.

440 Systems Analysis and Design. 3 F S
Principles and applications of computer based management information systems and analysis and design. Prerequisite: CIS 420.

502 Management Information and Decision Support Systems. 3 F, S
Fundamentals of computer based management information and decision support systems. Prerequisites: competition of a first year MBA courses. QBA 502.

505 Information Systems. 3 A
Data structures for information representation and manipulation, database management systems, design of database and information systems. Prerequisites: CIS 335 and a computational programming language or instructor approval.

510 Systems Models and Simulation. 3 N
Design of computer based decision systems. Simulation as a research and decision making tool. Prerequisites: MAT 210; QBA 502; a computational programming language.

515 Management Information Systems. 3 A
Systems theory, concepts applied to the collection, retention and dissemination of information for management decision making. Prerequisite: CIS 335 or 502.

520 Systems Design and Evaluation. 3 A
Methodologies of systems analysis and design, issues including project management, interface, organizational requirements, constraints, documentation, implementation, control and performance evaluation. Prerequisite: CIS 505 or equivalent.

530 Information Systems Development. 3) A
Evaluation of languages and quality assurance techniques for system implementation and maintenance. Prerequisite: CIS 505.

535 Distributed Information Systems. 3 A
Introduction to networking and its impact on information systems in business. Prerequisite: ACC 587 or CIS 505.

541 Business Database Systems. 3 A
Comparative analysis of hierarchical, network and relational systems. Theory of information storage and retrieval and design of business information structures. Prerequisites: CIS 505 or equivalent; MAT 210.

551 Decision Support Systems. (3 A
Def n t on, descr pt on and eva uat on of dec s on support systems, structure and app cat on of se ected DSS an guages Prerequ s tes C S 505 or QBA 505; MAT 210

591 Seminar in Selected Computer Information Systems Topics. (3) A

593 Applied Project. 3) F, S

791 Doctoral Seminar in Computer Information Systems. 3 A

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

QUANTITATIVE BUSINESS ANALYSIS

QBA 221 Statistical Analysis. 3 F S
Methods of stat st ca descript on App cat on of probab ty theory and statist ca nference in business Prerequ s tes MAT 119 210 *[Satisf es General Stud es Require ment N2]*

321 Intermediate Business Statistics. (3 N
App cat on of regress on and ana ys s of var ance mode s to bus ness and econom c prob ems. Prerequ s tes MAT 210 or equ va ent· QBA 221 or equ va ent

391 Intermediate Management Science. 3 N
Study of mathemat ca mode s and so ution techn ques wh ch can be used to a d dec s on makers Prerequ s tes MAT 119 210, 242, QBA 221

405 Sampling Techniques in Business. 3 N
P ann ng execut on and ana ys s of surveys n business research. Prerequ s tes MAT 210 or equ va ent, QBA 221 or equ va ent

410 Applied Business Forecasting. 3) N
App cat on of forecast ng techn ques n bus ness and n- st tut ona env ronments Prerequ s te QBA 321

421 Advanced Business Statistics. (3) N
App cat ons of probab ity and statist ca nference to busi ness dec s ons Probab ty theory deci s on theory and Bayes an nference Prerequ sites MAT 270; QBA 221

450 Decision Analysis Applications. 3 N
Imp ementation of quant tat ve techn ques for the analys s and so ut on of manager a prob ems Prerequ s tes QBA 391, 405 410.

502 Managerial Decision Analysis. (3 F, S
Fundamenta s of quant tat ve ana ys s to a d management deci s on mak ng under uncerta nty Prerequ s tes MAT 210 computer teracy graduate degree program student.

505 Management Science. 3) A
Quant tative approaches to deci s on mak ng, nc uding i n ear programming and s mu at on w th an emphas s on bus ness app cat ons Prerequi s tes MAT 210, QBA 502

510 Managerial Statistics. 3 A
Stat st ca methods used n dec sion mak ng nc uding analys s of var ance s mp e and mult p e near regres s on *Prerequ s tes· MAT 210· QBA 502 or an ntroduc* tory statist cs course

524 Nonparametric Statistics. 3) N
Nonparametr c stat st ca tests for ocat on d spers on trend, assoc at on corre at on and goodness of f t Non metric scal ng techn ques Prerequ sites: MAT 210, QBA 510

525 Applied Regression Models. 3 F S
S mp e near regress on mu t p e regress on nd cator var ables and og st c regress on. Emphas s on bus ness and economic app cat ons Prerequi s tes MAT 210, QBA 510

527 Categorical Data Analysis. 3) A
D screte data ana ys s n bus ness esearch Mu t dimen s ona cont ngency tab es and other d screte mode s Pre requ s te: QBA 525

528 Exploratory Data Analysis. 3 A
Introduces student to pr nci p es and methods of exp ora tory *data ana ys s Prerequ s te: QBA 502*

530 Experimental Design. 3 A
Exper menta des gns used n bus ness research Ba anced and unba anced factor a des gns, repeated meas ures de gns and mu t variate ana ysis of var ance Pre requi s te QBA 525 or equ va ent

535 Multivariate Methods. 3 A
Advanced stat stica methods used n bus ness research Mu t var ate ana ys s of assoc ation and nterdependence Prerequi s te. QBA 525

540 Forecasting. 3 A
Foundat on of statist ca forecasts and forecast ntervals app cat on of c assica and computer ass sted forecast ng methods to bus ness forecast ng prob ems Prerequ s tes MAT 210 QBA 502

550 Intermediate Decision Analysis. 3 A
Quantitat ve dec s on ana ys s methods for bus ness dec s on mak ng under uncerta nty inc ud ng dec s on d a grams subject ve probab t es and preference assess ment Prerequ s tes. MAT 210 QBA 502.

552 Statistical Decision Theory. (3 A
Stat st ca dec s on methods for bus ness deci s on mak ng under uncerta nty, nc ud ng Bayes an nference opt mal stat st ca dec sions and value of nformat on assessment Prerequ s tes MAT 210, QBA 510 or 550.

560 Probabilistic Models. (3 A
Deve opment and app cat on of probabi st c mode s for quant tat ve business ana ys s. Prerequ s tes: MAT 210 QBA 502

561 Mathematical Programming. 3 A
Techn ques for solv ng mathemat ca programm ng mod e s of bus ness prob ems Prerequ s tes· MAT 210, 242

562 Network Flow Models. (3) N
ntroduct on to network structure, app cat ons and a go r thms deve opment of data structures for network a go rithms app ed to bus ness prob ems Prerequ s tes QBA 561, or MAT 242 and QBA 505

564 Nonlinear Optimization. 3 A
Bas c properties of so ut ons and algor thms for con stra ned and unconstra ned m nim zat on bas c descent methods and barr er methods Prerequ s tes QBA 561; or MAT 242 and QBA 505

591 Seminar. 3 A

593 Applied Project. 3 F S

791 Doctoral Seminar in Quantitative Business Analysis. 3) A

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Economics

PROFESSORS:
BURGESS (BAC 667) BOYES BRADA, FA TH GOODING, HOFFMAN, HOGAN, JACKSON K NGSTON KNOX, LADMAN, McPHETERS, SCHLAGENHAUF
ASSOCIATE PROFESSORS:
BLAKEMORE COX, DeSERPA, HAPPEL, LOW, McDOWELL, MELV N, MENDEZ ORM STON, SM TH, W NKELMAN
ASSISTANT PROFESSORS:
FINN, WRASE
LECTURER:
ROBERTS
PROFESSORS EMERITI:
COCHRAN, LOWE, PLANTZ

The study of economics affords an opportunity for the student to acquire a general know edge of the methods by which goods and services are al located and incomes are generated and why prices, employment, money, and financial mar kets behave as they do. Some knowledge of eco nomics is crucial not only for those intending to participate in the business world, but for those in tending to pursue graduate educations in law or other business fields or to work in the world of journalism and communications Economists ob tain positions at universities and in government, financial institutions, brokerage houses, private nonfinancial corporations, and international or ganizations such as IMF and the World Bank and as financial journalists and as marketing and management specialists in domestic and interna tional firms.

Economics majors are required to earn a mini mum grade of "C" n MAT 270 Calculus with Analytic Geometry I before taking upper-division courses in economics.

The major in Economics consists of 18 semes ter hours of upper division courses in economics The following six hours must be included:

		Semester Hours
ECN 313	Intermediate Macroeconomic Theory	3
ECN 314	Intermediate Microeconomic Theory	3

ECN 313 and 314 are required They must be taken after the completion of MAT 270 and be fore other upper division courses in economics. Concurrent enrollment in ECN 313 and 314 is permitted Concurrent enrollment in ECN 313 or 314 and other upper division courses in economics is subject to the approval of the faculty advisor

ECONOMICS

ECN 111 Macroeconomic Principles 3 F S SS
Bas c macroeconom c ana ys s Econom c nst tut ons and factors determ n ng ncome eve s pr ce eve s and em p oyment evels *[Sat sf es Genera Stud es Requ rement SB]*

112 Microeconomic Princip es. 3 F S
Bas c m croeconom c ana ys s Theory of exchange and product on nc ud ng the theory of the f rm *[Satisf es Genera Stud es Requ rement SB]*

313 Intermediate Macroeconom c Theory. 3 F S
Determ nants of aggregate eve s of emp oyment output and ncome of an economy Prerequ s te ECN 111, 112 MAT 2 0 grade of C or h gher *[Satisf es General Stud es Requ rement· SB]*

314 Intermediate Microeconomic Theory. 3 F S
Ro e of the pr ce system n organizing econom c act v ty under vary ng degrees of compet t on Prerequ s tes ECN 111 112 MAT 270 grade of C" or h gher *[Satisfies Genera Stud es Requ rement SB]*

315 Money and Banking. 3 SS
Funct ons of money Monetary systems cred t funct ons bank ng pract ces and centra bank ng po cy Th s course cannot be appl ed to the Econom cs ma or Prerequ s te ECN 111. *[Sat sfies Genera Stud es Requirement SB]*

331 Comparative Economic Systems. 3 N
A ternat ve nst tut ons, past and present for organ z ng the soc a d v s on of abor Property r ghts, nformat on and ncent ves n ndustr a soc et es Prerequ s te· ECN 111 or 112 *[Sat sf es Genera Studies Requirements SB G]*

360 Economic Development. 3 A
Theor es of econom c growth and deve opment Ro e of cap ta format on techno og ca nnovat on, pop at on and resource deve opment n econom c growth Prerequ sites ECN 111 112 *[Sat sf es Genera Studies Requ rements SB G]*

365 Economics of the Soviet Union and Eastern Europe. 3 N
Or g ns and analysis of contemporary nst tut ons Com parat ve deve opment and d fferent at on n the 20th cen tury. Prerequ s tes ECN 111 112 *[Sat sfies Genera Stud es Requ rements SB G]*

394 Special Topics 3 SS
Current top cs of nterest n econom cs e , manager a econom cs microeconom c po cy ssues etc Prerequ s tes ECN 111, 112, jun or stand ng w th a 2 00 GPA

404 History of Economic Thought. 3 A
Deve opment of econom c doctr nes theor es of mercan t sm phys ocracy c ass c sm neoc ass c sm, Marx sm and contemporary econom cs Prerequ s tes· ECN 313, 314 *[Satisf es Genera Stud es Requ rement SB]*

421 Labor Economics. 3 A
Or g ns of abor movement ana ys s of abor un ons abor markets co ect ve barga n ng and cur ent po cy ssues. Prerequ s te ECN 314 *[Sat sf es General Stud es Re qu rement· SB]*

436 International Trade Theory. 3 A
The comparat ve advantage doctrine nc ud ng pract ces under vary ng commerc a po cy approaches The eco nomic mpact of nternat ona d sequ br um. Prerequ sites. ECN 313 314 *[Satisf es Genera Stud es Requ re ments. SB G]*

438 International Monetary Economics. 3 A
H'story theory and po cy of internat ona monetary eco nom cs. Ba ance of payments and exchange rates nter nat ona financ a markets nc ud ng Eurocurrency mar kets. Prerequis tes: ECN 313, 314 *[Sat sf es General Stud es Requ rements· SB, G]*

441 Public Finance. (3 A
Publ c goods, externa t es vot ng mode s, pub c expend tures, taxat on and budget format on w th emphas s on the federa government. Prerequ s te ECN 314 *[Sat sfies General Stud es Requirement SB]*

453 Government and Business. 3 A
Deve opment of pub c po c es toward bus ness Ant trust act v ty. Econom c effects of government po ic es Pre requ s te: ECN 314 *[Sat sf es Genera Stud es Requ re ment· SB]*

480 Introduction to Econometrics. (3 A
E ements of regress on ana ys s est mat on hypothes s tests, pred ction Emphas s s on use of econometr c re su ts n assessment of econom c theor es Prerequ s te ECN 314 *[Sat sf es Genera Stud es Requ rement N2]*

484 Economics Internship. 3 F, S, SS
Academ c cred t for profess ona work organ zed through the nternsh p Program Prerequ sites ECN 313 314· outstandng academ c record

485 Mathematical Economics. 3 A
ntegrat on of economic ana ys s and mathemat ca meth ods nto a comprehens ve body of know edge w th n con temporary econom c theory Prerequ s tes ECN 313 314 *[Sat sfies Genera Studies Requ rement N2]*

494 Special Topics. 3) N
Current top cs of interest n econom cs e , manager a econom cs, m croeconom c po icy ssues etc Prerequ s tes· ECN 313 314.

498 Pro-Seminar. 3 A
Chosen from se ected top cs, e g money, deve opment urban econom cs econom c regu at on, area stud es etc Prerequ s tes· ECN 313 314

502 Managerial Economics. 3 F S
App ication of econom c analys s to manageria dec s on mak ng in areas of demand, product on, cost and pr c ng Eva uat on of compet tive strateg es Prerequ sites· ca cu us, computer teracy, graduate degree program stu dent

504 Development of Economic Analysis. 3 A
H stor ca deve opment of econom c theory Emphas s on the deve opment of econom c ana ys s from prec ass ca econom cs through Keynes

509 Macroeconomic Theory and Applications. 3 A
Theory of ncome output emp oyment and pr ce leve Inf uence on bus ness a d econom c env ronment Pre requ s te ECN 111

510 Microeconomic Theory and Applications. 3 A
Theory of exchange production and pr c ng n a market economy nf uence on bus ness and econom c env ron ment Prerequ site ECN 112.

511 Macroeconomic Analysis I. (3 A
The nation s ncome output emp oyment and genera price eve Exam nat on of current theoret ca and emp r ca research and po cy prob ems. Prerequ s te ECN 313

512 Microeconomic Analysis I. 3) A
Theory of exchange product on resource use and pr c ng n cap ta stic and m xed systems Prerequ site ECN 314

513 Macroeconomic Analysis II. 3 A
Advanced top cs n macroeconom cs. Emphas s on ap p ed macroeconom c mode s Prerequ s te ECN 511.

514 Microeconomic Analysis II. 3 A
Advanced topics n m croeconom cs Emphas s on gen era equ br um we fare econom cs and production and cap ta theory Prerequ s te ECN 512

516 Monetary Theory. 3 N
Trad t ona and post Keynes an monetary theory, nterest rate determ nat on the demand and supp y of money Prerequ s te ECN 511

517 Monetary Policy. 3) N
Determ nants of the money supp y and nterest rate ev- e s Federa Reserve po cy and ts effect veness Pre requ s te ECN 516.

521 Labor Economics I. 3 N
Deve opment of bas c theoret ca mode s for ana yz ng a bor market ssues Prerequ s te ECN 512

522 Labor Economics II. 3 N
Extensions cr t c sms of abor market theor es App ca t ons to a variety of po cy ssues Prerequis te ECN 521

531 Economic Systems and Organizations. 3) N
Ph osoph ca foundat ons of major econom c systems and of propert es of pr nc pa system mode s Compar son of a ternat ve nst tut ons and system components of con temporary econom es Prerequ s tes· ECN 511, 512

536 International Trade Theory. 3 A
Theor es of comparat ve advantage and the r emp r cal ver fcat on Theory and po tica economy of commercia pol cy Resource transfers and the ro e of the MNC Pre- requ s tes ECN 511, 512

538 International Monetary Theory and Policy. 3 A
The fore gn exchange market ba ance of payments and nternat ona f nanc al nst tut ons and arrangements the ory and app cat ons Prerequ s tes ECN 511, 512

543 Public Sector Economics. 3 N
Econom cs of co ect ve act on, pub spend ng and taxa- t on mpact of centra governmenta act vity on resource a ocat on and ncome d str but on Prerequis te ECN 512

553 Industrial Organization. 3 N
Ana ysis of structure, conduct and performance in ndus tr a markets and recent deve opments n ant trust po c es. Prerequ s te ECN 512

561 Economics of Developing Nations. 3) N
Econom c problems, ssues and po cy dec sions fac ng the esser developed nat ons of the wor d Prerequ s tes· ECN 511, 512

572 Regional Economics. 3 N
ntroduct on to export base nput output, near program m ng mu at on and econometr c mode ng as too s of reg ona ana ys s Prerequ s te ECN 512

580 Econometrics I. 3 A
App cat on of mathemat ca and stat st ca techn ques to prob ems of econom c theory. Prob ems n the formu at on of econometr c mode s Prerequ s te 6 hours of stat st cs

581 Econometrics II. 3 A
Advanced topics n econometr cs Emphas s on extend ng the s mp e inear mode and on s multaneous re at on sh ps Prerequ s te ECN 580

584 Economics Internship. (1 3 SS
Academ c cred t for profess ona work organized through the nternsh p Program. Prerequ s tes ECN 511 512

591 Seminar in Selected Economics Topics. (3) N

594 Conference and Workshop in Economics. 1 2 F S
Work ng papers by department facu ty and outs de speak ers are presented and d scussed Econom cs ABDs wi a so present the r thes s proposals. Prerequ s te nstruc tor approva

791 Doctoral Seminar in Economics. 3 A

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Finance

PROFESSORS:
SMITH (BA 318), GUNTERMANN, JENNINGS JOEHNK, KAUFMAN, KRAFT, POE, SUSHKA

ASSOCIATE PROFESSORS:
ARANDA, BOHLMAN BOOTH, BUTLER, CESTA, DAVIS HOFFMEISTER LOCK, MARTIN MYLER, WILT

ASSISTANT PROFESSORS:
AMEL, BESSEMB NDER BROADMAN, CHANG, GALLINGER, HERTZEL, REISS

PROFESSORS EMERITI:
ANDERSON, DAUTEN, OLNEY, STEVENSON TENNEY

The study of finance prepares students to under stand the financial implications inherent in virtu ally all business decisions. Students majoring in Finance are prepared for entry level careers in corporate management, depository institutions, investment management, and financial services. The finance curriculum emphasizes financial markets, evaluation of investments, and efficient allocation of resources.

The major in Finance consists of 18 semester hours. The following courses must be included in the major:

			Semester Hours
FIN	331	Financial Markets and Institutions	3
FIN	361	Managerial Finance	3
FIN	421	Security Analys s and Portfolio Management	3
One additional 400 level FIN course			3

All students must complete ACC 321 Interme diate Accounting before taking 400 level finance courses. In addition, one of the following courses must be taken:

			Semester Hours
ACC	322	Intermediate Accounting	3
ACC	331	Cost Accounting	3
ACC	347	Accounting Information Systems	3
ACC	351	Income Tax Accounting	3

ACC 322 is particularly recommended. Stu dents have the option of including the ACC courses as part of the major or as free electives. If the ACC courses are chosen as free electives, the upper division courses used to complete the major must be approved by the Department of Finance.

Recommended Electives. It is suggested that the student, in consultation with an advisor, take additional courses in economics, English, mathematics, and statistics.

Real Estate

The Real Estate program is designed for students with a professional interest in real estate. Academic preparation can lead to careers in land development, investment analysis and counseling, appraisal, property management, sales, and finance.

The Real Estate major consists of a minimum of 18 semester hours with at least 15 hours in real estate courses BLW 411 and REA 300 must be completed before taking other real estate courses. REA 251 is not open to Real Estate majors.

The following 12 hours must be included:

			Semester Hours
BLW	411	Real Estate Law	3
REA	300	Real Estate Analysis	3
REA	331	Real Estate Finance	3
REA	401	Real Estate Appraisal	3

To complete the major, the student must select one additional upper-division course approved by the Department of Finance faculty and one of the following:

REA 441 Real Estate Land Development
REA 456 Real Estate Investments
REA 461 Current Real Estate Topics

FINANCE

FIN 251 Principles of Personal Investments. 3 N
nvestment concepts for nd v dua nvestors, fundamenta s of nvestment techn ques and pr nc p es of sound in vestment For nonmajors Course may be used on y for e ect ve cred t by Co ege of Bus ness students

300 Fundamentals of Finance. 3 F S SS
Theory and problems f nancia management of bus ness enterpr ses. Prerequ s tes ACC 212 ECN 112, QBA 221

331 Financial Markets and Institutions. (3) F S
Analys s of f nanc a markets and ntermed aries Theory of financ al ntermed ation 'nterest rate theory, money and cap ta market nstruments government regu at on Prerequ s tes· FIN 300; profess'ona program bus ness student

361 Managerial Finance. (3 F, S
Theories and prob ems in resource allocation, cost of capital, CAPM and cap ta budget ng, asset va uat on cap ta structure and f nanc ng po 'cy. Prerequisite FIN 300

421 Security Analysis and Portfolio Management. 3) F, S
Security ana ysis theory and practice Se ection and management of financ al asset portfol os. Securit es mar kets and portfo o risk-return ana ys s Prerequisites: ACC 321; FIN 331, 361 professional program bus ness stu dent.

427 Speculative Securities. (3) A
Study of stock opt ons, ndex opt ons convert b e secur t es, f nanc al futures warrants, subscr ption r ghts, arb trage pr cing theory. Prerequ s tes F N 421 profess ona program bus ness student.

431 Management of Financial Institutions. (3) A
Asset/l ab ty and cap ta management n financia nst tu t ons nf uence of market factors and regulatory agenc es Emphas s on commercia banks. Prerequis tes: ACC 321 FIN 331; professiona program bus ness student

441 Financial Planning. 3 N
Integrates f nance, insurance, real estate nvestments, taxat on and law nto the fe cyc e f nancia plann ng proc ess Prerequ sites: ACC 321, F N 300 professional pro gram bus ness student

451 Working Capital Management. (3) N
Ana ys s of short term prof tabi ity and iqu dity Emphas s on manag ng cash, accounts receivab e, nventory and current iab l t es. Prerequis tes ACC 321 F N 300, pro fessional program bus ness student

461 Financial Cases and Modeling. (3) A
Case oriented capstone course n manageria f nance. Contemporary ssues of qu dity management, capital budget ng cap ta structure and f nancial strategy Pre requis tes ACC 321, FIN 361; profess ona program bus - ness student

481 Risk Financing. (3) N
Ident f cat on, measurement and treatment of r sk financ ing. Control, retent on and transfer as a ternate ap proaches to the risk of oss. Prerequis tes FIN 300 pro fess onal program business student

502 Managerial Finance. (3 A
Theory and practice of financ al dec sion mak ng includes risk ana ys s, valuation, cap ta budget ng, cost of cap tal, and working capital management Prerequ s tes: ACC 502, ECN 502, QBA 502.

521 Investment Management. 3) A
Valuat on of equ t es f xed ncomes and options/f nanc a futures n an ind v dua security and portfo o context mathemat ca asset al ocation approaches Not open to students with credit in FIN 421. Prerequisite FIN 502

531 Capital Markets and Institutions. 3) A
Recent theoretical and operational developments in eco nom c sectors affecting capital markets and nst tutions. Not open to students w th credit n FIN 431 Prerequ s te FIN 502.

561 Financial Management Cases. (3) N
Case-oriented course n app ications of f nance theory to management ssues Acqu sition, a locat on and manage ment of funds w thin the bus ness enterpr se Working cap ta management, cap'tal budget ng cap ta structure and f nanc a strategy Not open to students w th cred t in FIN 461 Prerequ s te F N 502

581 Theory of Financial Decisions. 3) A
Theories and app cat ons of manageria f nance and n vestments Capita budgeting cap tal structure d vidend theory and va uat on Prerequ'site: FIN 502.

791 Doctoral Seminar in Finance. (3) A
a) Investments A
Investments and market theory; eff cient markets hy pothesis, opt on and commodity markets. Prerequi site FIN 581
(b) Financ al Institut ons and Markets A
Econom c and monetary theory app ied to financial markets and inst tutions mp icat ons of f nanc al structure for market performance and eff c ency Pre requ site: FIN 581.
(c) Financ al Management A
Financial theory perta ning to capita structure, d vi- dend po icy, va uat on cost of cap ta and cap tal budgeting Prerequ s te F N 581

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

REAL ESTATE

REA 251 Real Estate Principles. (3) N
Regu at on, pract ces egal aspects and professiona op- portun t es of the real estate ndustry Cannot be app ed to Rea Estate major.

300 Real Estate Analysis. (3) A
App cat on of econom c theory and analyt ca techn ques to rea estate markets Topics inc ude aw, f nance ap pra sal, market analys s, investments, development Pre requisite profess ona program business student.

331 Real Estate Finance. (3) A
Legal, market and nstitut onal factors re ated to financing proposed and ex sting propert es Emphas s on current f nanc ng techn'ques and quantitat ve methods Prerequ sites· F N 300, profess ona program business student

401 Real Estate Appraisal. (3 A
Factors affecting the va ue of real estate Theory and practice of appra sing and preparation of the appra sa re port Appra sa techn ques Prerequ sites. REA 300, pro fess ona program bus ness student

402 Income Property Appraisal. (3) N
Va uat on of net ncome streams for var ous types of in come produc ng propert es Prerequ sites: REA 401 pro- fessional program bus ness students

441 Real Estate Land Development. (3 A
Ne ghborhood and c ty growth Mun cipal p ann ng and zoning Deve opment of res dent al, commerc a ndustrial and spec a purpose properties Prerequ sites REA 300, profess onal program bus ness student

456 Real Estate Investments. (3) A
Analys s of investment decisions for various property types Cash flow and rate of return analysis Prerequ s tes. FIN 300, profess ona program bus ness student.

BUSINESS

461 Current Real Estate Topics. (3) N
Current rea estate top cs of nterest are d scussed and ana yzed Prerequ s tes REA 300 profess ona program bus ness student

591 Seminar in Selected Real Estate Topics. 3) N

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

BUSINESS LAW

BLW 305 Legal Environment of Business. 3 F S
Lega framework govern ng ru es of conduct among bus nesses and the mpact on estabi sh ng bus ness po cy.

306 Business Law. 3) A
Legal aspects of contracts, sales commerc a paper, se cured transactions documents of t t e etters of cred t and bank depos ts and co ect ons.

307 Business Law 3 A
Lega aspects of agency partnersh ps corporations regu at on of bus nesses bankruptcy and property

308 Business and Legal Issues in Professional Sports. 3) N
The econom c structure of profess ona sports and app cat on of contract antitrust, arb trat on, and abor aws n the ndustry

411 Real Estate Law. 3 A
Lega pract ces as app ed to the real estate f eld and to the f e ds of tit es mortgages end ng and trust work

412 Insurance Law. 3 N
Legal concepts and doctr nes app cab e to the f e d of n surance Prerequ s te. profess ona program bus ness student

579 Legal, Political and Ethical Issues for Business. 3 N
Study of ega eth ca and po t ca components of bus ness dec s ons se f regu at on and socia respons'b ty as regulatory and pol tical strateg es Prerequ s tes ACC 503 FIN 502 MGT 502, MKT 502

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

INSURANCE

INS 251 Principles of Insurance. 3 N
Coverages ava ab e buy ng methods regu at on c a ms nsurance nst tut ons, career opportun'ties

321 Life and Health Insurance. (3 N
Types and uses of fe and hea th po c es ndustry or gan zat on regu at ons underwr t ng and other company operat ons Prerequ s te profess ona program bus ness student

331 Property Insurance Principles and Coverage. 3 N
Pr ncip es of property and iab' ty nsurance ndustry or gan zat on types and forms of coverages and commerc a coverage fundamenta s. Prerequis tes NS 251 or n structor approva , profess ona program bus ness student

461 Estate Planning. (3 N
Use of fe nsurance w th w s trusts and buy se agree ments, tax aspects Needs approach to estate p ann ng Prerequ s te profess ona program bus ness student

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

General Business

PROFESSOR:
HENN NGTON

ASSOCIATE PROFESSORS:
SMELTZER (BA 367), GARCIA, GILSDORF
LEONARD, LYNCH MURRANKA

PROFESSORS EMERITI:
BATY, BOGGS, JACKS, LEWIS, A. SM TH
C SMITH, TATE

The general business faculty serve the College of Business by teaching the Bache or of Science degree upper division business core requirement GNB 301 Administrative Communication In addition, the faculty teach GNB 502 Managerial Communication, a core course in the Master of Business Administration degree, as well as other General Business courses

GENERAL BUSINESS

GNB 233 Business Communication. 3) N
Written and ora report ng Organ zat on, ana ys s and presentat on of bus ness nformat on us ng e ectron c and other med a. Prerequ s tes ENG 102, sophomore stand ng. *[Sat sf es General Stud es Requ rement L1]*

301 Administrative Communication. 3 F, S SS
Intrapersona , nterpersona and adm n strat ve commun cat on 2 ectures 1 rec tat on. Prerequ s tes CIS 200 ENG 101, 1 2 grade of C or h gher n these courses) *[Satisf es General Stud es Requ rement. L1]*

431 Business Report Writing. (3 N
Organ zat on and preparat on of reports ncorporat ng e ectron c data bases word process ng and graph cs Prerequ s te GNB 301

451 Business Research Methods. 3 N
Methods of co ect ng nformat on pert nent to bus ness prob em so v ng nc ud ng des gn co ect on ana ys s, n terpretat on and presentat on of pr mary and secondary data

502 Managerial Communication. 3 F S, SS
Ana ys s of var ous bus ness prob ems, s tuat ons and de ve opment of appropr ate commun cat on strateg es Pre requ s te: MGT 502

504 Professional Report Writing. 3 A
Preparat on and presentat on of profess ona reports

507 Business Research Methods. 3 N
Techn ques for gathering nformat on for business dec s on mak ng Se ect on des gn and comp et on of a bus ness or ented research project

591 Seminar. 3 N
Top cs such as the fo ow ng w be offered
a Se ected Bus ness Commun cat on Top cs

594 Study Conference or Workshop. 3 N

700 Research Methods. 3 N

Omnibus Courses: See pages 48–49 for omn bus courses that may be offe ed.

School of Health Administration and Policy

PROFESSOR:
SCHNELLER (BA 252)
ASSOCIATE PROFESSORS:
DUNDAS, KIRKMAN LIFF, W LLIAMS
ASSISTANT PROFESSOR:
MONDRAGON

The Graduate Program in Health Services Administration

The School of Health Administration and Policy offers the Master of Health Services Administration (M.H S.A.). Students enrolled in the school may earn the concurrent M.H.S.A./M.B.A. degrees. The school also collaborates with the College of Law to allow students to earn concurrently the M H S A /J.D. degrees. The school collaborates with the American College of Physician Executives and the Western network for Education in Health Administration to offer the Certificate in Healthcare Leadership and Management for physicians.

The M.H.S.A program is designed to prepare students for entry-level management positions in health services delivery, planning/policy, and consulting organizations. Although most program graduates have aspired to and successfully found employment in hospitals, the curriculum and research efforts within the school do not focus on one categorical setting. Students are able to study the characteristics of vertically integrated systems and may choose from courses focused on ambulatory settings, long term care, and other components of the continually evolving health care system. Since so many of the features of the environment of health services are subject to periodic change (e.g., reimbursement and informations systems), substantial emphasis is on building the basic skills and analytic perspectives necessary to encounter and react to change through innovation and action.

The program has a special commitment to provide students with an understanding of the competitive nature of the health care system. Since so many of the features of the environment of health services are subject to periodic change, substantial emphasis is placed on building basic skills to understand and scan environments and to encounter and react to change through innovative action. Program students are educated to think independently and to recognize the strengths and weaknesses of group processes in decision making.

The mission of the M.H.S.A. program is to develop in its students a pattern for skill acquisition, ideology, and style that is necessary for entry into the job market and for pursuing careers as chief executive officers in target organizations. To accomplish this mission, the curriculum provides (1) the skills of understanding, analysis, and application that are essential to effective health care administration, (2) internship, residency, and project experiences that bridge the gap between theory and practice; and (3) opportunities to interact with practioners, both in the classroom and in structured field experiences.

BUSINESS

HEALTH ADMINISTRATION AND POLICY

HSA 494 Special Topics in Health Administration. (3) A
Seminar topics, including comparative health care systems, ambulatory care administration behavioral health long term care and health economics. Prerequisite: instructor approval.

501 Health Care Organization. (3) F S
Concepts, structures functions, and values which characterize contemporary health care systems in the United States

502 Health Care Organization and Ethics. (4 F S
Concepts structures functions values and biomedical and managerial ethics as applied to the healthcare system.

505 Community Health Care Perspectives. (4 F, S
Epidemiological social epidemiological and political perspectives and techniques for analyzing health problems and responding to health care needs in communities Prerequisite HSA 502

512 Health Care Economics. 3 F, S
Economics of production and distribution of health care services, with special emphasis on the impact of regulation competition, and economic incentives Prerequisite HSA 502

520 Hospital Structure and Policy. 3 F, S
Functional relationships among managerial elements of health care institutions with major focus on hospital governance and policy dynamics. Prerequisite HSA 502

522 Health Care Management Systems. (3 F S
Systems concepts quantitative methods and information systems applied to management problems in health institutions and community health planning Prerequisites HSA 502 505 QBA 502

532 Financial Management of Health Services. 3 F S
Acquisition allocation and management of financial resources within the health care enterprise Budgeting, cost analysis financial planning and internal controls Prerequisites ACC 502 503 FIN 502 HSA 502

542 Health Care Jurisprudence. (3) F S
Legal aspects of health care delivery for hospital and health services administration Legal responsibilities of the hospital administrator and staff Prerequisites: HSA 502, 505 520.

571 Ambulatory Care Management. (3) A
The evolution, planning and management of multispecialty group practices, health maintenance organizations and other alternative delivery systems. Prerequisite: HSA 502.

589 Integrative Seminar. (3) F, S
Capstone assessment of current policies, problems and controversies across the broad spectrum of health services administration. Prerequisites: HSA 502, 505, 520, 522, 532.

591 Seminar. (3) A
Seminar topics such as the following may be offered:
(a) Comparative health care systems
(b) Cost containment and quality assurance
(c) Behavioral health
(d) Long term care
(e) Health care economics
(f) Health care labor law
(g) Topics in health services research
(h) Managing physicians
(i) Multihospital systems

593 Applied Project. (1–6) F, S, SS
Supervised on-site experience in advanced development of managerial skills in health services administration and policy. Minimum of 10 weeks. Prerequisites: 18 hours of credit toward program of study; director approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

International Business Studies

Certificate in International Business Studies

The program of study leading to the Certificate in International Business Studies is designed to prepare students for positions with multinational firms, banks, government agencies, and international organizations. This program is not a substitute for the listed areas of business specialization; rather, the courses required for the certificate add an international dimension to the student's chosen major.

The requirements for the certificate are:

1. At least 12 semester hours of approved courses in international business. The objective of this requirement is to introduce the student to the environment and operating principles of international business, to the international aspects of the student's chosen area of specialization, and to the interaction of all the business disciplines in an international environment. IBS 300 Principles of International Business is required of all candidates for the certificate. Other international business courses are:

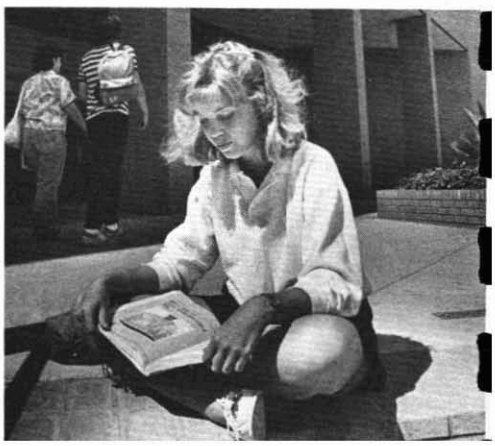
ECN	331	Comparative Economic Systems
ECN	360	Economic Development
ECN	365	Economics of the Soviet Union and Eastern Europe
ECN	436	International Trade Theory
ECN	438	International Monetary Economics
MGT	459	International Management
MGT	494	Special Topics: International Management
MKT	435	International Marketing
MKT	494	Special Topics: International Marketing
TRA	463	International Transportation

2. At least 18 semester hours of approved electives in international and area studies. A minimum of six semester hours must be in courses that provide a cross-cultural perspective from the global point of view of one or more disciplines. A minimum of nine semester hours must be in courses that provide an understanding of one region of the world.
3. Evidence of competence in a foreign language equivalent to one year of college study. Since the careful planning and selection of courses are necessary to meet the requirements for the certificate without exceeding the minimum number of hours required for graduation, interested students are urged to consult with an international business faculty advisor as early as possible.

INTERNATIONAL BUSINESS STUDIES

IBS 300 Principles of International Business. (3) A
Multidisciplinary analysis of international economic and financial environment. Operations of multinational firms and their interaction with home and host societies. Prerequisite: ECN 112. *[Satisfies General Studies Requirement: G]*

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



Management

PROFESSORS:
PENLEY (BA 367E BOHLANDER
GOMEZ MEJIA, MONTANARI PASTIN
RE F, WH TE

ASSOCIATE PROFESSORS:
BASSFORD, BRENENSTUHL CARDY, COOK,
HOM, KELLER, KINICKI, MANZ MOORHEAD,
OLIVAS, SH PPER VAN HOOK

ASSISTANT PROFESSORS:
CARSON, DAVY, GOODING, JACOBSON
KEATS REGER

SENIOR LECTURERS:
KRE TNER LEA

PROFESSORS EMERITI:
COCHRAN, DAVIS, GROSSMAN, HEIER,
INSKEEP, SCHABACKER

Management includes the functions of planning, organizing, staffing, motivating, and controlling in the business setting; yet management is more than mere administration. Good managers make things happen through their actions within an organization and through responsible contributions to society. Good managers also understand the implications of their actions in an international environment. The Department of Management offers international business seminars for its students, and it provides students opportunities to specialize their studies in management systems or human resources management

Management Systems

The purpose of management is to maximize desirable organizational outputs and minimize undesirable organizational outputs, given realistic constraints. Many tools and systems are used to achieve these ends. These tools and systems are the focus of the management systems track The following courses must be taken to complete this track

		Semester Hours
MGT 311	Personnel Management	3
MGT 352	Human Behavior in Organizations	3

Three of the following five courses:

MGT 433	Management Decision Analysis	3
MGT 434	Social Responsibility of Management	3
MGT 440	Entrepreneurship	3
MGT 459	International Management	3
MGT 468	Management Systems	3

In addition, students must take one MGT elective approved by a management advisor.

All Management majors are required to take six upper division General Studies hours selected from the College of Business *Policy Statement 63* and approved by a management advisor.

Human Resource Management

Effective organizational management depends upon creating an internal organization that is designed to accomplish the organizational mission. The human resource management track introduces the student to issues surrounding the human component of organizations. The curriculum encompasses planning, staffing, motivating, training and development, compensation, performance appraisal, labor relations, and labor law. The courses are designed to provide knowledge and skills that will allow HRM graduates to function as personnel specialists. The following courses must be taken to complete the human resource management track·

		Semester Hours
MGT 311	Personnel Management	3
MGT 352	Human Behavior in Organizations	3
MGT 413	Wage and Salary Management	3
MGT 423	Industrial Relations and Collective Bargaining	3

In addition, students must take two MGT electives in human resource management approved by a management advisor.

All Management majors are required to take six upper division General Studies hours selected from the College of Business *Policy Statement 63* and approved by a management advisor.

MANAGEMENT

MGT 301 Management and Organization Behavior. (3) F S SS
Administrative organizational behavior theories and functions of management contributing to the effective and efficient accomplishment of organizational objectives Prerequisites one psychology (social and behavioral) course and one sociology course

311 Personnel Management. 3 A
Manpower planning staffing training and development compensation appraisal and labor relations. Prerequisite MGT 301

352 Human Behavior in Organizations. 3) A
Human aspects of business as distinguished from economic and technical aspects and how they influence efficiency morale and management practice Prerequisite. MGT 301

413 Wage and Salary Management. 3 A
Installation and administration of a complete wage and salary program Includes objectives, policies organization, control, job evaluation and wage surveys Prerequisites· MGT 311; professional program business student

422 Training and Development. 3 N
Learn ng theory, or entat on and bas c eve tra n ng man agement deve opment resource mater a s and methods Prerequ s tes MGT 311, profess ona program bus ness student

423 Industrial Relations and Collective Bargaining. 3 A
Processes and procedures of co ect ve barga n ng Scope and negot at on of un on contracts

424 Employee Selection and Appraisal. 3 A
Concepts and methods of personne select on and per formance appra sa nc udes job ana ys s, measurement, and ega ssues Exper ent a exerc ses emphas zed Prerequis te MGT 311

433 Management Decision Analysis. 3 A
Dec s on mak ng concepts and methods n the pr vate and pub c sectors and the r app cat on to organ zat ona prob ems Understand ng of nd v dua and group dec s o mak ng Prerequ s tes: MGT 301 profess ona program bus ness student

434 Social Responsibility of Management. 3 A
Re at onsh p of bus ness to the soc a system and ts env ronment Cr ter a for appra s ng management dec s ons Managers as change agents Prerequ s tes MGT 301 profess onal program bus ness student

440 Entrepreneurship. 3 A
Opportun ties, r sks and prob ems assoc ated w th sma bus ness development and operat on

441 Venture Design and Development. (3 N
Ana ys s design and deve opment of a bus ness p an for a new venture Prerequ s te· ACC 212

442 Small Business Management. 3 N
Students, act ng as management consu tants app y bus ness pr nc p es and make recommendat ons to sma bus nesses wh le earn ng to manage sma f rms Prerequ s te: bus ness core except MGT 463

447 Management and the Impact of Technology. 3 N
The mpact of technology on strateg c p ann ng and hu man resources management n bus ness organ zat ons

448 Management and the Impact of Technology: Research. 3 N
Deve opment of research strateg es and cases for study ng the mpact of techno ogy on management theory and pract ce n bus ness organ zat ons. Prerequ s te MGT 447

452 Organizational Behavior Applications. 3 A
The comp ex set of behav ora forces and re at onsh ps that nf uence organ zat ona effect veness Intervent on strateg es and app cat on sk s Prerequ s tes MGT 352 profess ona program bus ness student

459 International Management. (3 A
Concepts and pract ces of mu t nat ona and fore gn f rms Objectives strateg es po c es and organ zat onal struc tures for operat ng n var ous env ronments Prerequ s te MGT 301

463 Strategic Management. 3 F, S, SS
Strateg c formu at on and adm n strat on of the tota or gan zat on, nc ud ng tegrat ve ana ys s and strategic plann ng To be taken ast semester of sen or year Pre requis tes comp et on of 108 hours, nclud ng a other bus ness adm n strat on core requ rements, profess ona program bus ness student *[Sat sfies General Stud es Requirement· L2]*

468 Management Systems. 3 A
Systems theory and pract ce app ed to organ zat on proc ess and research Organ zat ons seen as open systems nteract ng w th chang ng env ronments Prerequ s te MGT 301

494 Special Topics. 3 N
Chosen from top cs n human resources strateg c man agement and nternat ona management, nc ud ng sem nars n nternat ona management n As a or Europe etc

502 Organization Theory and Behavior. 3 F S
Important concepts and app cat ons n management n c ud ng mot vat on eader h p, group dynam cs organ za t on des gn dec s on mak ng commun cat on and organ zat on change. Prerequ s tes ca cu us computer teracy graduate degree program student

503 Complex Organ zations. 3 N
Concepts a d app cat ons n macro organ zat on theory Top cs nc ude organ zat on structure strateg c cho ce cu ture boundary spann ng effect veness and d fferent perspect ves of nterorgan zat ona re at ons

520 Problems in Personnel Management. 3} A
Se ect ng, deve op ng ma nta n ng and ut iz ng a compe tent abor force Case stud es of personne prob ems Preparat on of a wr tten personne program.

522 Labor Relations and Public Policy. 3 A
State and federa eg s at on Recent dec s ons of courts and abor boards Lega rights and dut es of emp oyers, un ons and pub c

559 International Comparative Management. 3 A
Ana ys s of comparat ve management pract ces, prob ems and ssues Management strateg es for the mu t nat ona organ zat on mpact of nat onal and cu tura env ron ments

589 Strategic Management. 3 F, S
Formu at on of strategy and po cy n the organ zat on, emphas z ng the ntegrat on of dec s ons n the funct ona areas. Prerequ s tes ACC 503 CIS 502; ECN 502, F N 5 2· GNB 502, MGT 502 MKT 502; OPM 502, QBA 502 comp et on of at east 36 hours of program of study cred ts

591 Seminar. (3 N
Top cs such as the fo ow ng w be offered·
a Manager a P ann ng and Contro
b Compet t ve Strategy
c Eth cs
d Human Resources Systems

598 Special Topics. 3 N
Graduate spec a top cs chosen from human resources strateg c management, and nternationa management, nc ud ng spec a top cs n nternat ona management n As a or Europe

791 Seminar: Doctoral Seminar in Management. 3 A
Top cs such as the fo ow ng w be offered
a Organ zat ona Behav or
(b Organ zat ona Theory
c Research Des gn and Methodology
d Strateg c Management
e Human Resource Management
(f) Compensat on

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Marketing

PROFESSORS:
BROWN GWINNER, HUTT JACKSON, OSTROM, RENGEN SCHLACTER BJ WALKER
ASSOCIATE PROFESSORS:
MOKWA (BAC 471) BELTRAMIN BLASKO CROSBY EVANS GOURLEY, STEPHENS, SWARTZ
ASSISTANT PROFESSORS:
BITNER, CHO, KALE, R. KLEINE, S. KLEINE, SINHA, B. WALKER, WARD
PROFESSORS EMERITI:
BESSOM, HARRIS OVERMAN, ROWE, SCHMIDT, ZACHER

Study in the field of marketing involves analysis of how businesses plan, organize, administer, and control their resources to achieve marketing objectives. Focus is placed on market forces, growth, and the survival of firms in competitive markets and on the marketing strategy and tactics of the firm. Through the proper selection of courses, a student may prepare for a career in (1) general marketing administration, (2) selling and sales management, (3) promotion management, (4) retail merchandising and management, (5) market research and planning, (6) industrial marketing, (7) international marketing, or (8) advertising.

A major in Marketing consists of 18 semester hours. The following 12 hours must be included:

		Semester Hours
MKT 302	Fundamentals of Marketing Management	3
MKT 304	Consumer Behavior	3
MKT 351	Marketing Intelligence	3
MKT 460	Strategic Marketing	3

To complete the major, students, in consultation with their faculty advisors, select six additional hours from among the following list of courses:

		Semester Hours
ADV 301	Advertising Principles	3
ADV 311	Advertising Creative Strategy	3
ADV 371	Advertising Media	3
ADV 461	Advertising Management	3
MKT 310	Principles of Selling	3
MKT 325	Public Relations in Business	3
MKT 411	Sales Management	3
MKT 412	Promotion Management	3
MKT 424	Retail Management	3
MKT 434	Industrial Marketing	3
MKT 435	International Marketing	3
MKT 444	Marketing Channels	3

In addition, all Marketing majors are required to take six hours from a list of communications and behavioral science courses approved by the Department of Marketing. The list of approved courses is contained in the *Marketing Field of Specialization Student Curriculum Guide*, a copy of which can be obtained from the department office.

ADVERTISING

ADV 301 Advertising Principles. 3 F S SS
Advertising as a communications tool in marketing and business management. Survey of market segmentation creative strategy, media and effectiveness measures Prerequisite: MKT 300

311 Advertising Creative Strategy. 3) F S
Application of communication theory to advertising. Evaluation of strategies and executions Creation of a portfolio containing print and broadcast advertisements Prerequisites ADV 301 non business majors must obtain department approval

371 Advertising Media. 3) F S
Media strategy as an extension of marketing strategy conceptual aspects of media planning, quantitative and qualitative analysis of media Prerequisites ADV 301 non business majors must obtain departmental approval

461 Advertising Management. 3) A
A capstone course in advertising dealing with the management of advertising from both the client and agency perspectives Prerequisites ADV 311 371 MKT 351

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

MARKETING

MKT 300 Principles of Marketing. 3) F, S, SS
Role and process of marketing within the society economy and business organization Prerequisite ECN 112

302 Fundamentals of Marketing Management. 3 F, S SS
Marketing planning implementation and control by organizations with special emphasis on identifying market opportunities and developing marketing programs Prerequisite MKT 300.

304 Consumer Behavior. (3 F, S, SS
Application of behavioral concepts in the analysis of consumer behavior and the use of behavioral analysis in marketing strategy formulation Prerequisite MKT 300.

310 Principles of Selling. (3 A
Basic principles underlying the selling process and their practical application in the sale of industrial goods consumer goods and intangibles Prerequisite. MKT 300

325 Public Relations in Business. 3) N
Role of public relations in business government and social institutions emphasizing policy formulation from a managerial perspective Prerequisite. MKT 300

351 Marketing Intelligence. 3 F S SS
Integrated treatment of the traditional approaches to marketing research and analysis of environmental factors affecting marketing decisions in the firm Prerequisites MKT 300 QBA 221.

411 Sales Management. 3 A
App cation of management concepts to the adm n strat on of the sa es operat on Prerequ s te MKT 302

412 Promotion Management. (3 A
Integration of the promotional activ ties of the firm 'nc ud ng advert s ng, persona se ng pub c relat ons and sa es promot on. Prerequis te: MKT 302

424 Retail Management. 3) A
Role of reta ling n market ng Prob ems and funct ons of reta l managers w th n var ous retai nst tut ons Prerequ s te MKT 300.

434 Industrial Marketing. 3) A
Strateg es for market ng products and serv ces to ndus tr a commercia and governmenta markets. Chang ng ndustry and market structures. Prerequ s te· MKT 302 or nstructor approval.

435 International Marketing. (3) A
Analys s of market ng strategies deve oped by nterna tiona f rms to enter fore gn markets and to adapt to chang ng nternat ona env ronments. Prerequ s tes. MKT 302 or nstructor approval profess ona program bus ness student

444 Marketing Channels. (3) N
D str but on channe s used by f rms engaged in market ng and manufactur ng Strateg es for market ng channels management Relat onsh ps among marketing ntermed ar es Prerequ s tes. MKT 302; profess ona program bus ness student

460 Strategic Marketing. 3 F S SS
Po cy formulat on and dec s on making by the market ng executive Integrat on of market ng programs and cons d eration of contemporary market ng ssues Prerequ s tes MKT 302 304 351 profess ona program bus ness stu dent

502 Marketing Management. 3) F S
Manag ng the market ng funct on, market and env ron menta analys s, market ng plann ng strategy and contro concepts Deve opment and management of market ng programs Prerequ s te ECN 502

520 Strategic Perspectives of Buyer Behavior. (3) N
Concepts and theor es from the behav ora sc ences as they re ate to marketing strategy formu ation Prerequ s te· MKT 502 or equ va ent· or nstructor approval

522 Marketing Information. 3 A
Market ng research, market ng nformat on systems and modern stat st ca techn ques n market ng dec s on mak ng Prerequ s te MKT 502

524 Services Marketing. (3 F, S
Strateg es for market ng serv ces emphas zing the d st nc t ve chal enges and approaches that make market ng of serv ces d'fferent from market ng manufactured goods Prerequ s te MKT 502 or equ va ent.

563 Marketing Strategy. 3 A
Plann ng and control concepts and methods for deve op ng and eva uating strateg c po cy from a market ng per spect ve Prerequ s te MKT 502

591 Seminar. 3 A
Top cs such as the fo ow ng w be offered.
- a Product Strategy
- b Channe Strategy
- c Promot on Strategy
- d) Market'ng n nternational Operat ons
- e Marketing Strategy n Not-for-Prof t and Pub ic Sector Organ zat on
- (f Serv ces Market ng
- g) Advert s ng Strategy

791 Doctoral Seminar in Marketing. 3) F S

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

Purchasing, Transportation, Operations

REGENTS' PROFESSOR:
FARRIS

PROFESSORS:
RUCH (BAC 530), HENDRICK, METCALF, VELLENGA

ASSOCIATE PROFESSORS:
CALLARMAN, DAN EL, PEARSON, D SM TH DANIELS V. SM TH DANIELS

ASSISTANT PROFESSORS:
GR TZMACHER S FERD

SENIOR LECTURER:
W GGINS

PROFESSORS EMERITI:
FEARON REUTER

Operations Production Management

Operations/Production Management majors study the planning and control of internal operations of manufacturing and service businesses. Topics covered include job design, facilities location and layout, work measurement, production planning and scheduling, quality control, inventory control, materials management, purchasing, and transportation. The goal is to design, implement, and operate a productive system to produce goods and services in a competitive global economy. Operations/Production Management majors are prepared for careers in the operations area of large and small firms in a wide variety of industries

A major in Operations/Production Management consists of the following 18 semester hours:

			Semester Hours
OPM	331	Product on and Operations Management	3
OPM	435	Service Operations Management	3
OPM	440	Product vity and Quality Management	3
OPM	475	Operations Strategies	3
PUR	432	Materials Management	3
TRA	445	Logistics Systems	3

Purchasing Materials Management

The major in Purchasing/Materials Management includes the functions of planning, organizing, and controlling the flow of purchased materials, products, and services into and out of the organization. Specific attention is given to planning and scheduling requirements, selecting and analyzing vendors, price determination, purchasing research and value analysis, controlling inventories, materials acquisition, requirements planning, transportation (inbound and outbound), distribution of finished products, and the disposal of scrap and surplus materials.

A major in Purchasing/Materials Management consists of the following 18 semester hours:

			Semester Hours
OPM	331	Production and Operations Management	3
PUR	355	Purchasing	3
PUR	432	Materials Management	3
PUR	455	Purchasing Research and Negotiation	3
PUR	479	Purchasing and Materials Management Strategy	3
TRA	345	Traffic and Distribution Management	3

Transportation

The major in Transportation covers the management of the flow of materials and passengers from both the shipper receiver and carrier perspective domestically and internationally. Emphasis is on the efficient use of transportation services by business management within a framework of logistics systems, government transportation policy relative to freight and passenger transportation, and the management of transportation shipper and carrier organizations. Students are prepared for employment by industrial firms, carriers, and governmental agencies

A major in Transportation consists of the following 18 semester hours

			Semester Hours
PUR	355	Purchasing	3
PUR	432	Materials Management	3
TRA	301	Principles of Transportation	3
TRA	345	Traffic and Distribution Management	3
TRA	445	Logistics Systems	3
TRA	460	Carrier Management	3

OPERATIONS PRODUCTION MANAGEMENT

OPM 301 Operations and Logistics Management. 3 F S SS
Identification and integration of major components of operations and logistics management and their impact on organizational productivity and performance

331 Production and Operations Management. (3 F S
Use of resources in producing goods and services Concepts of planning, scheduling and controlling productive activities and physical resources. Prerequisites OPM 301 professional program business student

335 Methods Management. 3 N
Theory and practice in work design methods improvement and work measurement. Relationship of attitudes and productivity Prerequisites: OPM 301 331 or instructor approval professional program business student

435 Service Operations Management. 3 A
Operations management techniques used in manufacturing and their application in service organizations Prerequisites OPM 301 331 or instructor approval professional program business student

440 Productivity and Quality Management. 3 A
Productivity concepts at the national, organizational and individual levels. Quality management and its relationship to productivity in organizations Prerequisites OPM 331 or instructor approval professional program business student

470 Production Systems. 3 A
Systems theory and management functions, basic tools of systems analysis organizational systems design systems applications, systems simulation Prerequisites OPM 331 professional program business student

475 Operations Strategies. 3 F S
Integrates operations management into strategic planning implementation and control Prerequisites OPM 331, 435 440, PUR 432, professional program business student

502 Operations and Logistics Management. 3 F S
Conceptual foundations for the total operations and logistics functions for all types of organizations Application of analytical methods to production problems Prerequisites. ECN 502 QBA 502

581 Management of Production. 3 A
Analysis of the production function from a managerial point of view. Conceptual foundations analysis of major problems and decision processes

591 Seminar. 3 N
Topics such as the following will be offered
a Production Systems Research
b High Tech Operations
c Operations Strategy
d Service Operations
e Productivity
f Quality

791-A Doctoral Seminar in Production Operations Management. 3 A

791-B Doctoral Seminar in Logistics Systems. 3 A

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

PURCHASING MATERIALS MANAGEMENT

PUR 355 Purchasing 3 F, S
Management of the purchasing function including organization procedures, supplier selection, quality, inventory decisions and price determination Prerequisites OPM 301 professional program business student

432 Materials Management. 3 F S
Analysis and managerial integration of the material flow process within an organization including purchasing, production and inventory control and MRP. Prerequisites OPM 301, professional program business student

455 Purchasing Research and Negotiation. (3) F, S
Current philosophy, methods and techniques used to conduct both strategic and operations purchasing research and negotiation. Includes negotiation simulations. Prerequisites: OPM 301, 331; PUR 355; professional program business student.

479 Purchasing and Materials Management Strategy. (3) F, S
Synthesis of purchasing, production, transportation to provide a systems perspective of materials management. Development of strategies. Prerequisites: OPM 331; PUR 355, 432, 455; TRA 345; professional program business student.

532 Materials and Purchasing Management. (3) A
Analysis of the incoming flow of materials and the economic environment in which the materials acquisition and allocation functions operate.

591 Seminar. (3) N
Topics such as the following will be offered:
(a) Contracting
(b) Systems Acquisitions
(c) Purchasing Research

791 Doctoral Seminar in Purchasing and Materials Management. (3) A

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

TRANSPORTATION

TRA 301 Principles of Transportation. (3) F, S
Economic characteristics, regulation and public policy implications of rail, motor, air, water and pipeline transportation. Managing the shipper's transportation needs. Prerequisite: upper-division standing or instructor approval.

345 Traffic and Distribution Management. (3) F, S
Managing transportation requirements in business enterprises: analysis of shipper-carrier relationships and the legal environment with respect to rates and services. Prerequisite: professional program business student.

405 Urban Transportation. (3) N
Economic, social, political and business aspects of passenger transportation. Public policy and government aid to urban transportation development. Prerequisite: upper-division standing or instructor approval.

445 Logistics Systems. (3) F, S
Managing the firm's logistics activities: integrating transportation, inventory, warehousing, facility location, customer service and related activities in a systems context. Prerequisite: professional program business student.

460 Carrier Management. (3) A
Analysis of carrier economics, regulation, management and rate-making practice; evaluation of public policy issues related to carrier transportation. Prerequisite: professional program business student.

462 Problems in Transportation. (3) N
Current problems of transportation operation, physical distribution and logistics, carrier management and public transportation policy. Prerequisites: TRA 301; professional program business student.

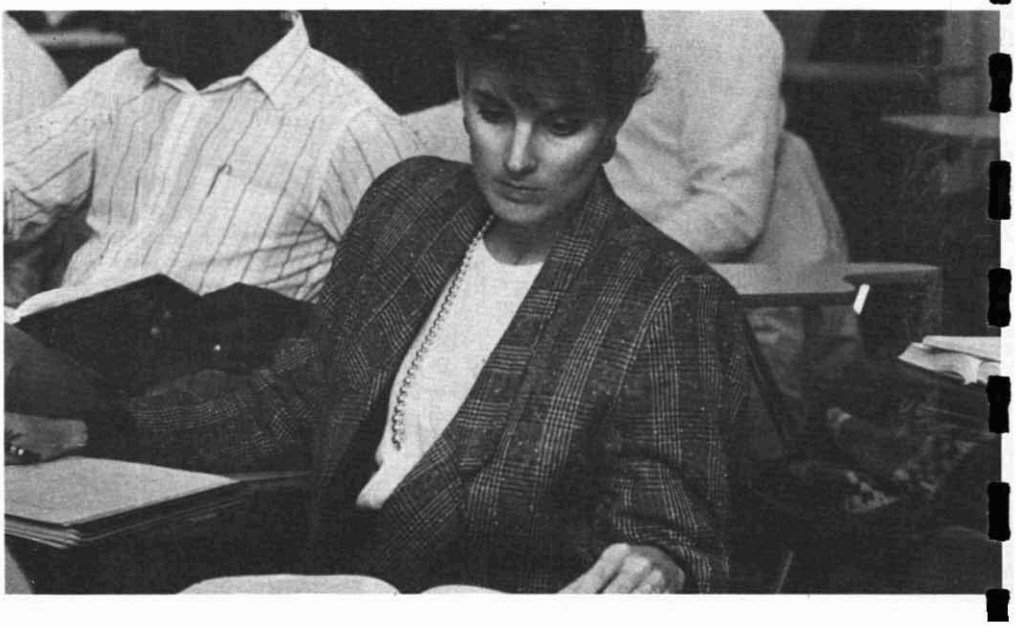
463 International Transportation. (3) A
Role of transportation in international business; economic and legal environment; carrier operations and practices; managing the firm's international transportation needs. Prerequisite: upper-division standing or instructor approval.

541 National Transportation Policy. (3) F
Policy alternatives and problems in transportation; interrelationships of competing transportation modes; relationships of public investment to private operations.

545 Business Logistics. (3) S
Systems management concepts approach to logistics requirements of the business enterprise; analysis of goods and information flows and coordinating activities.

791 Doctoral Seminar in Transportation and Physical Distribution Management. (3) A

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



College of Education

Gladys Styles Johnston, Ph.D.
Dean

Purpose

For students, choosing a professional college is a major decision. It represents the choice of a profession within which a career will be built. The College of Education provides a stimulating, challenging forum wherein scholars and practitioners interact in the discovery and mastery of the science and art of educational endeavors. This balanced approach, in which research and practice are viewed as essential and complementary, enables the college to produce superior educators.

The purposes of the faculty of the College of Education are: (1) the scholarly, scientific, and professional study of education, including its problems, structures, and processes, and (2) the education of students in such study. The College of Education is also dedicated to the design, development, implementation, and evaluation of innovative educational programs. In accord with these purposes, the College of Education is committed to producing quality scholarship and research and to excellence in teaching.

Organization

The College of Education is organized into three divisions. These divisions and their academic programs are listed below:

Division of Curriculum and Instruction
Program Areas
- Adult Education
- Early Childhood Education
- Educational Media and Computers
- Elementary Education
- Multicultural Education
- Reading and Library Science
- Secondary Education
- Special Education

Division of Educational Leadership and Policy Studies Program Areas
- Educational Administration and Supervision
- Educational Policy Studies
- Higher Education

Division of Psychology in Education
Program Areas
- Counseling
- Counseling Psychology
- Educational Psychology
- Learning and Instructional Technology

Services to students and the community are provided through the following centers and offices.

The *Center for Bilingual Bicultural Education* conducts interdisciplinary research on classroom interaction, language development, and cognitive development. The focus of these research efforts is bilingual and bicultural students in Arizona.

The *Center for Indian Education* serves as a service agency to Indian communities, school districts, and Indian students attending Arizona State University. The center also conducts research on Indian education in Arizona and other states with American Indian populations.

The *Office of Student Affairs* assists individuals interested in teacher preparation programs through advisement, admission, and retention activities, and certification assistance. Other services include program of study validation, petition review, student communications, high school and community college visitations/relations.

The *Office of Professional Field Experiences* places all teacher preparation students in public schools and similar institutions for internships and student teaching, monitors students' progress in their field experiences, sponsors courses for cooperating teachers, and conducts research on student performance in the field.

The *Office of Educational Services* advises students regarding College of Education scholarships and provides recruitment and support services for minority students wishing to enter the Professional Teacher Preparation Program (PTPP).

The *Center for Academic Precocity* provides academic services to intellectually advanced students in grades two through 11. These services include individual assessment, talent identification, and a variety of courses.

The *Counselor Training Center* provides counseling for ASU students, staff, faculty, and the community at large in personal and career development, stress management, and marriage and family issues. Counseling is conducted by graduate students in counseling and counseling psychology under the supervision of certified psychologists.

The *Special Education Evaluation Clinic* determines the level of academic competence and areas of remediation for persons experiencing learning difficulties.

The *Reading Clinic* diagnoses causes of reading problems and offers one-to-one tutoring by experienced teachers to students referred by parents and recommended by school districts.

Other units within the college offering specialized research and educational services include the Math Clinic, College of Education Preschool, School Personnel Evaluation and Learning Laboratory, Arizona Educational Information System, University Testing Service, Microcomputer Research Clinic, Mountain States Multifunctional Resource Center, Parent Development International, University Council for Educational Administration, and the National Center for Postsecondary Governance and Finance Research.

Degrees

MAJOR FIELD	DEGREE	DIVISION
Baccalaureate Degrees		
Early Childhood Education	B.A.E.	Curriculum and Instruction
Elementary Education bilingual education/English as a Second Language	B.A.E.	Curriculum and Instruction
Secondary Education Academic specializations: biological sciences; business, office and distributive education; chemistry; Chinese, communication; economics; English; French; general science; geography; geology; German; history; home economics, humanities; Italian; Japanese; journalism; mathematics; physical education; physics; political science; Russian, social studies; sociology; Spanish	B.A.E.	Curriculum and Instruction
Selected Studies in Education	B.A.E.	Interdisciplinary
Special Education	B.A.E.	Curriculum and Instruction
Graduate Degrees		
Counseling Psychology	Ph.D.	Psychology in Education
Counselor Education	M.C., M.Ed.	Psychology in Education
Curriculum and Instruction	Ph.D.	Curriculum and Instruction
Educational Administration and Supervision	M.A., M.Ed., Ed.D., Ed.S.*	Educational Leadership and Policy Studies
Educational Leadership and Policy Studies	Ph.D.	Educational Leadership and Policy Studies
Educational Media and Computers	M Ed.	Curriculum and Instruction
Educational Psychology	M.A , M.Ed. Ph.D.	Psychology in Education
Elementary Education	M.A., M.Ed. Ed.D., Ph.D.*	Curriculum and Instruction
Learning and Instructional Technology	M.A., M.Ed. Ed.D., Ph.D.	Psychology in Education
Higher and Adult Education	M.Ed., Ed.D.	Educational Leadership and Policy Studies
School Library Science	M.A.*, M.Ed.*	Curriculum and Instruction
Secondary Education	M.A., M.Ed. Ed.D.	Curriculum and Instruction
Social and Philosophical Foundations	M.A.	Educational Leadership and Policy Studies
Special Education	M.A. M.Ed., Ph.D.*	Curriculum and Instruction

* Applications are not currently being accepted.

The teaching majors of Art, Choral Music, Dance, Instrumental Music, and Theatre with the degree of Bachelor of Fine Arts are available through the College of Fine Arts. See pages 393–415 for more information.

Undergraduate programs leading to the Bachelor of Arts in Education degree are described below. Descriptions of graduate degree programs can be found in the *Graduate Catalog*.

Bachelor of Arts in Education

Candidates for the Bachelor of Arts in Education degree must complete the PTPP offered by the College of Education. Students completing the program are able to demonstrate proficiency in specified knowledge areas or skills, including:

1. Principles and application of effective instruction,
2. Classroom organization and management,
3. Content or subject matter,
4. Specific curriculum and teaching strategies,
5. Interrelationship of culture and schooling in a multicultural society,
6. Human development,
7. Communication skills,
8. Theories of learning and motivation,
9. Assessment and evaluation,
10. Computer literacy.

Each student in the PTPP selects one of four program areas that provide specialized instruction and preparation. These areas are: (a) Elementary Education, (b) Early Childhood Education, (c) Secondary Education, and (d) Special Education.

Those in Elementary Education have the option to complete an endorsement in bilingual education and/or English as a Second Language. Those in Secondary Education can be certified in one or more specific academic specializations and have an option to complete a K–12 endorsement in art, music, or physical education. Special Education majors can be certified in one or more areas: mental retardation, emotionally handicapped, and learning disabilities.

PTPP Areas and Optional Emphases or Endorsements

Early Childhood Education

Elementary Education
- Bilingual Education
- English as a Second Language

Secondary Education
- Specific academic specializations
- K–12 endorsements in art, music, and physical education

Special Education
- Mental Retardation
- Emotionally Handicapped
- Learning Disabilities

Elementary Education prepares students to teach in grades K–8. Students in this major develop the knowledge and skills needed to teach children with a variety of language, cultural, and developmental backgrounds. The bilingual education/English as a Second Language (ESL) option prepares students to work in bilingual/ESL settings in grades K–8. Early Childhood prepares students to work in infant programs, preschools, and grades K–3 to become eligible for certification in grades K–8. Special Education prepares students to teach in special education settings in grades K–12. Students selecting any of the above majors or options must also complete requirements for an academic specialization in human development. Careful planning and early advisement in developing an approved program of study is essential for students if they are to complete graduation requirements within the typical 126 semester hour program.

Secondary Education provides preparation for teaching subjects in grades 7–12. Teaching fields approved by the College of Education are offered in academic units of the Colleges of Liberal Arts and Sciences, Engineering and Applied Sciences, and Public Programs. Students with teaching majors in the College of Fine Arts earn the appropriate bachelor's degree from the College of Fine Arts.

All students pursuing the Secondary Education major should seek early advisement from the Office of Student Affairs in the College of Education. If accepted to the PTPP, a student has an advisor in the Office of Student Affairs and an advisor in the academic department that offers courses in the student's major teaching field(s).

Admission

Preprofessional Admission

Students admitted to Arizona State University may enroll in the College of Education during their freshman or sophomore years. Preprofessional students should seek advisement within the College of Education through its Office of Student Affairs, EDB 7. *Admission to Arizona State University and the College of Education with preprofessional status does not guarantee admission to the PTPP.*

Professional Program Admission

Consideration for admission to the PTPP requires that students:

1. Complete a minimum of 56 semester hours of appropriate university course work with a cumulative GPA of 2.50 or higher;
2. Achieve passing scores on the *Pre-Professional Skills Test (PPST)*, which assesses basic skills in reading, writing, and mathematics;
3. Be admitted to Arizona State University;
4. Submit an application form by deadline dates to the Office of Student Affairs.

Students are admitted to the PTPP in November of each year for the following spring semester and in April of each year for the following fall semester. Applicants should contact the Office of Student Affairs for exact dates, which are determined yearly.

Because PPST scores must be included for an application to be complete, applicants should plan to take the PPST *well in advance* of application deadlines. In most cases, the PPST can be taken as early as the end of the freshman year.

Admission to the PTPP is selective and based on available resources. *Not all students who meet minimum requirements are admitted to the program.*

Transfer Students

To be considered for admission to the PTPP, transfer students must meet all PTPP admission requirements and should contact the Office of Student Affairs for admission procedures and advisement. Students completing their first two years of course work at a community college or at a four-year institution in Arizona other than ASU should consult academic advisors during those two years for advice in planning a general studies sequence of courses that will meet ASU General Studies requirements.

Out-of-state transfer students should contact the Undergraduate Admissions Office. (See page 32 of this *Catalog*.)

The Admissions Office should receive the application for admission to the university, transcripts, applicable test scores, and other required information at least three months before the application deadline date for the desired PTPP admission.

Advisement

For any major in the PTPP, students should seek early advisement in the Office of Student Affairs EDB 7) and become familiar with specific program and College of Education requirements. Each student in Secondary Education must also consult an advisor in an academic unit offering course work in his or her field of study in the Colleges of Liberal Arts and Sciences, Engineering and Applied Sciences, Fine Arts, or Public Programs. Each Secondary Education major admitted to the PTPP has an advisor in the Office of Student Affairs and an advisor in the major teaching field.

Degree Requirements

General Studies Requirements

Undergraduate students must meet all University General Studies and college graduation requirements in order to earn the Bachelor of Arts in Education degree. General Studies requirements are usually met before formal admission to the PTPP. Each student should consult an advisor early in the college course work in order to select General Studies courses carefully. The University General Studies guidelines are on pages 55–59 of this *Catalog*.

General Studies courses are regularly reviewed. To determine whether a course meets one or more General Studies course credit requirements, see the listing of courses, pages 60–87.

Key to General Studies Credit Abbreviations

L1	Literacy and Critical Inquiry Core Courses (Intermediate level)
L2	Literacy and Critical Inquiry Core Courses (Upper division)
N1	Numeracy Core Courses (Mathematics)
N2	Numeracy Core Courses (Statistics and Quantitative Reasoning)
N3	Numeracy Core Courses (Computer Applications)
HU	Humanities and Fine Arts Core Courses
SB	Social and Behavioral Science Core Courses
S1	Natural Science Core Courses (Introductory)
S2	Natural Science Core Courses (Additional Courses)
G	Global Awareness Courses
H	Historical Awareness Courses

Program of Study

Students admitted to the PTPP must file a program of study during the semester before the time when they will register for their 87th semester hour. A program of study for the four-semester professional program includes core courses for *all* students, regardless of area or option selected.

Additional courses are required to meet degree requirements in the specific areas or options of Early Childhood Education, Elementary Education, bilingual education and English as a Second Language, Secondary Education, and Special Education. The program is sequential in nature and semesters may not be combined.

The general pattern listed below should be followed for each of the majors in the PTPP in the development of a program of study. Students should consult an advisor for assistance during the first semester of the program.

Any exceptions to the above requirements must be approved by the Standards and Appeals Committee of the Division of Curriculum and Instruction.

Human Development Specialization. Early Childhood, Elementary, and Special Education students enrolled in the PTPP must complete an 18 semester hour specialization in human development. Early Childhood and Elementary Education students are required to include MCE 446 Understanding the Culturally Diverse Child as part of their human development specializations. Special Education students are required to include SPE 314 Introduction to Bilingual/Multicultural Special Education in their human development sequences of courses.

Academic Specialization. Each Early Childhood, Elementary, and Special Education student in the PTPP must also complete an 18 semester hour academic specialization in a subject area taught at the school level at which he or she plans to teach. The academic specialization must be taken outside the College of Education.

Four-Semester Requirements Professional Teacher Preparation Program

Early Childhood Education (K–8) Major

Semester I — 7 semester hours

DCI 396 Field Experience
EDP 301 Learning and Motivation in Education
EDP 303 Human Development
SPF 301 Culture and Schooling

Semester II — 9 semester hours

DCI 302 Principles and Applications of Effective Instruction
DCI 303 Classroom Organization and Management
DCI 396 Field Experience
ECD 404 Language Arts
EDP 302 Assessment and Evaluation in Education
EMC 300 Computers in Education

Semester III — 9 semester hours

ECD 401 Instructional Strategies: Social Studies, Creative Arts
ECD 402 Instructional Strategies: Math, Science
ECD 496 Field Experience
RDG 401 Decoding and Reading
RDG 402 Reading Practicum

Semester IV — 14 semester hours

EED 478 Student Teaching in the Elementary School (12)
SPF 401 Theory and Practice in Education (2)

Elementary Education (K–8) Major

Semester I — 7 semester hours

DCI 396 Field Experience
EDP 301 Learning and Motivation in Education
EDP 303 Human Development
SPF 301 Culture and Schooling

Semester II — 7 semester hours

DCI 302 Principles and Applications of Effective Instruction
DCI 303 Classroom Organization and Management
DCI 396 Field Experience
EDP 302 Assessment and Evaluation in Education
EMC 300 Computers in Education

Semester III — 11 semester hours

EED 401 Teaching Science and Social Studies to Children
EED 402 Teaching Strategies in Mathematics
EED 404 Language Arts
EED 496 Field Experience
RDG 401 Decoding and Reading
RDG 402 Reading Practicum

Semester IV 14 semester hours

EED 478 Student Teaching in the Elementary School (12)
SPF 401 Theory and Practice in Education (2)

Elementary Education (K–8) Major with an Option in Bilingual Education/English as a Second Language

Semester I — 7 semester hours

DCI 396 Field Experience
EDP 301 Learning and Motivation in Education
EDP 303 Human Development
SPF 301 Culture and Schooling

Semester II — 7 semester hours

DCI 302 Principles and Applications of Effective Instruction
DCI 303 Classroom Organization and Management
DCI 396 Field Experience
EDP 302 Assessment and Evaluation in Education
EMC 300 Computers in Education

Semester III — 11 semester hours

BLE 401 Teaching Science and Social Studies to Children
BLE 402 Teaching Strategies in Mathematics
BLE 405 Decoding and Reading
BLE 406 Reading Practicum
BLE 407 Language Arts
BLE 496 Field Experience

Semester IV — 14 semester hours

BLE 478 Student Teaching in the Elementary School (12)
SPF 401 Theory and Practice in Education (2)

Secondary Education (7–12) Major

Semester I — 7 semester hours

DCI 396 Field Experience
EDP 301 Learning and Motivation in Education
EDP 303 Human Development
SPF 301 Culture and Schooling

Semester II — 7 semester hours

DCI 302 Principles and Applications of Effective Instruction
DCI 396 Field Experience
EDP 302 Assessment and Evaluation in Education
RDG 301 Content Area Reading: Decoding
RDG 302 Content Area Reading: Practicum
EMC 300 Computers in Education

Semester III — 7 semester hours

480 Major Methods
SED 403 Principles, Curricula, and Methods
SED 496 Field Experience

Semester IV — 14 semester hours

SED 478 Student Teaching in the Secondary Schools(12)
SPF 401 Theory and Practice in Education (2)

Special Education (K–12) Major

Semester I — 15 semester hours

EDP 301 Learning and Motivation in Education
EDP 302 Assessment and Evaluation in Education
EDP 303 Human Development
EED 404 Language Arts
EMC 300 Computers in Education
SPE 311 Orientation to Education of Exceptional Children
SPE 314 Introduction to Bilingual/Multicultural Special Education

Semester II — 12 semester hours*

EED 402 Teaching Strategies in Mathematics
RDG 401 Decoding and Reading
RDG 402 Reading Practicum
SPE 412 Evaluating Exceptional Children
SPE 413 Methods in Language, Reading, and Arithmetic for Exceptional Children
SPE 496 Field Experience

Semester III — 15 semester hours*

EED 320 Teaching Science to Children
SPE 411 Severely Handicapped, Gifted and Regulatory Issues
SPE 414 Methods and Strategies in Behavior Management
SPE 415 Social Behavior Problems of Exceptional Children
SPE 496 Field Experience

Semester IV — 12 semester hours

SPE 478 Student Teaching in Special Education

* *Select two of the following during semester II or III*

SPE 312 Mental Retardation
SPE 336 Behavioral and Emotional Problems in Children
SPE 361 Introduction to Learning Disabilities

Field-Experience Requirements

In addition to course work, students admitted to the PTPP are required to participate in directed field experiences during each semester of the program. The field experiences vary from short-term observation and participation to long-term supervised practice teaching. *Students should expect these field experiences to be above and beyond the class times listed in the* Schedule of Classes *for each semester.* Such field experiences typically take place in public schools throughout the greater Phoenix area. Regular attendance is required during all field experiences. Students should plan extra travel time and expect to confer with cooperating teachers and supervisors before or after scheduled field experiences. To meet field experience requirements, students must plan to have their own transportation and be available during regular school hours.

Student Teaching. The major field experience, called *student teaching*, occurs in the fourth semester of the PTPP. Student teaching is only possible during fall and spring semesters.

Applications for student teaching must be completed early during the semester before the student-teaching semester. To be accepted for student teaching, students must meet the following requirements:

1. An overall GPA of 2.50 or better;
2. A GPA of 2.50 or better in professional course work;
3. The completion of all required professional course work;
4. The removal of all academic deficiencies, such as grades of "D," "E," or "I" before placement;
5. The demonstration of appropriate professional conduct during the first three semesters of the program; and
6. Completion of the application procedure and approval to student teach from the Office of Professional Field Experiences.

Student teachers must adhere to the calendar, regulations, and philosophy of the schools in which they are placed. Beginning and ending dates for student teaching are determined by the

Office of Professional Field Experiences in cooperation with the placement schools. Students are encouraged to avoid extra activities and course work that interfere with the heavy demands placed upon them while student teaching.

Graduation Requirements

Candidates for the degree of Bachelor of Arts in Education are required to complete an approved program of at least 126 semester hours. The College of Education expects its degree candidates to meet individual course assessment standards, field experience observation criteria, and other proficiency standards and performance criteria required to demonstrate knowledge and skill in the areas listed under the Bachelor of Arts in Education description on page 260 of this *Catalog*.

Certification for Teaching

The College of Education is accredited by the National Council for Accreditation of Teacher Education and approved by the Arizona Department of Education for the preparation of elementary, secondary, and special education teachers. Students who complete an approved program of study and meet all graduation requirements of the university and the college are recommended for certification to the Arizona Department of Education. The Office of Student Affairs (EDB 7) maintains information about current certification requirements in Arizona and other states.

The College of Education also offers programs of study leading to special endorsements by the Arizona Department of Education. Of special interest are endorsements in the areas of bilingual education (BLE) and English as a Second Language (ESL), middle school education, and reading and library science. The bilingual education endorsement is required of all teachers specifically responsible for providing bilingual instruction. The English as a Second Language endorsement is required of all teachers specifically responsible for providing ESL instruction. Students should contact the Office of Student Affairs for information and advisement regarding teaching concentrations or special teaching endorsements.

Academic Standards

Retention and Disqualification

Students admitted to the College of Education on *preprofessional status* are subject to the general standards of academic good standing of the university. *Admission to preprofessional status does not guarantee admission to any teacher preparation program offered by the College of Education.*

Students admitted to the PTPP within the College of Education must maintain academic standards and demonstrate qualifications for the teaching profession, including sound physical and mental health, interpersonal skills, basic communication skills, a positive attitude, appropriate professional conduct, and satisfactory performance in field experiences.

To be considered in good standing, students must maintain an overall cumulative GPA *and* a GPA in PTPP course work of 2.50 or higher with at least a grade of "C" in each PTPP course. Any first or second semester PTPP student whose cumulative and PTPP course work GPAs fall below 2.50 may be placed on academic probation or suspended from enrollment in the next semester of the PTPP program.

Students on academic probation or suspension from the university and/or PTPP must seek advice from the Office of Student Affairs before registering for additional course work. A complete copy of the retention policy for the PTPP is available from the Office of Student Affairs in EDB 7.

Probation and suspension status for academic reasons begin on the first day of classes of the semester after the probation or suspension action. Students placed on probation for any reason are subject to disqualification by the College of Education at the end of the following semester if the conditions imposed for reinstatement are not met. A student placed on probation or suspension for any reason has his or her status reviewed at the end of the following semester.

Students demonstrating behaviors or characteristics that make it questionable whether they can succeed in the teaching profession are reviewed by the Standards and Appeals Committee of the Division of Curriculum and Instruction. The committee's review may result in a decision to disqualify the student or the specification of conditions under which continued participation is permitted, i.e., probation.

Students who wish to appeal decisions of the Standards and Appeals Committee of the Division of Curriculum and Instruction may do so in writing to the dean of the college or the University Undergraduate Admissions Board or both. Any exceptions to the above retention and disqualification policies and procedures must be approved by the Standards and Appeals Committee of the Division of Curriculum and Instruction and the dean of the College of Education.

Special Programs

Postbaccalaureate Certification Programs

Postbaccalaureate programs that lead to initial teaching certification are designed for those who hold a bachelor's degree in an area other than education. The college offers postbaccalaureate programs in Early Childhood, Elementary, Secondary, and Special Education. Information on postbaccalaureate programs is available through the Office of Student Affairs, in EDB 7. A student who wishes to be considered for entry must meet the College of Education admission requirements for postbaccalaureate programs, which are:

1. An earned bachelor's degree in an area or subject in which the student wishes to be certified to teach,
2. A GPA of 2.50 or better on the last 60 semester hours of credit earned,
3. Passing scores on the PPST or verbal and quantitative scores of 450 or above on the Graduate Record Examination (GRE), and
4. Submission of a completed application form and supporting materials by the appropriate deadline dates in the semester before admission.

Admission to postbaccalaureate programs is selective and based on available resources. *Not all students who meet the minimum requirements are admitted to the program.* A student admitted to the postbaccalaureate programs who does not begin course work within one calendar year of the date of admission must reapply for admission.

A student who also wishes to pursue a master's degree should contact the program coordinator in the intended area of study. The student must meet the admission requirements of both the College of Education and the Graduate College.

No more than nine semester hours of graduate credit earned before formal admission to the Graduate College can be included in a candidate's master's degree program of studies. Applications for student teaching must be filed early in the semester before to the student-teaching semester. The Office of Student Affairs should be contacted for advisement and admission requirements, procedures, and deadline dates.

Of special interest is the Military Education and Training program offered by the college for recently retired military personnel or those in their last few years of active service. This on-campus program is carefully designed to meet College of Education program standards and leads to teacher certification. The Office of the Dean of the College of Education should be contacted for further information regarding this program.

Multicultural Teaching Emphasis. An emphasis in multicultural education is offered at the undergraduate level. Courses in bilingual education, Indian education, and multicultural education are offered through the Division of Curriculum and Instruction. Courses taken in any area of concentration are usually in addition to regular program requirements.

Selected Studies in Education

An undergraduate student who is interested in a career in education other than public-school teaching can elect to develop an individualized degree program. A student who wants to develop a program of selected studies must fulfill College of Education admission requirements and should contact the Office of Student Affairs for program advisement. A program of study must be filed during the first semester of a student's program and be approved by the Standards and Appeals Committee of the Division of Curriculum and Instruction. This degree is not designed to lead to teacher certification.

Correspondence Course Work for Credit

It is the general policy of the College of Education not to accept course credit for *courses in education* taken through correspondence. Excep-

tions to this policy may be approved if the corre spondence course work has been approved in ad vance of enrollment in the course by the student's advisor, respective program coordinator, and division director. In all such cases, an appropriate rationale must be submitted with the request to enroll.

College of Education

All graduate programs of the College of Educa tion include a core of courses designed to give students an understanding of the context of American education and of the methods of schol arship by which an understanding of the educational system is deepened.

Candidates for M.Ed. and M.C. degrees must complete courses COE 501, 504, and 505 for a total of nine semester hours. Doctoral candidates must complete COE 502, 503, 504, and 505 for a total of 12 semester hours. The core courses are offered each semester and during the summer session. Students are urged to take the core courses early in the program since these courses form the foundation on which many subsequent courses are built.

The core courses follow.

COLLEGE OF EDUCATION

COE 501 Introduction to Research and Evaluation in Education. (3) F S, SS
Overview of educat onal inqu ry from contro led quant ta t ve to qua tat ve natural st c Emphasis on ocat ng and crit ca y interpreting publ shed research.

502 Introduction to Quantitative Methods. (3) F, S, SS
Topics n stat stical analysis measurement, research de sign Exp oratory data ana ys s estimation theory stat s t cal inference. Use of computers for data analysis Cross sted as EDP 502

503 Introduction to Qualitative Research. (3) F, S, SS
Term no ogy, h stor ca development approaches (inc ud ng ethnography ethnomethodo ogy cr t cal theory grounded theory hermeneut cs , qual tative versus quant t tative soc a sc ences; methods of inqu ry. Cross- sted as EDP 503

504 Learning and Instruction. (3) F, S SS
Introduct on to psychology of earn ng and nstruction In c udes the foundat ons of earn ng theories and their app i cat on to educat ona practice Cross l sted as EDP 504

505 American Education System. (3) F, S SS
Po t ca soc a , h stor ca and ph osoph ca ana yses of American educat on at al evels Examinat on of primary sources egal f nd ngs, case stud es

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Division of Curriculum and Instruction

(EDB 225, 965–1644)

PROFESSORS:
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ASSISTANT PROFESSORS:
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PROFESSORS EMERITI:
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Program Areas

Adult Education
Early Childhood Education
Educational Media and Computers
Elementary Education
Multicultural Education
Reading and Library Science
Secondary Education
Special Education

Degrees: B.A.E., M.A., M.Ed., Ed.D., Ph.D.

The Division of Curriculum and Instruction offers undergraduate and graduate academic programs. The undergraduate programs are designed to prepare persons to teach effectively in early childhood, elementary, secondary, and special education settings. Concentrations available at the undergraduate level include bilingual education, English as a Second Language (ESL), Indian education, and multicultural education. Programs of study leading to special endorsements by the Arizona Department of Education are bilingual education (BLE), English as a Second Language (ESL), middle school education, and reading and library science.

Postbaccalaureate programs leading to teaching certification are available in Early Childhood, Elementary, Secondary, and Special Education areas.

The graduate programs in this division are designed to prepare persons for roles such as master teachers, educational leaders, researchers, media and computer specialists, and librarians in schools, colleges, universities, and governmental agencies or service oriented organizations, both public and private.

Faculty within the division are engaged in research and professional training projects. Graduate students have opportunities to participate in varied teaching, research, and professional training (on and off-campus) activities.

Curriculum and Instruction

DCI 302 Principles and Applications of Effective Instruction. (3) F S
Princ pa s of teach ng identified by research on teaching effectiveness Appl cation of princip es to classroom prac tice. For majors on y. Prerequ site· EDP 303

303 Classroom Organization and Management. (2) F, S
Develops understanding and app cat on of classroom or *ganizat on and management pr ncip es strateg es, and* procedures. For majors on y. Prerequis tes: EDP 301, 303, SPF 301

396 Field Experience. (0) F S
Observat on and i m ted part c pation n a schoo sett ng Focus on observation of deve opment learning, manage ment, nstruction assessment, and mot vation. Corequ site semesters I and I of the PTPP.

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered.

Adult Education

AED 510 Introduction to Adult Education. 3) N
H storical development core content, and principal areas of adu t educat on.

511 Program Development in Adult Education. 3) N
An andrigog ca approach to p ann ng programs for adu ts Emphas s on agencies

512 Characteristics of Adult Learners. 3) N
Character st cs of the adu t learner throughout the life span.

514 Instructing Adults. 1 A
Theory and pract ce for nstruct ng adu ts.

522 Introduction to Educational Gerontology. (3) A
Educat ona cons derat ons and methods used n teach ng o der adu ts from the perspectives of psychology and educat ona gerontology

555 Adult Basic Developmental Education. 3) A
Ro es of teacher, student, and program n adu t bas c de ve opmenta educat on. H gh schoo equ va ency and re- ated areas

566 International Adult Education. 3) A
Rev ew and compar son of adu t educat on programs and fac l ties n se ected countr es

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Early Childhood Education

ECD 308 Introduction to Early Childhood Education. (3) S, F
An overv ew of the ear y ch dhood educat on f eld inc ud ng profess ona options h stor ca roots, and current theo r es and po cy deve opments at nat ona state and oca levels

310 Educational Environments: Infants/Toddlers. 3) F S
Organ z ng p ann ng and mplementing educat ona prac- t ces based on deve opmenta theories which w enab e early chi dhood educators to prov de opt ma earning en- v ronments for infants and todd ers Prerequis te ECD 314.

311 Social Studies in Early Childhood Education. (3) F
Deve opment of democrat c v ng n a areas of the cur ricu um Ob ect ves, prob em so v ng se ect on of content, scope and sequence construct on of nstructiona mate ria and resources Exper ences w th ch dren.

312 Educational Environments: Nursery–Kindergarten. (3) F S
Considers al aspects of curr cu um. Ph osophy, pr n c p es, p prob ems and eva uat on n the nte- grated exp nce program

314 The Developing Child. (3) F, S SS
Provides a base for understand ng and work ng w th young ch dren Examines a aspects of deve opment of ch ldren birth through e ght with mpl cat ons for teachers and parents. Prerequ s te. CDE 232 or equ va ent

322 Communication Arts in Early Childhood Education. (3) F
Factors affecting anguage deve opment Sett ng cond t ons for learn ng in sten ng, speak ng, read ng and wr t ng. Prerequis te ENG 213 or equ va ent

378 Practicum in ECD. (3) F, S
Prov des a f e d based experience n se ected early chi d hood sett ngs (outs de the pub ic schoo s pr or to student teach ng Prerequ s te ECD 314

401 Instructional Strategies: Social Studies, Creative Arts. (3) F, S
Presents materia s techniques, and resources for a bal anced program of socia studies and aesthetic expression appropr ate for ch dren preschoo through 3rd grade, w th emphas s on the ntegrated curricu um. Corequ s tes. ECD 402 496 RDG 401 402

402 Instructional Strategies: Math, Science. 3) F S
Emphasizes deve opmental y appropr ate educat onal strateg es and nstruct onal techn ques in teach ng mathe matics and sc'ence to chi dren preschoo through 3rd grade, within an ntegrated curricu um approach Pre requ sites BIO 100, MTE 180 or equ va ent, PHS 110 or equ va ent Corequisites ECD 401, 496, RDG 401, 402

404 Language Arts. (2) F S
Presents theory on the soc al nature of oral and written anguage and congruent classroom pract ces Corequ s tes DC 302, 303 396· EDP 302 EMC 300

411 Early Childhood Education: Programs and Materials. (3) F S SS
Pr nc p es experiments, research stud'es and recent trends as factors related to the educat on of chi dren through eight years of age. Prerequis te ECD 312 or equ va ent

496 Field Experience. (0 F, S
Appl cat on of course content in a P–3 sett ng. Emphas s on observat on, focus on ch ld centered curr culum p an n ng and de iver ng nstruct on and assessment Corequ s tes ECD 401, 402 RDG 401, 402.

522 Developmental Social Experiences in Early Childhood Education. (3) F
Materials, techn ques aesthet c express on creative ac tiv t es and values n the ntegrated curricu um Prerequ s te· ECD 311 or equ va ent

525 Communication Arts in Early Childhood Education. (3) S
Problems and trends of current programs and ora an guage deve opment. Effort to bring together anguage ac qu s t on f ndings with educationa pract ces Opportunity for self d rected learn ng study. Prerequ site ECD 322 or equivalent.

527 Mathematics in Early Childhood Education. (3 F
Theory and pract ce n the use of man pu ative mater a s for teaching mathemat cs to preschoo and pr mary grade ch dren. Prerequis te: EED 380, 402 or equ va ent

544 Play Education. 3) S SS
Theor es of p ay and the educat onal imp cations of each Pract cal app cat ons at the early chi dhood eve

555 Modern Practices in Early Childhood Education. (3) F SS
Trends and practices, nstruct onal and resource materi a s methods and techn ques n early chi dhood educat on

733 Social and Emotional Development. (3 A
nqu ry nto the socia and emot ona deve opment dynam cs in ch dren such as peer relationsh ps, se f concept, parent ng processes, with imp cat ons for teachers

744 Evaluative Procedures: Young Children. (3) S
A cr t cal exam nat on and use of deve opmental y appro priate eva uat ve procedures for ch dren b rth through e ght

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

Educational Media and Computers

BUSINESS EDUCATION

CBE 480 Teaching Business Subjects. (3) S
Organizat on and presentation of appropr ate content for bus ness subjects in the secondary schoo

501 Principles of Business Education. (3) F
H story, ph osophy, princ ples and objectives of bus ness and d str but ve educat on

502 Organization and Management of Cooperative Programs. 3 F
Work study programs for bus ness occupat ons n h gh schoo s and community co leges

503 Competency-Based Business and Vocational Education (3) S
Deve opment and admin strat on of competency based nd v dua zed programs n bus ness and vocat ona educat on

505 Current Literature in Business and Vocational Education. (3) S
Cr t ca ana yses general zations and trends n business and vocat onal educat on.

506 Information Processing for Business and Vocational Teachers. (3 SS
Deve opment of curr cu um and strateg es for teach ng n format on process ng hardware software eva uat on and equ pment acquis t on techn ques n bus ness and voca tiona educat on

512 Technology in Business and Vocational Education. (3 N
Emerg ng curr cula and nstruct ona techno ogy n busi ness educat on

515 Distributive Education (3) N
Plann ng, organ z ng and mp ement ng market ng and d str but ve educat on programs n secondary schoo s and commun ty co eges

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

EDUCATIONAL MEDIA AND COMPUTERS

EMC 321 Computer Literacy. (3) F, S, SS
Survey of the ro e of computers n business and educa tion. Emphasis on word processing database, and spreadsheets *[Satisfies General Studies Requirement N3]*

223 Computer Applications. (3) F S SS
ntroduct on to computer appl cat ons HyperCard, Te e commun cat ons, Authorng Languages, Expert Systems, etc. *[Satisfies General Studies Requ rement. N3]*

300 Computers in Education. (1) F S
An introduction to word processing, databases spread sheets teacher ut ty programs and eva uat on of educa t onal software Requ red for educat on majors

455 Animation and Special Effects. (3 S
An exam nat on of the art sc ence and mpact of anima t on and other specia effects used in f m

501 Computers in School Administration. (3 F, S
Survey of computer use and appl cations n schoo ad min strat on

502 Current Issues and Problems in Media Computer Education. (3) F
Cr t ca ana ysis of current pract ces in nstruct ona med a/ computer Prerequ site 6 hours n EMC CBE or instruc tor approva

511 Computer Applications in Education. 3) F, SS
Use and evaluation of computers for word processing n format on management, graph cs, and author ng nstruc t on n educational sett ngs

513 Introduction to Media Production. (3) SS
ntroduct on to med a production emphas z ng p anning and product on of overhead transparenc es s de tape programs, and v deo programs

521 Instructional Media Design. (3) F, S
Preparing spec f cat ons for instruct ona television, f m sl de tape programs and computer based instruct on

522 Evaluating Computer Materials. (3) S, SS
Se ection ut izat on design and eva uat on of nstruc t ona computer mater a s

523 Telecommunication for Instruction. 3) F
Instruct ona uses of sate l te teleconference and elec tronic networks for d stance earn ng

524 Instructional Photography. (3 F
Des gn and product on of photographs for use n educa tional presentat ons and pub cat ons Lecture Stud o

525 Presentation Graphics. (3) S
Des gn, product on, and d splay of computer graph cs for group presentations Prerequis te. EMC 521 or nstructor approva

527 Instructional Television. 3 F
Des gn and product on of nstruct ona programs for te ev sion Lecture and ab Prerequis te EMC 521 or nstructor approval

528 Advanced Photographic Media Production. (3) S
Design and production of mu t media nstruct onal pro grams Emphas s on sl de tape format Lecture and lab. Prerequisite EMC 521 or nstructor approva

530 Development of Computer-Based Instruction. (3) S
The systematic des gn, deve opment, and format ve eva uat on of computer based instruct on. Prerequ s te EMC 511 or nstructor approva

532 Desktop Publishing. (3) F, SS
Design and product on of educat ona materia s us ng computer based word process ng graphics, and page layout programs Lecture and ab

584 Instructional Media Internship. (1–6) F S SS
Prerequ s tes EDT 502 EMC 521 nstructor approva

637 Computers in Elementary School Curriculum. (3) SS
Exper ences with educationa uses of computers com puter awareness, fam y soc eta mpact classroom app cat ons software curricu um development.

701 Advanced Technologies in Education. (3) S
Exam n ng the ro e and mpact of art f c a nte gence, ex pert systems and related advanced technologies in edu cation

702 Research in Technology-Based Education. (3) F
Cr t ca exposure to theor es, research and methods in technology based educat on

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered

Elementary Education

EED 320 Teaching Science to Children. (3 F S, SS
Deve ops students persona ph losoph es of the nature of e ementary schoo sc ence, why teach science and how ch dren earn science. Know edge and skil s n p ann ng nstruction, using nstruct onal mode s, integrating the cur ricu um emp oying current science programs and mater als and evaluat ng ch dren's learn ng. Prerequis te A basic b olog cal and phys ca sc ence course. L m ted to students adm tted to the postbacca aureate certif cation program

333 Communication Arts in the Elementary School. (3) F, S, SS
Factors affect ng anguage growth. Sett ng conditions for teach ng oral and wr tten. Lim ted to students adm tted to the postbaccalaureate cert f cat on program.

344 Elementary School Organization and Management. 3 F S SS
Overa program of the e ementary schoo . Pract ca ap proaches to d sc p ne and to p ann ng organ z ng and manag ng the classroom L mited to students adm tted to the postbacca aureate cert f cat on program

355 Social Studies in the Elementary School. 3) F, S, SS
Methods and mater a s for teach ng Soc a Stud es in the elementary grades L m ted to students adm tted to the postbaccalaureate cert f cat on program

366 Observation and Participation. (1 3) F S SS
Students observe and work d rectly w th e ementary ch dren n a classroom s tuation Inc udes a cr t ca Limited to students admitted to the postbacca aureate cert f cat on program

380 The Teaching of Mathematics in the Elementary School. (3) F S SS
A beg nn ng course n methods and mater a s used. Labo ratory experiences and computer appl cat ons with cur ricu um materia s Classroom observat on requ red Lim ted to students adm tted to the postbacca aureate cert fi cat on program Prerequisite: MTE 180 or equ va ent

401 Teaching Science and Social Studies to Children. (4) F S
Exam nes core funct ons processes, concepts, materia s, goa s, object ves, scope and sequence, un t and lesson plann ng, and models of nstruction Corequ s tes: EED 402, 404 496 RDG 401 402

402 Teaching Strategies in Mathematics. (2) F, S
Strateg es and methodo og es of teach ng e ementary mathemat cs integrating modern techno og es, prob em so v ng man pu at ves current research and earn ng theories Prerequis te MTE 180 or equ va ent Corequ s tes RDG 401, 402

404 Language Arts. (2) F S
Presents theory on the soc a nature of oral and written anguage and congruent c assroom pract ces. Corequ s tes EED 401, 402, 496· RDG 401 402

478 Student Teaching in the Elementary School. (3–15) F, S
Superv sed teaching n the area of spec al zat on A syn thes zed experience n curr cu um, nstruct on and c ass room management Prerequisites 2 50 GPA complet on of professiona course sequence approval of Profes s ona F e d Expenences

496 Field Experience. (0) F S
App cat on of course content n a (K 8) schoo c ass room Emphas s on observation pup management, p ann ng and de very of instruct on and assessment Corequis tes· EED 401, 402, 404 RDG 401 402

511 Principles of Curriculum Development. (3) F, S, SS
Contemporary curr cu um theor es Curriculum as an nterre ated ent ty. Pr nc p es of conce v ng and effect ng change

526 Communication Arts in the Elementary School. 3) S, SS
A cr tical exam nat on of schoo anguage arts teaching, focus ng on theoret ca assumptions regard ng ora - and wr tten- anguage development

528 Social Studies in the Elementary School. (3 F SS
Prob ems and trends of current programs Development of a balanced and artıcu ated program of social stud es Prerequ s te EED 355 or equ va ent

529 Science in the Elementary School. (3) S
Problems and trends of current programs. Deve opment of a ba anced and art culated sc ence program Prerequ s te EED 320 or equ valent

530 Outdoor Education. 3) SS
Use of various outdoor settings as aborator es for class- room re ated experience study, observat on, nqu ry, re search, and recreat on

537 Mathematics in the Elementary School. 3 F SS
Contemporary mathemat cs teach ng Content materia s, and approaches to instruct on Prerequ s te EED 380, 402 or equ va ent.

578 Student Teaching in the Elementary School. (9–15 F S
Superv sed teach ng for postbacca aureate students syn thesized exper ence in curr culum nstruct on and c ass room management Prerequ s tes. complet on of 21 hours of identified course work from an approved program of study, a GPA of 2 50 postbaccalaureate nondegree) or 3.00 (postbacca aureate degree approva of Profes s ona Fie d Experiences

581 Diagnostic Practices in Mathematics. 3) F, S
Specific ski s n d agnos ng treat ng children s earn ng d ff cu t es n mathemat cs Inc udes pract cum exper - ences both on and off campus in ident fy ng strengths weaknesses and nitra remed ation. Prerequ s te EED 380, 402 or instructor approval

585 Contemporary Issues in Elementary Education. 3) S SS
A seminar wh ch deve ops an understand ng of a broad range of contemporary ssues Ass sts n estabi shing an nformed professional view Prerequis te. EED 511 or equ va ent

670 Qualitative Research in Elementary Education. (3 S
Survey of ethnograph c and natura ist c stud es of teracy; microethnographic ethnomethodo og ca and socio n gu st c stud es of c assroom interact on, ethnograph es of elementary schoo ng. Prerequ s te COE 503.

720 Language in Education. 3 A
Soc ol nguistic seminar on anguage issues n educat on anguage acqu s t on, c assroom interact on anguage at- t tudes re at on anguage and c ass-gender ethn c ty.

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

Multicultural Education

BILINGUAL EDUCATION

BLE 401 Teaching Science and Social Studies to Children. 4) F S
Introduct on of teach ng strateg es to be ut zed n work ng in bi ngua ESL c assroom settings. Corequis tes BLE 402 405 406 407 496

402 Teaching Strategies in Mathematics. 2 F S
ntroduct on and mp ementation concepts for teach ng mathematics to minor ty anguage popu at ons. Corequ sites BLE 401, 405, 406, 407, 496, MTE 180 or equ va ent

405 Decoding and Reading. 2 F S
Techn ques for teach ng read ng to students who are b n gua ESL. Decod ng phon cs vocabu ary comprehen s on and evaluation concepts are ntroduced. Prerequ s te ENG 213 or equ va ent Corequ s tes BLE 401 402 406, 407, 496

406 Reading Practicum. 1 F, S
Superv sed schoo based exper ence n teach ng read ng to b ngua ESL students Corequis tes BLE 401, 402, 405, 407 496

407 Language Arts. 2) F S
Theory of the soc a nature of ora and wr tten anguage and congruent c assroom pract ces for students prepar ng to teach b ingua and ESL students Corequ s tes: BLE 401, 402, 405 406 496

478 Student Teaching in the Elementary School. (3–15 F, S
Superv sed teach ng n the area of spec a zat on A syn thesized exper ence n curricu um nstruction and c ass room management n a b l ngua educat on ESL sett ng Prerequ sites 2.50 GPA comp et on of profess ona course sequence; approva of Off ce of Profess ona F eld Experiences

496 Field Experience. (0 F, S
App cation of course content n a b ngua ESL schoo setting Emphas s on observat on pupi management, plann ng and de ver ng instruct on and assessment Corequ sites· BLE 401 402 405 406, 407

511 Introduction to Language Minority Education. 3) A
H stor ca ph osoph cal theoret ca , and pedagogica foundat ons of anguage m nority educat on n the Un ted States

514 Bilingual Multicultural Aspects of Special Education. 3) S
Theor es and ıssues re ated to the educat on of bı ngua and cu tural y d verse except ona ch dren

515 Instructional Methods for Bilingual Students. (3 F, S
An ntroduct on to genera dua language teachıng ap proaches Focuses on the effect ve teach ng of ım ted Engl sh prof c ent populat ons

516 Teaching Strategies for Native American ESL Programs. 3 A
nc udes ınstruct ona act v ty deve opment, cu tura char acter stıcs and nfus on of culturally relevant content n ESL programs of nstruct on

522 Literacy Biliteracy Development. (3 S
Exam nes approaches to f rst and second language de ve opment for anguage m nor ty students

528 Social Studies for Bilingual ESL Teachers. (3) S
Prov des language and ınstruct ona methodo og es re e vant to bı ngua mult cu tura students ın soc a stud es content del vered ın Span sh and Eng sh

533 Reading-Teachıng Bilıngual Students. 3) F S
Acquaints teachers w th theory and pract ce n second anguage acqu sit on and w th strateg es for deve op ng word recogn tion and comprehens on n native anguage and second anguage read ng Span sh Eng ısh empha s s

535 Sociolinguistic Issues in Bilingual Education. 3 F
Survey of major theoret ca ssues (e g anguage s tu at ons, commun cative competence, anguage att tudes nterre at ng anguage soc a processes and b ngual educat on

541 Nature of Bilingualism Second Language Acquisition. 3) A
B ıngua and second anguage acquıs t on w th spec al emphas s n the Mex can Amer can ch d Psycho og cal and soc o og ca aspects w be stressed

543 Bilingual Education Models. 3) A
B ! ngua education programs n other countr es ana ysıs of po t ca , soc al econom c, and educat ona mpl ca t ons pract ce n p ann ng bı ngua educat on curr cula See a so offerıngs under MCE SED, SPE and SPF

561 Parent Involvement ın Language Minority Education Programs. 3 F S
Examines ssues, approaches and strateg es for mprov ıng parenta and commun ty nvo vement n the schoo ng of anguage minor ty ch dren and youth.

580 Practicum. 1–6 F S
Prov des for pract ca app cat on ın schoo sett ngs of prınc ples of b ıngua educat on or Eng sh as a Second Language Spec a perm ssıon requ red

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

INDIAN EDUCATION

IED 411 Foundations of Indian Education. (3 F S
H storical deve opment of Ind an affairs and nd an educa t on, nc ud ng contemporary educat ona ssues trad t ona Indian concepts of educat on and Ind an cultures

422 Methods of Teaching Indian Students. (3) F
Ph osoph es, methodo og es and materıa s used n In d an education Exam nat on of oca and tr ba c assroom mater a s Exper mentat on w th new teach ng concepts Prerequısite IED 411

424 Curriculum and Practices for Indian Education. 3 S
Curr cula, phı osoph es and research ın nd an education. Techn ques for curr cu um deve opment, change, and ım provement. Prerequ s te: IED 411.

433 Counseling the Indian Student. (3) A
Techn ques and methods used n counse ng w th empha s s on understand ng nd an cu tures and va ues Exper mentation w th new counse ng concepts Prerequ site IED 411

490 Problems of Teachers of Indian Students. (3) S
Current ssues, trends, and prob ems encountered by teachers V ab e so ut ons d scussed. Research rev ewed and eva uated. Prerequ'site. ED 411

500 PS: Administration and Management of Indian Education Programs. (3) A
Exam nat on of adm n strative and programmat c pract ces re ated to the schoo ng of Amerıcan Ind an populat ons

502 PS: Development of Indian Cultural and Language Materials. (3 A
Prov des a cu tural anguage approach to curriculum de velopment Exam nat on of nstruct onal mater als used n Amer can nd an b ngua b cu tura educat on programs.

511 Community Schools in Indian Education. (3) A
Deve opment, mplementatıon, and adm nistrat on of In dıan community schoo s. Techn ques and methods for ef fect ve schoo commun ty re at ons

522 Family Literacy in Language Minority Communities. 3 F, S SS
Exam nes theor es and pract ces re ated to ıteracy deve opment n adu ts Specıa emphasıs s gıven to Nat ve Amer can fam es

544 Role of Tribal, State, and Federal Government in Indian Education. 3) A
Exam nes responsıb ! t es and re at onshıps of each agency n the operat on of Ind an educatıon programs Ana yzes eg s at on, f nanc a resources and tr ba con tro

594 Workshop ın Indian Education. (6) SS
Pract ca approaches to teach ng Indian students Curr cu lum and mater a s deve opment communıty ınvo vement curren·t ssues and research examined

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

MULTICULTURAL EDUCATION

MCE 446 Understanding the Culturally Diverse Child. (3) F S SS
Survey of cu tura and ngu st c dıvers ty n Amer can edu cation: educat on equıty p ural sm earn ng styles and ro es of schoo s ın a mult ethn c soc ety

447 Methods of Teachıng the Culturally Diverse Child. (3) A
Techn ques for organ zıng and prov d ng spec a educa t ona experıences for students from cu tura y and ngu s tıca y d fferent popu atıons Prerequ s te MCE 446

Omnıbus Courses: See pages 48 49 for omn bus courses that may be offered

Reading and Library Science

LIBRARY SCIENCE

LIS 410 Children's Literature. 3 F S SS
Se ect ng ana yz ng and us ng modern and c ass c tera ture w th young readers.

510 Library Automation. (3 S
L brary uses of computers Fundamenta concepts and s sues n the fie d of brary automat on Prerequ s tes L S 571 581, or nstructor approva

533 Current Library Problems. (3 F
Cr t ca ana ys s of current pract ces and problems n schoo brarianshi p Prerequ s tes L S 540, 561 571 581, or nstructor approva

534 Evaluation of Literature for Young Readers. (3 S
Apply ng standards of terary cr tic sm to literature for young readers Prerequ s te L S 410 or nstructor ap prova

540 Classification and Cataloging. 3 F
Descr pt ve cata og ng and Dewey Decimal C ass f cat on of prnt and nonpr nt brary materia s

561 Selection of Library Materials. 3 F
Pr ncip es and procedures used n the se ect on of materi a s for the schoo brary

563 Library Materials for Children. (3 F
Select ng and us ng pr nt and nonpr nt mater a s to sup port the e ementary schoo curr cu um

564 Library Materials for Adolescents. 3 F
Se ect ng and us ng pr nt and nonpr nt materia s to sup port the secondary school curricu um

565 Literature for Hispanic Youth Literatura para Jóvenes Hispanoparlantes. (3 S
Se ect ng, ana yz ng and ut z ng terature for H spanic and Span sh speak ng ch dren and ado escents

571 Basic Reference Resources. 3 S
Prov ding reference serv ce n the schoo brary Content and use of bas c resources

581 School Library Administration. 3 S
Adm n strat on of K 12 brar es and media centers

584 School Library Internship. 1–6 F S
Prerequ s tes L S 410 540 561, 571, 581 Concurrent enro ment n L S 581 s perm tted

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

READING

RDG 301 Content Area Reading: Decoding. 1 F, S
Required course for a secondary educat on cand dates ntroduces theory and nstruct onal strateg es for learn ng from text across academ c d sc p nes Corequ s te RDG 302

302 Content Area Reading: Practicum. 1 F S
Supervised f eld exper ences app y ng nstruct ona strate g es ntroduced n RDG 301 Requ red course for a sec ondary educat on cand dates Corequ s te RDG 301

314 The Teaching of Reading. 3 F S SS
For e ementary teachers n tra n ng, a med at mprov ng c assroom read ng programs and pract ces Course pro v des bas c teacher sk ls, eva uat on c assroom env ron ments and read ng methods D scuss on sess ons might be nc uded L m ted to students adm tted to the postbac ca aureate cert f cation program Prerequ site ENG 213 or equivalent

315 Decoding in Reading. (3 F S SS
Emphas zes ngu st c and psycho ngu stic aspects of read ng nc udes teach ng sound symbo correspon dences through phon cs methods Discuss on sessions m ght be nc uded L m ted to students adm tted to the postbacca aureate cert fication program. Prerequis te RDG 314

401 Decoding and Reading. 2 F S
Requ red course for e ementary ear y ch dhood and spe c a educat on cand dates Decod ng (phon cs , vocabu ary comprehens on and eva uation concepts are ntro duced Prerequ site. ENG 213 or equ va ent Corequ - s tes: ECD 401, 402 496 RDG 402 *or* EED 401 402 496· RDG 402; *or* EMC 300 EDP 301 303· EED 320 RDG 402 SPE 311, SPF 301.

402 Reading Practicum. 1 F S
A superv sed schoo based practicum uti z ng d agnost c and treatment procedures w th ch dren exper enc ng read ng d ff cu ty Requ red for e ementary, ear y child hood and spec a educat on cand dates Corequ s tes ECD 401, 402, 496 RDG 401, *or* EED 401, 402, 496 RDG 401 *or* EMC 300; EDP 301, 303, EED 320; RDG 401, SPE 311, SPF 301

467 Reading in the Content Areas: Secondary. (2 F S, SS
Introduces read ng procedures n subject matter fie ds Emphas s content read ng pr nc p es and methodo ogy nc ud ng decod ng Corequ s te: RDG 480

480 Practicum: Secondary Reading. 1) F, S
Prov des for pract ca app cat on of content read ng prin- c ples n an on s te secondary schoo sett ng Corequ s te RDG 467

481 Practicum: Elementary Reading. 3 F S, SS
Preserv ce students test and tutor ch ldren who are expe r enc ng d ff cu ty w th read ng Th s practicum s sched u ed n oca schoo s under direct col ege superv s'on. L m ted to students adm tted to the postbacca aureate cert f cat on program Prerequ s te. RDG 314

505 Developmental Reading. (3) F S SS
For c assroom and spec a read ng teachers Spec fic pro fess ona sk s n decod ng comprehens on and evalu at on Requ red for spec a read ng endorsement Pre requ s te· teach ng cert f cate

507 Content Area Reading. 2) F S SS
Theory rat ona e and teach ng strateg es concern ng earn ng from text across subject matter d sc p nes. Core qu site RDG 508

508 Practicum: Content Area Reading. 1 F, S SS
Pract ca app ication of content area read ng pr nc p es in f e d s tes or through on campus s mu at ons Corequ s te RDG 507

533 Reading-Teaching Bilingual Students. 3) F, S
Acqua nts teachers with theory and pract ce n second anguage acqu sit on and w th strateg es for deve oping word recogn tion and comprehens on n nat ve language and second anguage read ng Spanish Eng sh empha s s

544 Comprehensive Secondary Reading Methods and Programs. (3 S
Teach ng methods program deve opment/evaluat on and resource work as carr ed out by the contemporary secon dary read ng specia st Prerequ s tes· RDG 507, 508

550 Directed Experiences in Reading. (3) F, S, SS
Practicum exper ence util zing d agnost c and instruction techn ques of the c assroom for correct ve reading reme diat on. Part c pants tutor ass gned students tw ce a week. Laboratory sections Prerequ s te RDG 505 or nstructor s approva Requ red for specia read ng endorsement

556 Diagnostic and Treatment Procedures in Reading. (3) F S SS
Bas c and spec a zed d agnostic and nstruct on tech n ques for corrective and c nica read ng remediat on Requ red for spec a read ng endorsement Prerequ s te: RDG 505

557 Reading Clinic Experience. (3 F
Practicum exper ence ut z ng spec a ized d agnost c and instruction techn ques for c n ca read ng remed at on Part cipants tutor ass gned students tw ce a week Rec ommended for spec al read ng endorsement Laboratory sect ons. Prerequ site RDG 556 or nstructor approval.

581 Learning to Read with Literature. (3) F, S SS
For classroom and spec al read ng teachers. The role of literature n the acqu sit on and development of literacy Spec f c suggest ons for he p ng ch dren earn to read us ing l terature as the med um of nstruct on Prerequ s te teach ng cert f cate.

629 Seminar: History of Reading Instruction and Research. 3 S
Recurrent themes prom nent author ties and s gnif cant research and publ cat ons n the h story of read ng educa t on and related curr cu a Prerequ s te nstructor ap prova

630 Research in Reading. (3 S
For advanced graduate students nterested n appl ed re search prob ems, l terature of read ng instruct on and ma jor ssues related to read ng research. Prerequ s te: 'n structor approval

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Secondary Education

HUMANITIES EDUCATION

HUE 101 Ideas and Values in the Humanities. (4) F, S
nterrelat on of art arch tecture, l terature, mus c, ph oso phy re gion, and theatre and other perform ng arts in the modern world 2 lectures 2 d scuss on meetings per week *[Satisfies General Studies Requ rement HU]*

102 Ideas and Values in the Humanities. 4 F, S
See HUE 101 *[Satisfies General Studies Requirement HU]*

118 Encountering the Arts. (3) F S
ntroductory course emphas zing persona contacts w th the f ne and perform ng arts. Attendance of a wide range of events w th ana ys s and eva uat on

130 Introduction to Popular Culture. 3 F, S
Ref ect ons of Amer can va ues n 20th-century popu ar arts Mus c, pr nt art te ev s on rad o, mov es, the esthet- cs of popular cu ture *[Sat sf es General Studies Require ment· HU]*

401 Humanities in World Cultures. (3–6 N
A human t es study program of fore gn trave . F ne and performing arts of the var ous wor d cu tures May be re peated for credit. Prerequ s te: nstructor approval

480 Methods of Teaching the Humanities. (3) N
Methods of instruct on organ zation d scuss on, and presentat on of the courses n the nterd sc plinary hu man t es. Prerequ s tes: HUE 101 102, or nstructor ap prova .

530 Popular Culture in America. (3) F
The uses of e sure t me from a h stor ca perspect ve Ar eas of concern nc ude telev sion and rad o f lm and stage music, art and paperbacks

585 Philosophical Foundations of the Humanities. (3 N
ssues n nte lectual tradit ons of the Western world that are basic to the nterd sc p nary human t es Prerequ s te human t es educat on graduate stand ng or instructor ap prova

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

SAFETY EDUCATION

SAE 466 Safety Education. 3) N
Safety educat on in home school and place of employ ment

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered.

SECONDARY EDUCATION

SED 403 Principles, Curricula, and Methods. (4) F, S
Advanced eve of deve opment of know edge and ski ls of instruct ona plann ng and methods of teach ng and eva u at ng in the secondary schoo Observation participation required Corequ s te SED 496

478 Student Teaching in the Secondary Schools. 3–12) F S
The practice of teach ng. The re at onship of theory and pract ce n teaching Prerequis tes· SED 403; spec al methods approva of Off ce of Profess ona F e d Exper ences

480 Special Methods of Teaching Social Studies. (3 F S
nterd scip inary approaches; production and co ect on of mater als

496 Field Experience. 0 F, S
App ication of course content n a secondary schoo set t ng Emphas s on observation, pup management, p an ning and de ver ng nstruction, and assessment. Core qu s te. SED 403.

501 Introduction to Effective Instruction. 6) F, S, SS
ntroductory course for postbacca aureate cert f cat on program n secondary education Emphas s upon deve - oping bas c c assroom management, nstruct on and eva uat on Includes a f eld ass gnment of at east 120 hours Prerequis te adm ss on to postbacca aureate cer t f cat on program

522 Secondary School Curriculum Development. (3) F, S, SS
Soc al processes ssues pr nc p es patterns, and proce dures n curr cu um development

533 Improving Instruction in Secondary Schools. (3 F, S SS
Ana yses of procedures, methods, techniques, and ex periments in teach ng n secondary schoo s Prerequi sites· SED 478 578

566 Evaluating Secondary School Programs. 3 N
Development of eva uative criter a for secondary schoo programs Prerequ s tes SED 478 578

577 Issues and Trends in Secondary Education. 3) N Analyses of lay and profess onal reports problems and issues n American secondary educat on Prerequ s tes SED 478, 578

578 Student Teaching in the Secondary Schools. (3–12) F, S
The pract ce of teach ng The re at onship of theory and pract ce n teach ng. Post Baccalaureate students on y Prerequis tes comp et on of approved post baccalaure ate program, a min mum 2 50 GPA, approval of Off ce of Profess onal F e d Experiences

588 Human Relations in the Secondary Schools. (3 A Prob ems in human re at ons nherent n the nteract on of pup s, teachers, adm nistrators, nonprofess onal staff, and aymen. Prerequ s tes SED 478 578

711 Secondary Curriculum Development. 3) S, SS
Theor es and processes of deve op ng curr cu um; eva u at on of research Prerequis tes SED 522 or equ va ent 478, 578

722 Improvement of Instruction in the Secondary School. 3) F
Evaluat on of the research ssues and theor es re ated to the mprovement of nstruct on Prerequ s te SED 533

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Special Education

SPE 311 Orientation to Education of Exceptional Children. (3) F S, SS
nc udes g fted, m ld y hand capped severe y hand - capped and the b ngua mult cu tura except ona ch d *[Satisfies General Stud es Requ rement SB]*

312 Mental Retardation. (3 F S SS
Character stics and assessment spec f c to mental retar dat on Term no ogy, deve opment educationa program ming and therapeutic procedures w be emphas zed. Prerequisite: SPE 311.

314 Introduction to Bilingual Multicultural Special Education. (3) F, S SS
Theoretica background and pract ca app cat on of gen era ssues regard ng the educat on of b ngua mu t cu tu ral handicapped ch dren Prerequ s te SPE 311

336 Behavioral and Emotional Problems in Children. 3) F, S SS
Characteristics and assessment specif c to emot ona y and behav ora y d sturbed ch dren Term no ogy, devel opment, and educat ona programm ng emphasized Pre requisite SPE 311

361 Introduction to Learning Disabilities. 3 F S, SS
Character st cs and assessment spec f c to earning d s ab l t es Term no ogy, development, and educat ona pro gramm ng emphasized Prerequ s te SPE 311

411 Severely Handicapped, Gifted, and Regulatory Issues. (3) F S, SS
Presented n three modu es parent schoo and commu n ty re at ons teach ng the gifted and teach ng the se verely handicapped Prerequ s te SPE 311

412 Evaluating Exceptional Children. 3 F, S
Normat ve and cr terion referenced d agnost c techn ques nclud ng format ve evaluat on Emphas s upon appl ca t on. Pract cum required Prerequ s tes EDP 301 302 EED 404, SPE 311 Corequ s tes ECD 402; RDG 401 402, SPE 413, 496

413 Methods in Language, Reading, and Arithmetic for Exceptional Children. 3 F S
Methods, techn ques and matena s for use n prescr pt ve teach ng. Pract cum nc uded. Corequ s tes SPE 412 496

414 Methods and Strategies in Behavior Management. 3 F S
The organ zat on and de very of nstruct on, nc ud ng for mative eva uat on techn ques Techn ques of behav or management Pract cum inc uded Prerequ s tes SPE 412, 413, ECD 402 RDG 401, 402 Corequ s tes: SPE 415, 496.

415 Social Behavior Problems of Exceptional Children. 3 F S
Ana ysis and ntervent on nto socia behav or prob ems of except ona popula ons Pract cum nc uded Prerequ s tes SPE 412 413 ECD 402; RDG 401 402 Corequ s tes SPE 414 496

455 Early Childhood and the Handicapped. 3) S
Ear y chi dhood educat on as it appl es to the handi- capped ch d.

478 Student Teaching in Special Education. 3 15 F S
"Y" grade only. Prerequ s tes: 1 approva of spec a edu cat on program coord nator 2 comp et on of SPE 311, 414 415 and bas c ntroductory course n area of student teach ng and 3 comp et on of other spec f ed prerequ s tes

496 Field Experience. 0 F, S
App cat on of course content n a spec a educat on set t ng Emphas s on observat on pup management p an n ng and del ver ng instruct on and assessment Core quisite SPE 412 413 or 411 414 415

511 The Exceptional Child. 3 F, S SS
Educat ona needs of except ona ch dren and adu ts Not recommended for students who have completed SPE 311

512 Individuals with Mental Retardation. 3) F SS
Et o ogy d agnos s, and management of nd v dua s with mental retardation Current trends n prevention, pro gramm ng and teacher preparation Not recommended fo stude ts who have comp eted SPE 312

513 Teaching Students with Mental Retardation. (3) S SS
Spec f c methods mater a s and curr cu um for students w th m ld or moderate retardat on Prerequ s te SPE 312 or 512.

514 Bilingual Multicultural Aspects of Special Education. 3 S
Theor es and ssues re ated to the educat on of b ngual and cu tura y d verse except ona ch dren

515 Methods for the Remediation of Learning Problems of Exceptional Children. 3 S SS
Methods and mater als for remed at ng the bas c aca dem c prob ems of except ona ch dren Prerequ s tes SPE 511 · a methods course n the teach ng of reading and mathemat cs

531 Behavior Management Approaches with Exceptional Chi dren. 3 F SS
Behav or management approaches for c assroom behav or of except onal ch dren Prerequ s te SPE 511 or equ va ent

536 Characteristics of Children with Behavioral Disorders. (3) F SS
Variab es contr butng to behavior patterns of behav or d sordered chi dren.

538 Methods of Teaching Students with Behavioral Disorders. 3 S SS
Deve opment of methods for manag ng the academ c and soc al behav or of behaviora y disordered ch dren and youth n educat ona sett ngs. Prerequ site: SPE 336 or 536.

551 Teaching Young Children with Special Needs. (3) S
Methods materia s and curricu um for preschoo and pn mary aged children w th spec a needs Prerequ s tes SPE 455 511, or equ va ents

552 Management of Individuals with Severe Handicaps. 3) F
nstruct on and management of school aged and adu t in d v duals with severe, phys ca , or mu t p e hand caps. Prerequ s tes. SPE 511 or equ va ent; nstructor approval

553 Developmental Functional Assessment. 3) F
Teacher focused developmenta funct ona assessment of preschoo and severely physica y and mult ply hand capped nd v duals F e d exper ence requ red Prerequi sites SPE 511 512 574 or equ valents

554 The Parent/School Partnership. (3) S
nc udes know edge and procedures for nvo vement and training of parents and careg vers of preschool and se verely hand capped nd vidua s F e d experience re qu red Prerequis tes SPE 455 511, or equ va ents

561 Characteristics Diagnosis of Learning Disabilities. 3) F, SS
Theor es re ated to earn ng d sab t es inc ud ng dentif cat on and character st cs

562 Methods of Teaching Students with Learning Disabilities. (3 S, SS
Var ous methods and ntervent on strateg es for remed at ng earn ng d sabi it es of chi dren and youth Prerequi s te SPE 361 or 561

563 Methods of Teaching Adolescents with Mild Handicaps. 3 A
Identif cat on remed at on and a ternative curriculums for except ona students at the secondary schoo eve Soc a and academ c variab es

574 Educational Evaluation of Exceptional Children. 3 F, SS
Des gn and stat stical cons derat ons of normat ve and cn ter on referenced tests Co ect on, record ng, and ana y sis of data from format ve eva uat on Prerequ s tes SPE 511 or equ va ent; a methods course n the teaching of read ng and mathemat cs

575 Current Issues in the Education of Exceptional Children. (3 F, SS
Ma nstreaming noncategor cal f nanc ng ega d agnos t c abe ng eg s at ve and other crit ca and controver s a ssues re ated to the educat on of except ona ch dren

576 Precision Teaching. 3 S
Theory and techn ques wh ch app y to systems of forma t ve evaluation Emphas s on prec s on teach ng

577 Mainstreaming Methods. (3) S
Successfu ma nstream ng methods practica problem so v ng sessions re ated to teacher's c assroom needs and nd vidua contracts focus ng on ma nstream ng s sues are addressed

578 Student Teaching in Special Education. (9–15) F, S
"Y" grade on y Prerequis tes comp et on of spec f ed courses and approva by the spec a education program coord nator

579 Vocational Programs for Individuals with Mental Retardation. (3) F
Curr culum plann ng and methods of teaching n secon dary school and post schoo programs Work eva uat on work study sheltered emp oyment Prerequ site SPE 312 or 512.

582 Classroom Research with Exceptional Children. 3) S
ntroduct on to nterpret ng research Spec f c research techn ques w th pr mary emphas s on c assroom research nc ud ng app ed behavior ana ysis.

585 Creativity: Research and Development. 3) S
Nature of creat v ty exp ored n terms of phi osoph cal un derp nn ngs emp r ca ev dence human development, se f actual zation and the eco ogy surround ng the crea t ve event

586 Advising the Gifted Child. 3 A
Focus on educat ona p anning and guidance soc al and emot onal deve opment, and family prob em solving re gard ng needs of g fted ch ldren

587 Controversies in Educating the Gifted. (3) F
In depth ana ys s of major controvers es n educat ng the g fted nc ud ng nature nurture the ro e of menta tests, and sex d fferences.

588 The Gifted Child. 3 F, SS
Gifted ch dren s character st cs dent f cat on needs, schoo and home environments definit ons, and m sun derstand ngs. Research by Pressey, Stan ey, Terman and others.

589 Methods in Teaching the Gifted. 3 S, SS
Methods n teach ng e ementary and secondary schoo g fted ch dren nc ud ng nd vidua zed and computer as sisted nstruct on, team teach ng Prerequ s te. SPE 588.

674 Identification, Evaluation, and Classification of Exceptional Children. (3) F
Ana ys s of the research and theoret cal l terature focused on the dentif cat on evaluat on and c ass f cat on of ex cept onal ch dren

675 Causation of Handicapping Conditions. 3) F
Ana ys s of the phys o og ca and environmenta factors wh ch ead to hand capping conditions Emphas s g ven to the development of primary prevention

774 Characteristics of Exceptionality. 3) F
Ana ys s of the terature descrb ng earn ng educationa persona socia and cognt ve characterist cs of excep t ona ch dren

775 Intervention Program in Special Education. (3) S
Ana ysis of the research terature focused on ntervent on programs for preschoo , schoo aged and ado escent adu t except ona persons

781 Research and Evaluation in Special Education. (3 S
ssues and problems n conductng research and/or eva u at on programs nvolving except ona ch dren

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

Division of Educational Leadership and Policy Studies

(ED 108, 965–6357)

PROFESSORS:
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Program Areas

Educational Administration and Supervision
Educational Policy Studies
Higher Education

Degrees: M.A , M.Ed., Ed.S.*, Ed.D., Ph.D.

Programs of the Division of Educational Leader ship and Policy Studies are designed to develop leaders, researchers, and policy analysts for ca reers in schools, colleges, and private and gov ernment agencies. Graduates are able to examine educational institutions, theories, and practices within broad economic, historical, political, social, and intellectual contexts in this country and abroad.

Three basic emphases exist within the division's programs. One strand focuses on the administration and policies of educational institu tions and practices from preschool through secon dary education. The second strand focuses on the administration and policies of postsecondary edu cation. The third strand emphasizes: (1) inquiry into the processes by which educational policy is formulated and (2) evaluation of policy decisions. Each strand brings together the methods and per spectives of the social sciences and the social and philosophical foundations of education.

Faculty within the division are involved in both databased and theoretical research. Qualita tive and quantitative paradigms are employed. Students have the opportunity to work on research projects in the College of Education and in school districts and educational agencies through out the country.

The division is a member of the University Council for Educational Administration

* Applications are not being accepted for the Educa tional Specialist program.

Educational Administration and Supervision

EDA 501 Competency Performance in Educational Administration. (6) F S, SS
The nature of educationa adm n strat on the concept of competency as t appl es to educat ona adm n stration.

510 Introduction to Organization and Administration of American Public Schools. (3 F, S
Organizat onal structure and adm nistration of pub ic edu cation are exp ored through the application of egal and eth ca concepts and relevant nformat on of the social sci ences. Cross isted as SPF 510

511 School Law. 3 F, S SS
Constitut ona statutory and case aw that relates to al schoo personne pup s the schoo distr ct, and other governmenta un ts Contracts, d sm ssals tenure, retire ment pup l njur es, liab lity of personnel and d strict, school d strict boundary changes bonding

521 Evaluation of Teaching Performance. 3) F
In depth analys s of ega bas s of teacher appraisal, teacher competency measurement of teacher perform ance and app icat on of performance appra sa systems

524 Theory and Application of Educational Administration. (3) F SS
H story and deve opment of pub c school adm nistrat on n the Un ted States current organizat ona patterns for pub c educat on at oca ntermed ate, state and nat onal eve s, current theoret ca pos t ons n educat ona adm ni stration

525 Human Relations and Societal Factors in Education. (3) N
nterrelations between prob ems of educat ona admin stration and nterdisc p nary soc al sciences Commun ca t ons skil s, morale author ty and perception Concepts from po t ca sc ence, econom cs and social-psychology usefu to the adm n strator

526 Instructional Supervision. (3) F, S, SS
Adm n ster ng curricu um mprovement, n service educa t on, eva uat ng and mprov ng teach ng competence, ad ministrative nstructional respons b l ties

527 Managerial Functions in School Administration. (3) F
Re ates to the work of the central d strict office staff and the schoo principa . Use of human resources, educat onal p ann ng, and organ zat on and management of t me

538 Administration of the Community School. (3) N
Ph losophy, history organ zat on, and operat on of the commun ty centered schoo Introduct on of the commu n ty educat on concept nto a schoo system and mak ng t operat ona

544 Public School Finance. (3) F
Measures of ab ity, efforts, and educat ona need cap ta out ay funding tax revenues federa , state and local f nanc ng alternat ves, and major ssues and trends in the financ ng of pub c education.

548 Community Relations in Education. (3) N
Adm nistrat ve factors of pr mary importance in deve op ng community nvo vement n pub c schoo s Emphasis on theory and ski l of school system and ind v dua commun cation.

549 Programming and Financing Community Education. *(3) N*
n-depth nvest gation of component programs effect ve as a vehic e for community educat on n area schoo s; plans which he p schoo s change mode s for funding commu nity education Prerequisite EDA 538 or nstructor ap proval

555 Educational Facility Planning. (3) F
Schoo bu ld ng needs, educat ona p ann ng for faci ities respons b ities of arch tects dut es of contractors equip ping and furnishing of schoo bu ldings

568 Role and Responsibility of Supervising Teacher. (3) N
Exper ences and content for those planning to become superv sors of student teaching in teacher-educat on programs n serv ce tra n ng for those n student teach ng

571 School Business Management. (3) F, S, SS
Purchas ng budgeting account ng, payrol management, aud t ng, financia reporting, nsurance and admin strat on of nonteach ng personne and services

573 School Personnel Administration. (3 S
Organizat on for personne serv ces; deve opment of po cy to govern se ect on orientation, p acement, remunera tion, transfers, separat ons, and deve opment of mora e among nstructional and non nstruct ona personnel.

576 The School Principalship. (3) F S, SS
Prob em and laboratory approaches used to provide ap pl cation of adm nistrat ve act vit es of elementary and secondary schoo s.

634 Instructional Leadership. (3) N
Curricu ar pract ces and processes used by instructional eaders who p an, organ ze, and coord nate the profes s onal activ t es n e ementary and secondary schoo s Prerequisite· EDA 526

675 Politics of Education. (3) S
Soc a sc ence theory and research are used to consider the po tical context of educat ona po icy mak ng

676 The School Superintendency. (3) S
Crit cal examinat on of the school superintendency and the pr mary funct ons of th s educational pos t on The du ties, respons b t es act vities and prob ems of the schoo super ntendent are inc uded. The un que eadersh p role of the schoo superintendent is exam ned Prerequisite instructor approva

679 Administration of Special Programs in Education. (3) N
For personne adm n ster ng spec al educational serv ces; respons b t es of super ntendents, pr ncipals superv sors, and directors for spec a educat on, student person nel, audiov sua brary sc ence and others.

711 Administrative Leadership. (3) F
Emphasis on research n leadersh p app cat on of re search findings to adm n strative and supervisory functions in educationa endeavors Prerequ s tes: 30 semes ter hours n educationa adm n strat on; admiss on to doc toral program

722 Administration of Instructional Improvement. (3) S
Recent research re at ng to adm nistrative and supervi sory responsib ities for the mprovement of the educa t ona program. *Effective processes by adm n strators, su* perv sors, consu tants, and coordinators. Prerequis tes: 30 semester hours n educat ona admin stration; adm s s on to doctora program

733 Administrative Management. 3) S
Recent research relat ng to school management Schoo f nance, aw, bu d ngs, transportation, food serv ces and *supp y management. Prerequis tes. 30 semester hours in* educat ona adm n stration adm ss on to doctoral pro gram

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered.

Educational Policy Studies

SPF 111 Exploration of Education. (3) F, S
Educat on as an nstrument n the deve opment of the n div dua and society; ts significance as an Amer can nst tut on *[Satisfies General Studies Requirement SB]*

301 Culture and Schooling. (2) F S
For the professiona teacher preparat on program. an overv ew of the cultura , socia , and po tical milieus in wh ch formal schoo ng takes p ace n the Un ted States For education majors only

333 Basic Issues in Education. (3) N
Important contemporary soc ophi osoph ca ssues educators face, ana ys s and prob em so v ng

401 Theory and Practice in Education. (1–2) F S
For the profess ona teacher preparation program The ana ysis and interpretat on of classroom behavior from perspect ves derived from ph osophy soc a science, and law. For education majors only.

411 History of American Education. (3) N
Soc al cond t ons, deas and institut ons wh ch formed American educat on *[Satisfies General Studies Require ment: SB]*

457 Third-World Women. (3) F
Econom c soc opolitica , and demograph c context for understand ng the ro es of third world women n hea th fam y, work, educat on and commun ty. Prerequis te. 6 hours of social sc ence credit or nstructor approva Cross l sted as FAS 494 NUR 457, WST 457. *[Satisfies General Studies Requirements SB, G]*

510 Introduction to Organization and Administration of American Public Schools. (3) F, S
Organ zat ona structure and adm n strat on of pub ic edu- *cat on are explored through the appl cation of ega and* ethical concepts and re evant nformat on of the soc a sc - ences Cross sted as EDA 510

511 School and Society. (3) F, S SS
nterre ationsh p of schoo and soc ety and the role of edu cat on n soc a change

515 Education of Women. (3) A
Ana ys s of ro es and status of women educat'ona prac tices and alternat ves

520 Cultural Pluralism and Education. (3) N
Ph osoph c analys s of the concept of cu tura p ura ism and ts soc a mp cat ons for American educat on

533 Comparative Education in the Western World. (3) F
Educat ona practices and trad t ons n the lead ng nat ons of Europe and the Sov et Un on

534 Education and Change: Developing Nations. (3 S
Educat on as econom c and soc opol tical change agent in Africa, As a, the M dd e East, and Lat n Amenca

543 Bilingual Education Models. (3 F
B l ngua educat on programs in other countr es· ana ysis of po t ca soc a , economic and educational mp cations, pract ce n p anning bi ngual educat on curr cu a.

544 Philosophical Foundations of Education. (3) F
Theor es of educat on n anc ent, med eval and modern c ass ca and contemporary ph losoph'es.

566 History of Education. (3) S
Deve opment of educationa nst tut ons and ideas in the Western Wor d, from ancient t mes to the 20th century

711 Social and Historical Foundations of Education. (3) S SS
Prob ems of American education and their soc ohistor ca context.

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Higher Education

HED 510 Introduction to Higher Education. (3) F, S
An overview of American h gher educat on nc uding ph o soph ca , po t ca and soc a aspects

515 Instructional Personnel. 3) N
Profess ona ro es and respons b t es of nstruct ona per sonne n higher educat on

516 Management Concepts in Higher Education. (1) N
Introduct on to concepts of management theory and prac t ce

533 The Community-Junior College. 3) F, S
History funct ons organ'zation and current ssues Meets Ar zona commun ty co lege course requirement for certifi cat on.

611 Curriculum and Instruction. (3 S
Curr cu um deve opment nstruct ona organ zation, and mprovement of nstruct on in h gher educat on Prerequi s te: HED 510.

644 Higher Education Finance and Budgeting. (3) S
Financ a p ann ng and budget ng in h gher education n stitut ons Issues re ated to f nancing pub ic and pr vate co eges and un vers ties Prerequ s te: HED 510

649 Law of Higher Education. 3 F
Ana ys s of lega issues re ated to h gher education exam nat on of key court dec s ons Prerequisite HED 510.

689 Administration. 3) F
Theory and pract ce of admin strat on n h gher educat on nst tutions Prerequ s te HED 510

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered.

Division of Psychology in Education

(EDB 301, 965–3384)

REGENTS' PROFESSOR:
KULHAVY

PROFESSORS:
HELMSTADTER (EDB 301A), BERLINER, BERNSTEIN CABIANCA GLASS, GRINDER, HACKETT, HARRIS, HORAN, KERR, KRUS, McWHIRTER, NELSEN, ROBINSON, SATTLER, SMITH, SNYDER, STOCK STROM, SULLIVAN, VAN WAGENEN

ASSOCIATE PROFESSORS:
ARCINIEGA, BARONA, BETZ, BROWN BURKE, CHRISTIANSEN COHN, CUMMINGS, GROSS, KINNIER METHA MOORE SHELL

ASSISTANT PROFESSORS:
KLEIN, SANTOS DE BARONA

PROFESSORS EMERITI:
BENEDICT, BLACKHAM, BLAESSER, BOETTO, CHURCHILL, DAANE, DAVIS, GAFFNEY, GERLACH, GUINOUARD, KIMLER, MAZEN, MILLER, MOULTON, NICHOLS, NOBLE, RICHARDSON, STAFFORD, VERGIS, WRENN

Program Areas

Counseling
Counseling Psychology
Educational Psychology
Learning and Instructional Technology

Degrees: M.A., M.Ed., M.C., Ed.D., Ph.D.

The faculty in the Division of Psychology in Education offer graduate degrees in a number of program majors. Master's degrees are offered in Counselor Education, Educational Psychology, and Learning and Instructional Technology. Doctoral degrees are offered in the program majors of Counselor Education (applications for the doctorate in Counselor Education are no longer being accepted), Counseling Psychology (a program accredited by the American Psychological Association), Educational Psychology, and Learning and Instructional Technology. In the Ph.D. program in Educational Psychology, concentrations are available in: school psychology (a program accredited by the American Psychological Association); measurement, statistics, and methodological studies, and life-span developmental psychology.

Students applying to the graduate programs in Counseling Psychology or Educational Psychol ogy are required to submit scores on the Graduate Record Examination (GRE). The Miller Analo gies Test may be substituted for the GRE in the area of Counselor Education and Educational Technology. All degree programs require the successful completion of comprehensive exami nations.

Additional information on graduate programs may be obtained directly from the division office. Persons requesting information should specify the program of interest.

Counselor Education

CED 422 Group Dynamics and Education. (3) A
Theory and use of group processes to fac l tate human n teract on and learn ng.

512 Introduction to the Helping Relationship. (3) F, S, SS
Introduction to the ski s used in the he p'ng profess ons and an examination of the sett ngs in wh ch they occur.

522 Personality Development. (3) F, S, SS
Interact on of affective and cognitive factors in persona ity development at different age levels. Various persona ty theories examined.

523 Psychological Tests. (3) F S, SS
Standardized tests in the study of the nd'v dua w th em phas s on test score interpretation n counse ng.

534 Occupations and Careers. (3) F, S, SS
The world of work, career development, education and train ng for occupationa entry and mobi ity.

545 Analysis of the Individual. (3) F, S, SS
Theory and methods commonly used n study'ng the nd v dua Observat ona methods, d agnostic nterviews, structured and semi structured methods for assess ng personality. Pre- or corequisite CED 523.

567 Group Procedures. (3) F, S SS
Soc al psychologica factors determining interaction, ef fect veness and mora e n sma groups Techn ques of observat on, assessment and leadership

577 Counseling. (3) F S, SS
Princ ples and app cat on of counseling w th part cular emphasis on counseling theor es. Prerequis tes· CED 512, 523, 534, 545; adm ss on to M C. or school coun selor certificat on program

655 Student Development Programs in Higher Education. (3) A
Emerging conceptual mode s of student deve opment. Overview of student personnel and student affa rs pro grams in commun ty co eges, four-year col eges and uni vers ties Observat on on campuses

656 The American College Student. (3) A
Selected theor es of human development w th app ication to academic sociopsycholog cal earning tasks of postsecondary environmenta influences, includ ng facu ty expectat ons, campus subcu tures.

672 Marriage and Family Counseling I. (3) F
ntroduct on to marr age and family counse ing theor es Emphas s s on a systems-commun cation mode util z ng co counse ing

673 Marriage and Family Counseling II. (3) S
Advanced ana ys s and appl cat on of systems commun cat on counsel ng. Focus on mar tal and sexual counse ng Practicum recommended

681 Supervised Practice. (3) F S
Superv sed exper ences n schoo s or community agen- c es Prerequisite nstructor approval

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

Counseling Psychology

The doctoral program in Counseling Psychology is ac credited by the American Psychological Association.

CPY 613 Child Counseling. (3) N
Appl cat ons of counse ng theory n work ng with ch ldren in c n cs and elementary schools. Integrated practicum ava lab e with permission of nstructor. Prerequ site· CED 577 or equivalent

622 Group Counseling. (3) F S
Theor es and methodo og es used n group counsel ng. Prerequ s tes CED 567, 577 or equ valents.

634 Organizational Development and Planned Change. (3) S
Organizat onal/individual dynam cs theory, analys s, tech- n ques and consultation intervent on strategies used n organ zat onal development F e d consultat on projects Prerequ s tes CED 567 577 or equ valents

644 Psychology of Careers. (3) S
Advanced career counsel ng. theory research and prac- t ce. Prerequ s tes CED 534 577, or equ va ents

645 Professional Issues and Ethics. (3) F S
Eth cal, legal, and profess onal issues of concern to prac- tit oners and researchers funct oning in a var ety of set- t ngs. Prerequ s tes: CED 512 523 or equ va ent

666 Comparative Theories of Personality. (3) F
Comparat ve analys s of personal ty theor es n re at on to counse ing pract ces. Prerequis te: CED 577 or equiva ent

667 Patterns of Behavior Disorders. (3) A
Etio ogy and treatment of a var ety of psycholog ca prob- ems, part cularly those represented in DSM II R Prere- requ s te CED 577 or equivalent

670 Behavioral Counseling. (3) N
Theory, procedures, and appl cat ons of behav or mod f cation and therapy n working w th ch dren parents, and adu t c ients in schoo , c in c and nst tutional sett ngs D - dactic nstruction, ana ys s of nd v dual and group prob ems, and d rected exper ences Prerequ s te: CED 577 or equ va ent

671 Multicultural Counseling. 3 A
Provides awareness of the influence of soc ocu tura var - ables on human development and explores mp icat ons for counse ng m nority popu ations. Prerequ s te CED 577 or equ va ent

672 Human Diversity: Social Psychological Perspectives. (3) A
mp ıcat ons for psycho ogıcal pract ce of soc a , psycho og cal, and b o og cal factors n the deve opment of be havioral d fferences.

674 Counseling Women. (3 F
Exp ores women s deve opment and ts mpl cations for counse ng Sex sm n menta hea th, sex differences in diagnos s and psychopathology and women s part cu ar treatment needs.

675 Counseling Interventions in Stress Management. 3) S
Theory procedures and app ıcat on of stress manage ment techn ques nclud ng bıofeedback, med tat on re axat on, autogen c therapy v sua ızat on, and ımagery Prerequ s tes CED 577 or equ va ent nstructor approva .

677 Advanced Counseling. (3) N
Advanced top cs n counseling theory research and practice Prerequisite CED 577 or equ va ent

679 History and Systems of Psychology. (3) A
Examinat on of the deve opment and d fferentiation of the d sc pl ne of psycho ogy from ts or g ns n ph osophy to the present

701 Science and Practice of Counseling Psychology. (3 A
Directed experiences nvo ving the ntegrat on of theory research, and pract ce n counse ıng psycho ogy Pre requ s te nstructor approva

702 Research Methods in Counseling Psychology. 3) A
The app cat on of exper mental and or quası experimental methods to theory construct on and treatment eva u ation n counse ng psycho ogy Prerequıs te COE 502 or equ va ent.

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Educational Psychology

The doctoral program n school psychology, a concentra tion within the degree in Educational Psychology ıs ac credited by the Amencan Psycholog cal Assoc at on

EDP 301 Learning and Motivation in Education. (2) F, S
Us ng a case format earn ng and mot vat on prınc p es are app ed to educat on contexts Educat on majors on y

302 Assessment and Evaluation in Education. 1) F S
Usıng a case format assessment and eva uat on pr n c ples are appl ed to educat on contexts Education ma ıors on y

303 Human Development. (3) F S
Selected aspects of child and ado escent development Emphas s on poss b ıt es for nfluence by teachers and parents For majors on y Prerequ s te CDE 232 or equ va ent

310 Educational Psychology. 1–6) F, S, SS
Human behav or ın educat ona s tuations presented through nstruct onal modu es Students may re enro for cred t to a tota of 6 hours *[Satısfıes General Studies Requirement. SB]*

313 Childhood and Adolescence. 3 F S, SS
Pr nc p es under y ng tota deve opment of pre and ear y ado escent ch dren Emphas s on phys ca ntel ectual soc a and emotiona deve opment w th pract ca mp ca t ons for teachers grades 5–9. Prerequ s te EDP 303 or adm ss on to Co lege of Educat on postbacca aureate pro gram

454 Introduction to Statistical Data Analysis in Education. 3) F S, SS
The ro e of statist cs n research Tabular and graph c data presentat on Frequency d str butions descr pt ve ndexes and ntroduct on to stat st ca nference Pre requıs te MAT 117. *[Satısf es General Studies Requ re ment N2]*

502 Introduction to Quantitative Methods. 3 F, S SS
Top cs n stat st ca ana ys s, measurement, research de s gn Exp oratory data ana ys s, est mation theory, stat s tica nference Use of computers for data ana ys s Cross ısted as COE 502

503 Introduction to Qualitative Research. 3) F, S, SS
Term no ogy h storica development approaches (ınc ud ng ethnography, ethnomethodology, cr t ca theory grounded theory, hermeneut cs , qua tat ve versus quan t tat ve soc a sc ences; methods of nqu ry Cross ısted as COE 503

504 Learning and Instruction. 3 F, S SS
ntroduct on to psycho ogy of learn ng and nstruct on In c udes the foundat ons of earn ng theories and the r app cat on to educationa pract ce Cross ısted as COE 504

510 Essentials of Classroom Learning. (3 F, S, SS
Theoret ca and emp r ca foundat ons of earning n the classroom m eu. Cr t cal exposure to research and method ın nstructional psychology

513 Child Development. 3 F S, SS
Exam nat on of problems and ach evements experienced by chi dren grow ng up n a techno ogica soc ety. Empha s s on d scover ng the ch ld's perspect ve.

514 Psychology of the Adolescent. (3) F S, SS
Cogn t ve, physıca , and soc al deve opment of ado es cents n contemporary soc ety. mpact of fam y schoo and work p ace on adolescent deve opment. Prerequıs te: EDP 310 or PGS 100 or equ valent.

530 Theoretical Issues and Research in Human Development. (3 F
Psycho og ca theor es research, and methods re evant to human development emphas z ng the re ations between ear y deve opment and ater performance

532 Psychology of Exceptionality. (3 S
Genera psycholog ca theory and exper menta research relevant to except ona ty emphas zıng mp cations for educat ona programs which recogn ze un que earner character stics F e d work

534 Principles of Behavior Modification. (3) F
Pr nc p es of cond t on ng as appl ed to behav or mod fica t on, current research on the experimenta ana ys s of be havior ın educat ona psycho ogy.

540 Theoretical Views of Learning. 3) F S
C ass cal and cogn t ve theories of learn ng p us recent or ental ons ustrative exper menta and rat ona founda t ons, mpl cat ons for educat ona pract ce

542 The Psychology of Learning and Instruction. (3) S
Cr t cal rev ew and evaluat on of research on earn ng var ab es re evant to acqu s t on and retent on of nstruc t ona mater a s Laboratory experience

543 Psychological Research on Life-Span Development. (3 S
Crit ca rev ew and eva uat on of contemporary research on cogn tive and affect ve deve opment across the fe span Prerequ s te EDP 530 or equ va ent

544 Psychology of Reading. (3) N
A ternate ana yses of the reading process, des gns and procedures for nvest gat ng nstruct ona and non n structiona variables re ated to read ng ach evement.

550 Introduction to Measurement in Education. (3) F, S
Nature and types of educat ona measures Critiqu ng and se ect ng appropr ate measur ng dev ces Construct ng measuring dev ces Soc al controversies about tests

551 Expository Writing and Research Heuristics. (3) F
Weekly writing pract ce making use of heurist c concepts and expository pr nc p es The construct'on of rationales for research problems Log c and coherence in rhetor c Writ'ng style appropriate to expos tion

552 Basic Statistical Analysis in Education. (3) F S SS
Nature of educat ona data and statist'ca ana ys s. Fre quency d stribut ons and descriptive ndexes. ntroduct on to hypothes s test ng ANOVA and regress on

554 Intermediate Statistical Data Analysis in Education. (3) F S, SS
Mu t'ple regress on ANOVA by mu t'p e regression, re peated measures and other des gns, covariance analys s and ntroduction to MANOVA Prerequ s te: COE 502 or EDP 552 or pass ng grade on a qua fy ng exam

556 Data Processing Techniques in Measurement and Research. (3) S
Advancement of stat st ca des gn and measurement sk ls through deve opment of data process ng techn ques and usage of spec al programs and data processing pro grams Prerequ s te: EDP 554.

560 Individual Intellectual Assessment. (1–6) F, S
Exper ence n adm n'ster ng and nterpret ng ind vidua tests. Theoretica bas s for ab l ty test ng, ethica cons d erations and d agnost c use of test resu ts n t a enro ment, three hour min mum Laboratory exper ence Pre requis tes EDP 454 and adm ss on to a program in pro fessiona psycho ogy; or instructor approva .

562 School Psychology: Theory and Practice. (3) F
Development and present status of schoo psychology. overv ew of assessment and ntervent on strateg es and profess ona issues

563 Interventions in School Psychology. (3) F
Examination of case based consultation and consu tat on research relevant to schoo psychology pract ce F eld ex per ence. Prerequ site: schoo psycho ogy program or in structor approva

566 Diagnosis of Learning Difficulties. (3) S
Cl n ca d agnos s of learn ng d fficu ties emphasizing spe cif c academ c prob ems Use and nterpretat on of diag nost c instruments n pract ca schoo s tuat ons Pre requ s tes· EDP 560, 562, or equiva ents, nstructor ap prova .

567 School Psychological Services to Minority Students. 3) S
H storica perspectives and major issues n psycholog ca and academ c assessment and ntervent ons w th m nority school chi dren

568 Organizational Development: School Psychological Perspectives. (3) F
App cations of organ zat on deve opment strateg es and techniques n faci itat ng the positive mpact of schools on students' earn ng and soc al functioning

651 Methods and Practices of Qualitative Research. (3) S
Advanced course for students fam ar with theory and ex tant work Topics inc ude data co ection, ana ys s, report ng and an extens ve fie dwork project Prerequisite COE 503

652 Multivariate Procedures in Data Analysis I. (3) F
Mu t var ate ana ys s of var ance and covar ance, mu ti var ate mu t ple compar son procedures power analys's and effect s ze, d scrim nant analys s, repeated measures analys's. Prerequ s te EDP 554 or pass ng score on qua fy ng exam

654 Multivariate Procedures in Data Analysis II. (3) S
Mu t variate mu t p e regress'on canonical corre ation, factor analysis categorica data ana ys s, og inear mod els, structura equat on mode s Prerequ s te EDP 554 or passing score on qua ify ng exam

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Learning and Instructional Technology

EDT 501 Foundations of Educational Technology. (3) F, S
Introduction to nstruct ona development An exam nat on of accomp! shments and prob ems in the f e d.

502 Design and Development of Instruction. (3) F, S
Des gn, development and format ve evaluation of objec t ves based instruct onal mater a s

503 Research Techniques for Instructional Development. (3) F
Procedures for analyz ng the effects of alternat ve nstruc tional pract ces.

504 Educational Evaluation. 3) S
Eva uat on procedures in nstruction and tra ning

584 Educational Technology Internship. (1–6) F, S, SS
Prerequ sites EDT 501 502 nstructor approval Pre or corequ s te EMC 521

780 Advanced Instructional Development. (1 3) S
Conduct ng and document ng se ected nstruct ona deve - opment act v t es. Prerequ sites: EDT 502; nstructor ap prova .

792 Advanced Instructional Research. (3) F
Des gn and execution of 'nstruct onal research on se lected topics Prerequ s tes: EDT 503; instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

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, agribusiness and environmental re sources, technology, computer science, or con struction. Every effort is made to carry on well-rounded, well integrated programs that not only give the student proficiency for a professional ca reer but also 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 College of Engineering and Applied Sci ences comprises the following units:

School of Agribusiness and Environmental Resources

School of Construction and Technology

Department of Aeronautical Technology
Department of Construction
Department of Electronics and Computer Technology
Department of Industrial Technology
Department of Manufacturing Technology

School of Engineering

Department of Chemical, Bio and Materials Engineering
Department of Civil Engineering
Department of Computer Science and Engineering
Department of Electrical Engineering
Department of Industrial and Management Systems Engineering
Department of Mechanical and Aerospace Engineering
Programs in Engineering Special and Interdisciplinary Studies

Research Centers. The college is committed to becoming one of national prominence in research. In addition, it is the policy of the col lege to encourage exceptional upper division un dergraduate students and graduate students to participate with faculty in research activity. Most faculty are conducting research on government or industry-sponsored programs. Research activities include computer science and applications, com puter integrated manufacturing, materials sci ence, solar energy, thermosciences, transportation systems, signal processing, computer design, turbine design, aerodynamics, structures, structural dynamics, rotor dynamics, CAD/CAM, solid-state electronic devices, power systems, telecom munications, environmental, nuclear radiation, biomedical, arid land agriculture, semiconductor materials and devices, biotechnology, microelec tronics manufacturing, 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
Center for Computer Integrated Manufacturing Systems Research
Center for Energy Systems Research
Center for Solid State Electronics Research
Center for Telecommunications Research
System Science Engineering Research Center

Center for Professional Development. The Center for Professional Development in the College of Engineering and Applied Sciences es tablishes a cooperative focus with the college's academic departments and research centers to provide a wide variety of technical conferences, institutes, seminars, short courses, research briefings, and televised and satellite-transmitted pro grams to enable engineers, scientists, and techni cal managers locally, nationally, and internation ally to continue their lifelong learning in a con stantly changing technical world.

Programs may be conducted on campus in the center's conference room, at various off campus locations, or at company sites upon request.

For information, contact the director, Center for Professional Development, ECG 148, 602/ 965–1740.

Admission

Students who wish to be admitted to freshman standing in the College of Engineering and Applied Sciences should present certain secondary units that are specified in the requirements of the three schools. Students who have omissions or deficiencies in secondary school subject matter preparation may be required to complete addi tional university course work that may not be ap plied toward their degrees.

Students not admissible to programs in this college and 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 the students have the proper course prerequisites.

Entrance requirements of this college may dif fer from those of other ASU academic units. Stu dents may be admitted under two different classifications, the professional and preprofessional programs.

Professional Program. For admission to a *professional program*, Arizona residents must meet one of the following requirements:

	Minimum Scores		
	H S. Rank	ACT	SAT
Agribusiness and Environmental Resources	Upper 50%	21	930
Construction	Upper 50%	23	1050
Engineering	Upper 25%	23	1050
Technology	Upper 50%	21	930

For admission to a professional program, a *non resident* must meet one of the following requirements:

	Minimum Scores			
	H S Rank	ACT	SAT	TOEFL*
Agribusiness and Environmental Resources	Upper 25%	23	1010	500
Construction	Upper 25%	23	1050	550
Engineering	Upper 25%	23	1050	550
Technology	Upper 25%	23	1010	500

* For international students, see pages 38 and 42

Students admitted to the university by the General Education Development (GED) are required to take either the ACT or the SAT in order to be admitted to a professional program.

Preprofessional Program. Students not admissible to a professional program within the college but who are otherwise admissible to Arizona State University may be admitted as a *preprofessional* student to any one of the departments or schools of the college. International students whose TOEFL scores do not meet the above minimum scores also may be admitted to the pre professional program. A student admitted into this classification follows the freshman-sophomore sequence of courses as required by the chosen major. Courses are 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 professional program. *International students must also submit a* TOEFL *score equivalent to that required for admission to the professional programs.* Students admitted as preprofessional students are not permitted to register for 300 and 400 level courses in the College of Engineering and Applied Sciences until their status is changed to the *professional classification.*

Readmission. Students applying for readmission to professional status for any program in this college must have a cumulative GPA for all college course work equal to that of the transfer admission requirements shown below. A student who does not meet these requirements may request admission to the preprofessional program, subject to the restrictions shown above.

Transfer into and within the College. Students transferring into or between schools or departments within the college or from other colleges within the university must meet both the cumulative GPA requirement and the *Catalog* requirements of the new school or department in effect at the time of transfer. Students who are

transferring from an Arizona community college and have been in continuous residence may continue under the *Catalog* in effect at the time of entering the community college.

Transfer Students. A student who contemplates transferring into this college from another institution, whether a community college or four-year institution, should study carefully the pertinent sections under this college pertaining to the particular program and, if possible, consult an advisor in this college before enrolling in the other institution. This assures a smooth transition at the time of transfer. Transfer students may request admission to either preprofessional or professional status in any of the programs offered by this college. The restrictions with regard to preprofessional status are shown above. The departments and schools may impose additional admission and graduation requirements to those minimums specified by the college.

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

The minimum requirements for admission of resident and nonresident transfer students to the professional program are as follows:

	Transfer GPA*		
	Resident	Nonresident	TOEFL**
Agribusiness and Environmental Resources	2.00	2.50	500
Construction	2.25	2.50	550
Engineering	2.50	2.50	550
Technology	2.25	2.50	500

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

** For international students (see page 38 and 42).

Credit is granted for transferred courses that are deemed equivalent to corresponding courses in the selected program of study, subject to grade and senior residence requirements. Credits transferred from a community college are applied only as lower-division credits. Prospective Arizona community college transfer students should consult their advisors and refer to the annual *Arizona Higher Education Course Equivalency 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 is made within the appropriate department or school with the approval of the dean.

Advisement

For assistance and counseling in planning a program of study, each student in this college is assigned a faculty advisor who is familiar with the chosen field of specialization and who must be consulted before registering each semester. The student should inform the advisor of any outside work or activity so that course loads may be adjusted accordingly.

The associate director of Student Academic Services is also available to all students for counseling and advising.

Minority Engineering Program. The Minority Engineering Program director and the academic advisor are available to assist prospective, newly admitted, and continuing students with academic advisement and a variety of support services. Advisement is also provided in the procurement of financial aid, scholarships, and professional development.

Degrees

Majors. Programs leading to the B.S. and B.S.E. degrees are offered by the College of Engineering and Applied Sciences, with majors in the following subjects. Each major is administered by the academic unit indicated.

MAJOR FIELD	DEGREE	DEPARTMENT/SCHOOL
School of Agribusiness and Environmental Resources		
Agribusiness	B.S.	Agribusiness and Environmental Resources
Environmental Resources in Agriculture	B.S.	Agribusiness and Environmental Resources
School of Construction and Technology		
Aeronautical Engineering Technology	B.S.	Aeronautical Technology
Aeronautical Management Technology	B.S.	Aeronautical Technology
Construction	B.S.	Construction
Electronics Engineering Technology	B.S.	Electronics and Computer Technology
Industrial Technology	B.S.	Industrial Technology
Manufacturing Engineering Technology	B.S.	Manufacturing Technology
School of Engineering		
Aerospace Engineering	B.S.E.	Mechanical and Aerospace Engineering
Bioengineering	B.S.E.	Chemical, Bio and Materials Engineering
Chemical Engineering	B.S.E.	Chemical, Bio and Materials Engineering
Civil Engineering	B.S.E.	Civil Engineering
Computer Science	B.S.	Computer Science and Engineering
Computer Systems Engineering	B.S.E.	Computer Science and Engineering
Electrical Engineering	B.S.E.	Electrical Engineering
* Engineering Business and Pre-law	B.S.	Engineering Interdisciplinary Programs
** Engineering Mechanics	B.S.E.	Mechanical and Aerospace Engineering
*** Engineering Synergy	B.S.E.	Engineering Special Programs
* Geological Engineering	B.S.	Engineering Interdisciplinary Programs
Industrial Engineering	B.S.E.	Industrial and Management Systems Engineering
** Manufacturing Engineering	B.S.E.	Industrial and Management Systems Engineering
Materials Science and Engineering	B.S.E.	Chemical, Bio and Materials Engineering
Mechanical Engineering	B.S.E.	Mechanical and Aerospace Engineering
** Microelectronics Manufacturing Engineering	B.S.E.	Electrical Engineering
*** Nuclear Sciences	B.S.E.	Engineering Special Programs
*** Pre medical Engineering	B.S.E.	Engineering Special Programs
*** Systems Engineering	B.S.E.	Engineering Special Programs

* These options under the Engineering Interdisciplinary Programs are administered by the Office of the Dean.

** These options under the Engineering Special Programs are administered by the departments shown above.

*** These options under the Engineering Special Programs are administered by the Office of the Dean.

Integrated B.S.E.–M.S. Program. To provide greater program flexibility, qualified students of the School of Engineering may undertake a program that 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 that supervises 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 requires an application submitted to the dean through the faculty advisor and the department chair. Applications are reviewed by a school committee that recommends 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 are specified at the time of admission. The Graduate Record Examination (GRE)—the verbal, quantitative, and analytical components 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 Computer Science Degree (M.C.S.)

This is a master's degree program designed for students desiring a professionally oriented, graduate level education in Computer Science and Engineering. All of the Graduate College entrance requirements and departmental academic performance and preparation requirements must be satisfied for admission. The applicant must have a baccalaureate degree with a major in Computer Science, Computer Engineering, or a closely related degree program. The program requires a minimum of 36 semester hours of approved graduate level course work. At the end of the program of study, the student must pass a final written comprehensive examination over the graduate course work taken for the degree and over the appropriate undergraduate prerequisites. Details of the content and format of the examination are available from the department.

Master of Science Degree (M.S.)

Agribusiness and Environmental Resources. This program provides competent students with opportunities to complete advanced studies with emphasis on research. Areas of concentration in agribusiness are management, marketing, finance, international agriculture, and food industry. Areas of concentration in environmental resources in agriculture are natural resource management and range ecology. Admission requires completion of 18 semester hours in agribusiness and environmental resources or closely related course work. Scores from the GRE or Miller Analogies Test (MAT) are required. The Graduate Management Admission Test (GMAT) is accepted for Agribusiness students only. A minimum of 30 semester hours of approved graduate course work is required, including a thesis. An oral examination in defense of the thesis is required.

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

Engineering. These are research oriented graduate degree programs, providing opportunities to highly competent students to major in bioengineering, chemical, civil, electrical, industrial or mechanical engineering, or engineering science. Options in aerospace engineering, biotechnology, engineering mechanics, engineering science, materials science and engineering, nuclear sciences and engineering, and system science and engineering are available under the engineering science major. M.S.E. and Ph.D. degree programs are also available in these options.

The M.S. degree program (including all options) is administered through the office of the college assistant dean for Graduate Studies. Admission normally requires an appropriate undergraduate engineering degree and satisfaction of all Graduate College admission requirements and special department requirements. A minimum of 30 semester hours of approved graduate course work is required, which must include a thesis and an oral examination at the completion of the program. Students writing a thesis must enroll in a combination of both 592 Research and 599 Thesis, totaling six semester hours.

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

Engineering. These are professionally oriented graduate degree programs intended as a preparation for a career in professional practice. Two options are available: the first is a thesis (engineering report or research paper); the second is a no thesis, no report. Both options require a minimum of 30 semester hours of approved graduate level course work. Entry requires satisfying all Graduate College admission requirements, special department requirements, and a baccalaureate degree with a major in engineering or another closely related degree program.

Option One This option is designed primarily for full time students. The M.S.E. degree option one is awarded upon successful completion of graduate course work, engineering projects, and a research endeavor resulting in a thesis (engineering report or research project). A final oral examination is required in defense of the thesis.

Option Two. This option is designed primarily for students who hold full time jobs and must attend university classes on a part time basis. The M.S.E. degree option two 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 should check with their respective departments for the format of the final examination

Master of Technology Degree (M.Tech.)

Technology. This degree program is designed for flexibility, permitting 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 Master of Technology with a major in Technology is offered by the Departments of Aeronautical Technology, Electronics and Computer Technology, Industrial Technology, and Manufacturing Technology. Admission requires an appropriate baccalaureate degree with a minimum of 30 semester hours in technology or equivalent. 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 Ph.D. degree is awarded in Engineering or 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 Catalog*

Degree Requirements

For detailed information on the degree requirements of a major in the College of Engineering and Applied Sciences, refer to that department's or school's individual descriptions on the ensuing pages.

English Proficiency Requirement. English proficiency is required. As a minimum each student must complete both ENG 101 and 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 director or department chair. See the statement on English proficiency, page 43.

Pass/Fail Grades. Students enrolled in the College of Engineering and Applied Sciences do not receive degree credit for pass/fail courses taken at this institution. In addition, no course in this college is offered for pass/fail credit. Students requesting credit for pass/fail courses taken at another institution must file a Petition for Adjustment to Curriculum Requirements. Each request is judged on its particular merits.

Entry into Upper-Division Courses. Before enrolling in courses at the 300 level and above, a student in good academic standing must secure the approval of his or her advisor. A student who is not in good academic standing must secure the approval of his or her advisor and 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 departments and schools have certain additional requirements that must be met in addition to the above college requirements and students should consult them for details.

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

General Studies Requirements

Higher education should provide the student not only with competency in the chosen subject field, but also with experiences that 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 and 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.

Specific attention should be directed to the University General Studies requirements shown on pages 55–59. Additional requirements and recommended course selections are shown in appropriate *Catalog* sections for the schools and departments of this college.

School of Engineering majors have some restrictions on the selections of course work used to fulfill the General Studies requirements in humanities (HU), social and behavioral sciences (SB), and lower-division literacy (L1). Please refer to pages 330 for details.

General Studies courses are regularly reviewed. To determine whether a course meets one or more General Studies course credit requirements, see the listing of courses by core and awareness area, pages 60–87. General Studies courses are also identified following course descriptions according to the following key:

Key to General Studies Credit Abbreviations

L1	Literacy and Critical Inquiry Core Courses (Intermediate level)
L2	Literacy and Critical Inquiry Core Courses (Upper division)
N1	Numeracy Core Courses (Mathematics)
N2	Numeracy Core Courses (Statistics and Quantitative Reasoning)
N3	Numeracy Core Courses (Computer Applications)
HU	Humanities and Fine Arts Core Courses
SB	Social and Behavioral Science Core Courses
S1	Natural Science Core Courses (Introductory)
S2	Natural Science Core Courses (Additional Courses)
G	Global Awareness Courses
H	Historical Awareness Courses

Graduation Requirements

Graduation requirements in this college are listed under the description of each school or major.

Academic Standards

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 is considered unsatisfactory progress and results in the student being placed on provisional (probationary) status:

1. A deficiency of 15 grade points.
2. A semester or summer session with a GPA less than or equal to 1.50.
3. Two successive semesters with GPAs less than 2.00.
4. Grades of "E," "W," or "I" in half the semester hours appearing on the official enrollment record for any semester.

Students not meeting department standards are placed on probation at the department's discretion.

Students on probation are subject to disqualification (1) if they do not attain a semester GPA of 2.25 and if their cumulative GPA is below 2.00 at the end of the probationary semester (items 1, 2, and 3 above); (2) if they are placed on probation for two consecutive semesters; or (3) if they receive an "I," "E," or "W" during the provisional semester (for item 4 above). Courses completed during the summer sessions may not be used to reevaluate a student's fall probationary status.

Provisional and probationary students may not register for the next semester without a special permit from Student Academic Services. Special permits are not given until grades are recorded by the registrar for the current semester.

Disqualification. During a semester on provisional status, a student who fails to meet the retention standards specified above is disqualified. Students may request a review of their disqualification status by contacting the associate director of Student Academic Services in the Engineering Center G Wing. 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. Disqualified students who do register for courses in this college may be withdrawn from these courses any time during that semester. Furthermore, 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 does 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 is required, for example, completing pertinent courses in the discipline at a community college with better than average grades.

Student Responsibilities

Course Prerequisites. It is expected that students consult the *Schedule of Classes* and the *Catalog* with regard to course prerequisites. Students who register for courses without the designated prerequisites may be withdrawn without the student's consent at any time before the final examination. Such withdrawal may be effected by the instructor, the chair of the department offering the course, the director of the Student Academic Services, or the dean of the college. In such cases, there is no monetary reimbursement to the student. However, such withdrawal is considered to be unrestricted as described on pages 51 52 and does not count against the number of restricted withdrawals allowed.

Special Programs

Student Academic Services. The dean's office in the College of Engineering and Applied Sciences maintains a special office staffed to assist students in various matters. This office coordinates the work of the College Admissions and Standards Committee and administers the probation, disqualification, and readmission processes for those students who are academically deficient.

Academic Honors. Students completing baccalaureate degree requirements 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, (7) Tau Beta Pi—National Engineering Honor Society, and (8) Upsilon Pi Epsilon—National Computer Science Honor Society. Information on any of these organizations may be obtained from the respective department or school offices or Student Academic Services.

The University Honors College. The College of Engineering and Applied Sciences participates with the University Honors College, which affords superior undergraduates opportunities for enhanced educational experiences. Participating students can major in any academic program, including the engineering synergy option under Engineering Special Programs. A description of the requirements and the opportunities offered by the University Honors College can be found on pages 98–100 of this *Catalog*.

Scholarships. Academic scholarships for continuing students in this college may be applied for by contacting the Student Academic Services Office or the various department or school offices. Other scholarships may be available through the university Student Financial Assistance Office.

ASU 3+2 Programs. Students desiring to earn a baccalaureate degree from Grand Canyon University (Phoenix, Arizona) in Mathematics, Chemistry, or Physics, or from Southwestern University (Georgetown, Texas) in Physical Science and a baccalaureate degree in Engineering or Construction from Arizona State University can take advantage of a 3+2 program that has been approved by these institutions. Students from Grand Canyon University may also select a degree program in Construction. Such students complete the first three years of study at their respective college or university and the last two years of study at Arizona State University. At the end of the fourth or fifth year, assuming all degree requirements have been met, the baccalaureate degree is awarded by the student's respective college or university and the appropriate engineering or construction baccalaureate degree is awarded by Arizona State University. More information can be obtained by writing to one of the following offices:

Office of the Administrative Vice President
Grand Canyon University
3300 West Camelback Road
Phoenix, Arizona 85017 1097

or

Provost and Dean of
The Brown College of Arts and Sciences
Southwestern University
Georgetown, Texas 78626

or

Office of the Dean
College of Engineering and Applied Sciences
Arizona State University
Tempe, Arizona 85287–5506

The Department of Construction also has 2+2 agreements with several selected out-of-state colleges and universities. For a listing and additional information, contact the department chair.

ROTC Students. Students pursuing a commission through either the Air Force or Army ROTC programs are 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. Because of accreditation requirements, aerospace studies (AES) courses are not acceptable for engineering or engineering technology degree credit as a social or behavioral science under General Studies. ROTC students must also meet all other degree requirements of this college.

A military construction option is available in the Department of Construction.

General Information

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

Program of Study This is a broad term describing the complete array of courses included in the study leading to a degree. Examples: engineering, technology, construction, agribusiness and environmental resources.

Major. This is a specialized group of courses contained within the program of study. Example: program of study—engineering; major—Civil Engineering. Example: program of study technology; major—Industrial Technology.

Area of Emphasis (technical electives), Option, or Concentration. Each of these 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 preselected 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.

School of Agribusiness and Environmental Resources

_____, Director

PROFESSORS:
_____ (AG 281), BRADY, CHALQUEST, EDWARDS, GORDON, STILES, WOOLVERTON

ASSOCIATE PROFESSORS:
BROCK, MADDY, W. MILLER, RACCACH, SEPERICH, WHYSONG

PROFESSORS EMERITI:
BARRETT, JUDD, LYTLE, V. MILLER, MOODY, RASMUSSEN, RICHARDSON, ROBINSON, TAYSOM

Purpose

The School of Agribusiness and Environmental Resources provides academic programs directed toward agribusiness and the environmental aspects of agriculture. Agribusiness is a dynamic industry that provides employment to about 23% of the U.S. labor force. Environmental resources emphasizes both the conservation of wildland resources for the needs of future generations as well as their use to meet present day needs. Courses in the School of Agribusiness and Environmental Resources are designed to prepare students for the wide range of job opportunities that exist in the agricultural industries and governmental agencies. The academic programs are especially designed to meet the needs of the urban student who has had little or no previous agriculture experience. An interest in plants, animals, or 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.

Organization

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	*Option*
Agribusiness	General Agribusiness
	International Agribusiness
	Food Industry
	Computer Analysis
	Pre Veterinary Medicine

Environmental Resources in Agriculture

Concentration	*Option*
Natural Resource Management	Range Ecology
	Wildlife Habitat Management

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 ASU faculty and both private firms and public agencies. While it specializes in new crops and products derived therefrom, it acts as a resource and manages programs developing new technologies and inventions not directly related to agriculture.

Degrees

Bachelor of Science (B.S.). The School of Agribusiness and Environmental Resources offers the Bachelor of Science degree in Agribusiness and in Environmental Resources in Agriculture.

Master of Science (M.S.). The School of Agribusiness and Environmental Resources offers the Master of Science degree in Agribusiness and in Environmental Resources in Agriculture. The program includes research and the preparation of a thesis. A minimum of 30 semester hours of graduate level course work is required for the degree. Additional details for this degree are given in the *Graduate Catalog*.

Admission

See pages 31 38, 53 55, 283 284, and 289 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

In addition, students who are beginning their initial college work in the School of Agribusiness and Environmental Resources should present secondary school units in accordance with the minimum university requirements. There are no secondary school agricultural course requirements.

Graduation Requirements

The completion of a minimum of 126 semester hours—including University General Studies, the school and major cores and option courses—leads to the B.S. degree. An overall GPA of 2.00

is required. Of the semester hours required for graduation, 40% must be upper division. Also see special graduation requirements under the pre veterinary medicine concentration described on pages 295–296.

Curricula in Agribusiness and Environmental Resources in Agriculture

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 learn to analyze firms involved in input supply activities, commodity processing, food manufacturing, and food distribution. Students also study government agricultural programs and national policy activities that affect agribusiness. Because of the U.S. role in supplying commodity and food products to the world markets, international aspects of agribusiness development and trade are emphasized.

The natural resource management concentration within the Environmental Resources in Agriculture major emphasizes the study of wildland ecosystem management. Application of the systems approach in a wide variety of resource management situations is emphasized. Students pursue an ecological emphasis in the range ecology option or the wildlife habitat management option. In both cases, students are trained to apply ecological principles to management of wildlands. Students with particular interest in vegetation, water, and soil resources should pursue the range ecology option. Students with a particular interest in animal resources should pursue the wildlife habitat option.

The baccalaureate degree requirements in Agribusiness and Environmental Resources in Agriculture include the General Studies, the School of Agribusiness and Environmental Resources core, a proficiency core, the major core, and the option courses and elective courses to complete the graduation requirement of 126 semester hours. Before entering the junior year, each student, with the aid of an advisor, is expected to select a concentration and an option.

Degree Requirements

All students pursuing a B.S. degree in the School of Agribusiness and Environmental Resources must satisfy English proficiency and General Studies requirements as follows:

			Semester Hours
English Proficiency			
† ENG	101, 102	First-Year Composition	6
		or ENG 105 Advanced First Year Composition (3)	

General Studies

*Literacy and Critical Inquiry**
(6 semester hours minimum)

One course, generally at the sophomore level, that includes a series of formal, graded, written or spoken assignments in composing critical literature 3

A second course, upper division, that involves critical writing in a specialized discipline 3

Numeracy
† (6 semester hours minimum)

Humanities and Fine Arts
*Social and Behavioral Sciences**
(15 semester hours minimum)

(At least one course must be upper division level; two courses must be from same department, and two departments or more must be represented in total selection)

Humanities and Fine Arts ..... 9 to 6
Social and Behavioral Sciences ..... 6 to 9

Natural Sciences
† (8 semester hours minimum)

Total General Studies 35

NOTE: One course in the area of global awareness* and one course in historical awareness* *must* appear in the final list of courses offered in the student's graduation program of study. If desired, these can be included in the humanities and fine arts/social and behavioral sciences course selections.

* See pages 60–87 for the acceptable courses in these categories.

† See the school academic advisor for approved courses.

Agribusiness and Environmental Resources in Agriculture Core

All students pursuing a B.S. degree in the school must complete the following general core courses:

			Semester Hours
AGB	300	Livestock Management	3
AGB	302	Introduction to Agribusiness	3
AGB	310	Crop Management	3
ERA	346	Natural Resource Conservation	3
		Total	12

The following proficiency core courses are required of all students except those in the com-

puter analysis and pre-veterinary medicine concentrations:

			Semester Hours
BIO	181, 182	General Biology	8
		or AGB 130 Plant Science (3) and AGB 150 Animal Science (3)	
CHM	101	Introductory Chemistry	4
		or CHM 113 General Chemistry (4) and CHM 115 General Chemistry with Qualitative Analysis (5)	
* ECN	111	Macroeconomic Principles	3
* ERA	350	Applied Quantitative Methods	3
* MAT	117	College Algebra	3
		or MAT 210 Brief Calculus (3)	
		A minimum of one computer course	3
		(A list of acceptable courses is available in School of Agribusiness and Environmental Resources Office)	
		Total	24–29

* These courses are a part of the General Studies requirements.

Agribusiness

The Agribusiness major offers several concentrations and options. It 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 input 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.

Agribusiness. The agribusiness concentration contains the following options:

General agribusiness integrates the knowledge and skills needed to 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 allow graduates to meet challenges in the food and fiber industries. Graduates are qualified to make significant contributions in a broad range of career opportunities that exist in agribusiness. Many start career paths that lead to upper level agribusiness management/marketing positions.

International agribusiness 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 that is designed to train either the U.S. or foreign student to work in the enhancement of agricultural programs of foreign countries. Provided is a basic knowledge of U.S. agricultural techniques that 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 national, international, and foreign. A language capability in addition to English is recommended.

Food industry focuses on the scientific and technical competence required for employment in this field. Strong emphasis is given to basics such as food chemistry, food processing, and food safety. This unique program offers employment opportunities for graduates in food industries, regulatory agencies, and consumer organizations.

Students selecting the agribusiness concentration are required to take the following courses:

			Semester Hours
ACC	211	Introductory Financial Accounting	3
		or AGB 390 Agricultural Accounting (3)	
AGB	312	Agricultural Marketing	3
AGB	332	Agribusiness Finance	3
AGB	342	Agribusiness Management I	4
AGB	364	Agribusiness Technology	3
AGB	412	Agricultural Commodities	3
AGB	443	Agribusiness Management II	3
AGB	444	Agribusiness Analysis	3
AGB	455	Agricultural Marketing Channels	3
AGB	458	International Agribusiness	3
AGB	474	Agribusiness Policy and Government Regulations	3
AGB	490	Recent Advances in Agribusiness	1
ECN	112	Microeconomic Principles	3
		Total	38

Typical Curriculum for the Agribusiness Concentration

First Year

			Semester Hours
AGB	130	Plant Science	3
AGB	150	Animal Science	3
CHM	101	Introductory Chemistry	4
ENG	101, 102	First Year Composition	6
MAT	117	College Algebra	3
Social and Behavioral Sciences Courses[1]			6
General Elective Courses			6
Total			31

Second Year

ACC	211	Introductory Financial Accounting or AGB 390 Agricultural Accounting (3)	3
AGB	302	Introduction to Agribusiness	3
ECN	111	Macroeconomic Principles	3
ECN	112	Microeconomic Principles	3
Agribusiness Electives Courses			9
Humanities and Fine Arts Courses[1]			6
General Elective Courses			6
Total			33

Third Year

AGB	312	Agribusiness Marketing	3
AGB	332	Agribusiness Finance	3
AGB	342	Agribusiness Management I	4
AGB	364	Agribusiness Technology	3
AGB	300	Livestock Management	3
AGB	310	Crop Management	3
ERA	346	Natural Resource Conservation	3
ERA	350	Applied Quantitative Methods	3
Option Courses			6
Total			31

Fourth Year

AGB	412	Agricultural Commodities	3
AGB	443	Agribusiness Management II	3
AGB	444	Agribusiness Analysis	3
AGB	455	Agricultural Marketing Channels	3
AGB	458	International Agribusiness	3
AGB	474	Agribusiness Policy and Government Regulations	3
AGB	490	Recent Advances in Agribusiness	1
Option Courses			9
General Elective Courses			3
Total			31

[1] See pages 55 87 for the requirements and the approved list.

Computer analysis. This concentration gives students the necessary background to move into a wide variety of career opportunities involving the use of computers in the agribusiness industries. A basic core of agricultural science courses is combined with a proficiency core of agribusiness marketing, management, finance, and critical computer science courses. A graduate of this program is prepared to handle the problems agribusiness firms and organizations face in applying the latest computer technology to operations.

Students choosing the computer analysis concentration are required to take the following proficiency core courses:

			Semester Hours
AGB	312	Agribusiness Marketing	3
AGB	332	Agribusiness Finance	3
AGB	342	Agribusiness Management I	4
BIO	181, 182	General Biology	8
CSC	100, 101	Introduction to Computer Science I and II	6
CSC	120	Digital Design Fundamentals	3
CSC	201	Application Languages Programming Laboratory	1
CSC	310	Data Structures	3
CSC	340	Structure of Programming Languages	3
ERA	350	Applied Quantitative Methods	3
MAT	243	Discrete Mathematical Structures	3
MAT	271, 272	Calculus with Analytic Geometry II and III or MAT 290, 291 Calculus I and II (10)	8
MAT	342	Linear Algebra	3
Total			51 53

Typical Curriculum for the Computer Analysis Concentration

First Year

			Semester Hours
CSC	100, 101	Introduction to Computer Science I and II	6
ENG	101, 102	First Year Composition	6
MAT	243	Discrete Mathematical Structures	3
MAT	270, 271	Calculus with Analytic Geometry I and II	8
Humanities and Fine Arts Courses[1]			6
Social and Behavioral Sciences Courses[1]			3
Total			32

Second Year

AGB	302	Introduction to Agribusiness	3
BIO	181, 182	General Biology	8
CSC	120	Digital Design Fundamentals	3
CSC	201	Application Languages Programming Laboratory	1
CSC	310	Data Structures	3
MAT	272	Calculus with Analytic Geometry III	4
General Elective Courses			9
Total			31

Third Year

AGB	300	Livestock Management	3
AGB	310	Crop Management	3
AGB	312	Agribusiness Marketing	3
AGB	332	Agribusiness Finance	3
AGB	342	Agribusiness Management I	4
CSC	340	Structure of Programming Languages	3
ERA	350	Applied Quantitative Methods	3
MAT	342	Linear Algebra	3
Social and Behavioral Sciences Courses[1]			6
		Total	31

Fourth Year

ERA	346	Natural Resource Conservation	3
General Elective Courses			13
Supporting Courses			16
		Total	32

[1] See pages 55 87 for the requirements and the approved list.

Pre-veterinary medicine. This concentration is primarily designed to meet the entrance requirements of professional veterinary medical schools in the United States and Canada. Selection of this area permits 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 B.S. degree in Agribusiness at ASU is provided by completing additional credits, if desired. A pre-veterinary medicine student who has been accepted to a school of veterinary medicine and who also elects to earn a Bachelor of Science degree in the School of Agribusiness and Environmental Resources may do so by completing a minimum of 30 semester hours at ASU and by completing the Agribusiness and Environmental Resources in 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 is 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 GPA 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.

Students selecting the pre-veterinary medicine concentration are required to take the following proficiency core courses:

			Semester Hours
BIO	181, 182	General Biology	8
CHM	113	General Chemistry	4
CHM	115	General Chemistry with Qualitative Analysis	5
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
ERA	350	Applied Quantitative Methods	3
MAT	117	College Algebra	3
MAT	210	Brief Calculus	3
MIC	206	Microbiology Laboratory	1
MIC	220	Biology of Microorganisms	3
		Total	38

Typical Curriculum for the Pre-Veterinary Medicine Concentration

First Year

			Semester Hours
CHM	113	General Chemistry	4
CHM	115	General Chemistry with Qualitative Analysis	5
ENG	101, 102	First-Year Composition	6
MAT	117	College Algebra	3
MAT	210	Brief Calculus	3
Humanities and Fine Arts Courses[1]			6
Social and Behavioral Sciences Courses[1]			6
		Total	33

Second Year

AGB	300	Livestock Management	3
AGB	353	Wildlife and Domestic Animal Nutrition	3
BIO	181, 182	General Biology	8
CHM	331, 335	General Organic Chemistry and General Organic Chemistry Laboratory	4
CHM	332, 336	General Organic Chemistry and General Organic Chemistry Laboratory	4
General Elective Courses			6
Humanities and Fine Arts Courses[1]			3
		Total	31

Third Year

AGB	439	Veterinary Practices	3
BIO	340	General Genetics	4
CHM	361	Principles of Biochemistry	3
CHM	367	Elementary Biochemistry Laboratory	1
ERA	346	Natural Resource Conservation	3
ERA	350	Applied Quantitative Methods	3
MIC	206	Microbiology Laboratory	1
MIC	220	Biology of Microorganisms	3
PHY	111, 113	General Physics and General Physics Laboratory	4
PHY	112, 114	General Physics and General Physics Laboratory	4
		Total	29

Fourth Year[2]

General Elective Courses	6
Supporting Courses	15
Upper Division Courses	12
Total	33

[1] See pages 55 87 for the requirements and the approved list

[2] Assuming application and acceptance to a veterinary college during the beginning of the third year, the courses from the first year of the veterinary program are substituted for the classes of the fourth year for the B.S. degree.

Environmental Resources in Agriculture

Natural resource management and conservation is the primary emphasis of the Environmental Resources in Agriculture major. Particular attention is given to the study of ecosystem characteristics as they relate to man's use of renewable resources. Applications of ecological principles to resource management are considered using examples drawn from Arizona's forest, range, and agricultural ecosystems. Employment opportunities in environmental resource management, range ecology, land reclamation, soil conservation, and agribusiness exist with both private firms and government resource management agencies.

Natural resource management. This concentration includes the following options:

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

Wildlife habitat management emphasizes the interaction of renewable resources with the wildlife populations that inhabit them. Primary training is in the areas of ecology, plant, and soil science, with strong supporting course in wildlife. Students completing this option may choose careers as professional wildlife habitat managers for federal and state agencies or in the private sector.

Students selecting the natural resource management concentration are required to take the following courses:

			Semester Hours
ERA	325	Soils	3
ERA	326	Soils Laboratory	1
ERA	333	Water Resources Management	3
ERA	360	Range Ecosystem Management	4
ERA	402	Range Habitat Inventory	4
ERA	407	Range Plants and Habitats	4
ERA	420	Range Habitat Improvements	3
ERA	475	Wildlife and Range Animal Management	3
ENG	301	Writing for the Professions	3
BIO	320	Fundamentals of Ecology	3
BOT	370	The Flora of Arizona	4
ERA	490	Recent Advances in Environmental Resources	1
		Total	36

Typical Curriculum for Environmental Resources in Agriculture

First Year

			Semester Hours
BIO	181, 182	General Biology	8
CHM	101	Introductory Chemistry	4
ENG	101, 102	First-Year Composition	6
MAT	117	College Algebra	3
Computer Course			3
General Elective Courses			7
		Total	31

Second Year

ERA	325	Soils	3
ERA	326	Soils Laboratory	1
BOT	370	The Flora of Arizona	4
Humanities and Fine Arts Courses[1]			8
Social and Behavioral Sciences Courses[1]			8
Option Requirements[2]			7
		Total	31

Third Year

AGB	310	Crop Management	3
AGB	300	Livestock Management	3
AGB	302	Introduction to Agribusiness	3
ERA	350	Applied Quantitative Methods	3
ERA	346	Natural Resource Conservation	3
ERA	360	Range Ecosystem Management	4
Option Requirements[2]			14
Total			33

Fourth Year

ERA	490	Recent Advances in Environmental Resources	1
General Elective Courses			4
Option Requirements[2]			26
Total			31

[1] See pages 55 87 for the requirements and the approved list.

[2] 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. *[Satisfies General Studies Requirement: G]*

130 Plant Science. (3) S
Plant growth and development in the rural and urban environment Lecture, lab

150 Animal Science. (3) F
Comparative growth development and propagation of farm animals. Lecture, ab.

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 Prerequisites BIO 181, 182.

302 Introduction to Agribusiness. (3) F
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 tasks involving the principles of nutrition and the physiological roles of nutrients in metabolism 3 hours lab Corequisite. AGB 305.

310 Crop Management. (3) S
Crop production and management principles and their application to crop growth and development Prerequisites BIO 181, 182

312 Agribusiness Marketing. (3) F
Marketing arrangements for agricultural products. Prerequisite AGB 342.

332 Agribusiness Finance. (3) S
Agribusiness investment management and financial institutions that serve agriculture. Prerequisites: AGB 342; ECN 111.

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

342 Agribusiness Management I. (4) S
Principles of management: planning, organizing integrating, measuring, and developing people in agribusiness organizations Lecture, computer lab.

353 Wildlife and Domestic Animal Nutrition. (3) S
Feedstuffs, feeding standards, and their application in meeting nutritional needs of animals producing food and fiber

364 Agribusiness Technology. (3) S
Biotechnology and other technologies of the three sectors of agribusiness· input production and commodity food processing and distribution Prerequisites B O 181 182 or instructor approval

368 Food Processing. (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 Lecture lab. Prerequisites: CHM 225, 226.

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

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

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

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

404 Sales and Merchandising in Agribusiness. (3) N
The principles and techniques of selling and commodity merchandising in the agricultural industries Lecture, ab.

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

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 413

423 Food and Industrial Microbiology. (4) F
Food and industrial related microorganisms; deterioration and preservation of industrial commodities. Lecture, ab. Prerequisite M C 205 206, or instructor approval.

424 Food and Industrial Fermentations. (4) S
Management, manipulation and metabolic activities of industrial microbial cultures and their processes. Lecture ab. Prerequisite: AGB 423 or instructor approval

425 Food Safety. (3) S
Microbial and chemical food borne diseases control, prevention, and prediction Prerequisite AGB 423 or instructor approval

426 Food Chemistry. (4) S
The b ochem ca and chem ca nteract ons that occur in raw and processed foods Lecture lab Prerequis tes. CHM 115, 231

428 Comparative Nutrition. (3) N
Effects of nutrition on an ma systems and metabo c func tions. Prerequis tes. AGB 305, CHM 231.

433 Diseases of Domestic Animals. (3) N
Contro and prevention of nfectious and noninfectious diseases of domest c animals Prerequisite MIC 206 or 220

435 Animal Physiology I. (4) F
Control and function of the nervous muscu ar, cardiovas cular, respiratory, and rena systems of domest c an mals. Lecture lab. Cross isted as BME 435. Prerequ s tes: BIO 181, CHM 113

439 Veterinary Practices. (3) F S
Observation of and part c pation n veter nary med c ne and surgery supervised by oca veter narians Prerequ - site advanced pre veterinary student

440 Food Marketing. (3) S
Food processing packaging d str but on, market research, new food research and development, and soc a mp cat ons Prerequ s te AGB 312

443 Agribusiness Management II. (3) F
Principles of human resource management with emphas s on the spec'al problems of agr business systems. Pre requ s te: AGB 342

444 Agribusiness Analysis. (3) S
Analysis of agribus ness firm dec sions n the eco ogica , economic, social, and po tical env ronments. Spec a emphasis on ethical 'ssues surrounding food production and consumpt on Prerequisites AGB 312, 332, or equivalents.

450 International Agricultural Development. (3) F
Trans t on of deve oping countries from subs'stence to modern agriculture Technology transfer and food im provement programs are emphasized Prerequ site. AGB 312. *[Satisfies General Studies Requirements. SB G]*

452 World Food Dynamics. (3) N
Trans tion and development of raw agricultura commod - ties into nutrit onal food products Emphasis g ven to food expans on in develop ng countries. Prerequ site AGB 302.

453 World Agricultural Resources. (3) S
World product on and consumption of agr cultural prod ucts, 'nternationa relat onsh ps and agencies concerned w th world agr cu tural development prob ems Prerequ - site AGB 302

454 International Agricultural Trade. (3) N
D mensions, locat ons, m x, methods, and changes of n ternational trade in agricu tural products. Prerequisite AGB 312

455 Agricultural Marketing Channels. (3) S
Operat ona stages of agricultura commod t es in norma distr but on systems and mp ementation of marketing strategies. Prerequ s'te: AGB 312

458 International Agribusiness. (3) N
Ident ficat on and analys s of methods prob ems and fu ture of international agribus ness operat ons. Emphasizes spec a prob ems associated w th internationa agribus ness systems. Prerequ s te AGB 312 *[Satisfies General Studies Requirements. SB, G]*

460 Agribusiness Management Systems. (4) S
The deve opment and use of dec sion support systems for agr bus ness management and marketing Lecture, lab Prerequ'sites: AGB 332, 342, ERA 350

474 Agribusiness Policy and Government Regulations. (3) F
The development and imp ementation of government food, drug pesticide and farm pol c es and regu at ons that affect the management of agribusiness. Prerequisites AGB 312, 342 412.

490 Recent Advances in Agribusiness. (1) F, S
Reports and discuss ons of current topics and prob ems associated w th agribus ness May be repeated for credit.

505 Commodity Analysis. (3) N
Ana ys s of commodity markets. Prerequisite: 1 year of econom cs or marketing

508 Advanced Agribusiness Marketing. (3) F
Theory and ana ysis of marketing farm commodit es, risks, and effect of future trad ng on cash prices.

509 Advanced Agribusiness Marketing Channels. (3) S
Ana ysis of agribusiness market channel systems. Formu ation of marketing strateg es.

510 Advanced Agribusiness Management I. (3) F
Assessment and current problems in manag ng human and financ al resources n agribus ness Case stud es and analysis of spec al agr bus ness prob ems Prerequis te. AGB 342

511 Advanced Agribusiness Management II. (3) S
Analys s of organizat on behavior, change, and resource requ rements w thin agribus ness systems Prerequ site AGB 342

512 Food Industry Management. (3) S
Operations and management of food processing facto- r es food d str bution centers and retail food hand ng firms.

516 International Agricultural Techniques. (3) N
Coord nat on of product on and market ng techn ques to consumpt on object ves with agr cu tura products in for e gn countries

518 World Agricultural Development. (3) N
Factors that influence product on process ng, and mar ket ng of agricultura products in deve op ng countries

520 Advanced Agribusiness Analysis I. (4) S
Vert cal ntegrat on and d fferentiation n food and agricul tura industr es. Lecture recitat on. Prerequ s tes AGB 508, 510, 532; or equ'valents

521 Agribusiness Coordination. (4) N
Organizational a ternatives for agr'business with empha sis on cooperatives and trad ng companies Lecture, reci tation Prerequisites AGB 508, 510 532; or equ va ents.

525 Advanced Agribusiness Management Systems. (3) N
Development and use of decis'on support systems for ag r business management decision mak ng. Prerequ s tes: AGB 510, 532.

527 Agribusiness Research Methods. (3) N
The use of model bui d ng hypothes s test ng and empiri cal analys s in solving agribus ness prob ems.

530 Advanced Agribusiness Policy. (3) N
Pol cy making h story, structure, and process Prerequ s te: AGB 508.

532 Advanced Agribusiness Finance. (3) F
F nancia management of agribusiness f rms; agribusi ness f nanc a analys s, investment analys s, agricultura risk management, and ntroduction to agricu tura f nancial intermedianes.

535 Advanced Food Science. (3) N
Chemica and physica nature of processed foods Em phasis on food product development Prerequisite: AGB 364.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

ENVIRONMENTAL RESOURCES IN AGRICULTURE

ERA 325 Soils. (3) F
Fundamenta propert es of soi s and their re ation to plant growth and the nutr tion of man and an mals. Relat on of so s to environmenta qual ty. Prerequisite: CHM 101 or 113 or equiva ent

326 Soils Laboratory. (1) F
Selected exercises to broaden the background and understand ng of basic so l princip es. Lab. Corequ site: ERA 325.

332 Agricultural Chemicals. (3) N
Composition, propert es and use of agr cultura commer c al ferti izers and pest c des and their effects on so , air, and water quality.

333 Water Resources Management. (3) S
Sources, their deve opment and conservation n ar d re gions for agricultura , natural resources and urban uses Prerequ site. CHM 101 or 113.

346 Natural Resource Conservation. (3) S
A g obal perspective on the conservat on of wild and and agr cu tural resources. Deve opment/resource conserva tion interre ationsh ps. *[Satisfies General Studies Re quirement. G]*

350 Applied Quantitative Methods. (3) F
Statistical methods w th appl cat ons in natura resource management and the agricu tural sc ences Use of dig ta computer. Prerequ s te: MAT 117 or equ va ent. *[Satis fies General Studies Requirement: N2]*

360 Range Ecosystem Management. (4) F
The interre ations of vegetation so s, and grazing an - mals Eva uation and simu ation of graz ng an mal impact. Lecture, recitation Prerequ sites. BIO 320; ERA 346, or equivalents.

365 Watershed Management. (3) N
Hydro ogic, physica bio ogica and eco og cal princip es appl ed to watershed management Impact of ecosystem man pulations on water y eld and qua ty. 1 weekend field trip Prerequ s tes ERA 325, 346.

370 Forest Silvics and Management. (3) N
Silvicultura princ p es underly ng the pract ce of forestry Growth of trees and stands forest site eva uat on, ma nipulation of stands to direct success on and forest measurements Lecture, ab. Prerequ sites: BIO 320; ERA 346, 350

402 Range Habitat Inventory. (4) S
Vegetation samp ing and inventory as re ated to an mal habitat relations. Lecture, lab; 1 weekend f e d trip Pre requ s tes: ERA 350 360

407 Range Plants and Habitats. (4) F
The d stribution eco og cal characteristics, identificat on of key plants, and va ues of hab tats on western range- ands. Laboratory emphasis on grass dentification. Lec ture, lab. Prerequisite BOT 370 or equ valent.

410 Wildlife Habitat Relations. (3) N
Interact ons among anima popu at ons and the r habitat. Systems s mu at on of population dynamics as nf uenced by compet tion and management strateg es. Lecture, 1 weekend field tr p. Prerequisite. ERA 360.

420 Range Habitat Improvements. (3) S
Current practices in brush and weed contro , revegetat on burn ng, water deve opments, fencing, and graz ng as too s for range improvement Lecture, 1 weekend f eld trip Prerequ site: ERA 360.

425 Soil Classification and Management. (3) N
Princ ples of soi genes s morphology, and classification. Management and conservation pract ces wil be pre sented. Prerequisite. ERA 325

446 Soil Fertility. (3) S
Ab l ty of soils to retain and supp y plant nutrients. Reac tions of fert lizers n so ls Prerequisites ERA 325, 326.

448 Soil Ecology. (3) N
So s viewed in an ecosystem context soil-plant re ation- sh ps, nutrient budgets, and abiotic factors that inf uence so processes. Prerequisites: BIO 320; ERA 325 326; or nstructor approval.

452 Soil, Water and Irrigation. (3) N
Water measurement conveyance and conservat on w th emphasis on crop production and soil plant water rela tions. Prerequisite: ERA 325.

460 Applied Systems Ecology. (3) N
The systems approach applied to analysis and manage- ment of natura resource ecosystems Use of s mu ation models. Prerequ sites: ERA 350 or equivalent, one course in ecology

470 Land Reclamation. (3) N
Prob ems of reestab sh ng vegetation on disturbed sites Specia revegetat on techn ques surface modificat ons and government regulat ons. 1 weekend field tr p. Pre- requ s tes ERA 407 420, 446, 448; or nstructor ap proval.

475 Wildlife and Range Animal Management. (3) N
Princ ples and techn ques for management of domestic and nondomestic an mals using rangeland ecosystems. Emphasis on practica app ication ons of management. Weekend field trips. Prerequisite: nstructor approval

480 Natural Resource Planning. (3) N
Princip es and techn ques of planning for management and conservation of natural ecosystems. Use of opt miza t on models and dec sion theory Preparat on of manage ment p an. Lectures, 1 weekend fie d trip. Prerequis tes. ERA 402, sen or standing

490 Recent Advances in Environmental Resources. (1) N
Current iterature and s gn f cant developments involv ng environmenta resources. May be repeated for credit

540 Plant Responses to Environmental Stresses. (3) N
React on of plants to environmenta stresses; herb vores, f re, pest cides mechan ca treatments, aer a pol utants, and soi amendments. 1 weekend field tr p. Prerequ sites· BOT 360 ERA 420; or instructor approva

548 Plants, Soils and Environmental Quality. (3) N
Effects of air qua ity on plants and so s, and their ro e n removing contaminants from the atmosphere Prerequi- site ERA 325

550 Vegetation Dynamics. (3) N
Success on concept and ts use in s te eva uation. Hab tat type concept. Herb vore as an ecologica process Prerequ s te: BOT 420 or nstructor approva .

560 Systems Ecology. (3) N
Quant tative descr pt on and mathematical mode ing of ecosystem structure and funct on. Techn ques for mode construction and simu ation. Lecture, ab Prerequisites: 6 hours n eco ogical stud es; computer programming; ERA 350 or equiva ent

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

School of Construction and Technology

Paul E. Russell, Ph.D., Director

Purpose

The primary purpose of the school is to provide students the opportunity to obtain a quality education in construction and technology and to qualify them directly for positions of leadership and responsibility in industrial, commercial, educational, and government activity.

The construction program and its options provide a well integrated program that gives the student proficiency for a professional construction career. In addition to technical skills, it develops the ideals, judgment, character, and breadth of view important to success in the industry.

The technology programs provide the opportunity to earn a degree that stresses theory reinforced by laboratory application a more applied approach than engineering students experience. The technology programs assist in preparing for challenging career opportunities in industry and government for the forward looking student. The technology graduate in industry becomes a member of the total engineering effort, contributing an applications orientation to complement the engineer's more theoretical concepts. The student is educated to render practical decisions with safety and economy in mind, to install and operate technical systems, to develop or improve a product, to revise systems, and to provide customer support when needed.

Degrees

Bachelor of Science degree programs and options within each major are offered in the five departments as shown on page 282. Each curriculum includes some elective courses that are reserved for the student's use to add a unique emphasis or dimension. These credits are traditionally referred to as technical electives and are normally restricted to upper division courses in technology, construction, engineering, and computer science. In each case, the choice of technical electives must be approved by the student's faculty advisor and department chair. Requirements for each of the majors offered are described on the following pages.

In addition to the undergraduate degrees offered in the School of Construction and Technology, a graduate degree, the Master of Technology (M.Tech.), is offered by each of the four departments in technology in accordance with the details given on page 287. See the *Graduate Catalog* for complete details.

Admission

See pages 31–38, 53 55, 283 284, and 289 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

A preprofessional category is available for applicants deficient in regular admission requirements.

The Department of Construction requires secondary school units totaling 3½ units in mathematics, including geometry, advanced algebra, and trigonometry. Students having omissions or deficiencies in subject matter preparation are required to complete additional university credit course work that is not applied toward a Construction major. These may include MAT 118 Precalculus Algebra and Trigonometry and PHY 101 Introduction to Physics. Vocational and craft-oriented courses taught at community colleges are not accepted for credit toward a bachelor's degree in Construction.

Entry into a program in one of the departments of technology as a freshman student assumes three years of high school math (algebra I and II and geometry). High school chemistry and physics are recommended. Students without the required math background must take appropriate deficiency courses before entry or immediately upon enrollment at ASU. Associate degree transfer students are expected to have completed college algebra and trigonometry.

Students who begin their college education at institutions other than ASU with intent to transfer to ASU should consult the given major requirements and seek equivalent courses at the transfer institution. Any transfer courses from a community college are applied only as lower division credit.

The GPA requirement for admission of transfer students into the School of Construction and Technology is 2.25 for Arizona residents and 2.50 for nonresidents. 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 550 for admission to a Construction major and 500 for admission to a technology major.

Degree Requirements

Refer to the individual department descriptive material for specific departmental degree requirements.

Graduation Requirements

In order to qualify for graduation from the School of Construction and Technology, a student must have an overall grade point average (GPA) of at least 2.00 for the required courses in the major field.

General Information

Professional Accreditation and Affiliations. The Department of Construction 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).

The programs in Aeronautical Engineering Technology, Electronic Engineering Technology, and Manufacturing Engineering Technology are accredited by the Accreditation Board for Engineering and Technology.

Special Programs

ASU 2+2 Programs. The School of Construction and Technology maintains a cooperative agreement with most community colleges within the State of Arizona and also with selected out-of-state colleges and universities to structure courses that are directly transferable into the construction and technology programs at ASU.

ASU 3+2 Programs. The Department of Construction is participating in the ASU 3+2 programs with Grand Canyon University and Southwestern University. See page 290 for details.

Construction

PROFESSOR:
ROUNDS
ASSOCIATE PROFESSORS:
BADGER (COB 268), BURTON, MULLIGAN, WEBER
ASSISTANT PROFESSOR:
SHING
PROFESSORS EMERITI:
HASTINGS, MICHELS, PETERMAN, SELLECK, WARD, WOODING

Purpose. Construction careers are so broadly diversified that no single curriculum prepares 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 construction. To ensure a balanced understanding of the technical, professional, and philosophical standards that 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 options to suit individual backgrounds, aptitudes, and objectives. These options are not absolute but generally match major divisions of the construction industry.

Degrees. The Department of Construction offers the Bachelor of Science degree with a major in Construction. Five options are available: general building, general development, heavy construction, military construction, and specialty construction.

Each option 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. The military construction option complements the heavy construction option but permits the use of 18 semester hours of ROTC credits for appropriate technical electives and management type courses.

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

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.

Degree Requirements

Students complete the following basic requirements before registering for advanced courses:

1. All first semester, first-year courses and the university English requirement (see page 43) 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 are given a one-semester waiver.

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

Construction—B.S.

Students in all options are required to complete a construction core of science-based engineering, construction, and management courses. Since the semester hours vary for some alternative courses in the core, any difference in credits is made up in the selected fields of specialization to achieve a minimum of 132 semester hours. The sequential arrangement of course work is shown below.

English Proficiency *Semester Hours*
(6 semester hours)

† ENG 101, 102 First Year Composition ... 6
or ENG 105 Advanced First Year Composition

General Studies Requirements
(36 semester hours)

*Literacy and Critical Inquiry**
(6 semester hours minimum)

† COM 225 Public Speaking 3
† TCE 400 Technical Communications 3

Numeracy
(6 semester hours minimum)

† MAT 270 Calculus with Analytic Geometry I 4
or MAT 260 (3) *and* MAT 261 (3)
† ECE 106 Introduction to Computer Aided Engineering 3

Humanities and Fine Arts
*Social and Behavioral Sciences**
(15 semester hours minimum)
(At least one course must be of upper division level; two courses must be from the same department and two or more departments must be represented in the total selection.)
Humanities and Fine Arts ..... 9 to 6
One course must be CON 101 Introduction to Construction (3)
Social and Behavioral Sciences ..... 6 to 9
† ECN 111 Macroeconomic Principles (3)
† ECN 112 Microeconomic Principles (3)

Natural Sciences
(8 semester hours minimum)

† PHY 111 General Physics 3
† PHY 112 General Physics 3
† PHY 113 General Physics Laboratory 1
† PHY 114 General Physics Laboratory 1

Total General Studies 36

NOTE: One course in the area of global awareness* and one course in historical awareness* *must* appear in the final list of courses offered in the student's graduation program of study. If desired, these can be included in the humanities and fine arts/social and behavioral sciences course selections

* See pages 55–87 for the requirements and the approved list.

† Required for graduation.

Construction Core Requirements Common to *All* Options

			Semester Hours
ACC	211	Introductory Financial Accounting	3
CON	221	Applied Engineering Mechanics: Statics	3
CON	243	Introduction to Construction Materials and Specifications	3
CON	244	Construction Graphics	2
CON	251	Microcomputer Applications for Constructors	3
CON	252	Construction Equipment	2
CON	323	Strength of Materials	3
CON	341	Surveying	3
CON	366	Construction Methods	3
CON	383	Construction Estimating	3
CON	389	Construction Cost Accounting and Control	3
CON	495	Construction Planning and Scheduling	3

CON	496	Construction Contract Administration	3
ECE	105	Introduction to Languages of Engineering	3
STP	226	Elements of Statistics	3
Science Elective			3
		Total Common to All Options	46

Secondary Core for General, Heavy, and Specialty Options

			Semester Hours
CEE	310	Testing of Materials for Construction	3
CEE	340	Hydraulics and Hydrology	3
CEE	450	Soil Mechanics in Construction	3
CON	273	Electrical Construction Fundamentals	3
CON	345	Mechanical Systems	3
CON	371	Construction Management and Safety	3
CON	424	Structural Design	3
CON	453	Construction Labor Management	3
CON	463	Foundations and Concrete Structures	3
BLW	306	Business Law	3
Technical Elective			3
		Total Secondary Core Required	33

Secondary Core for the General Development Option

			Semester Hours
ACC	212	Introductory Managerial Accounting	3
APH	314	History of Western Architecture	3
BLW	306	Business Law	3
COM	222	Argumentation	3
CON	483	Advanced Building Estimating	3
FIN	300	Fundamentals of Finance	3
FIN	361	Managerial Finance	3
GPH	111	Introduction to Physical Geography	4
PUP	301	Introduction to Urban Planning	3
REA	251	Real Estate Principles	3
Technical Elective			3
		Total Secondary Core Required	34

Secondary Core for the Military Option

			Semester Hours
CEE	310	Testing of Materials for Construction	3
CEE	450	Soil Mechanics in Construction	3
CON	273	Electrical Construction Fundamentals	3
CON	344	Route Surveying	3
CON	345	Mechanical Systems	3
CON	371	Construction Management and Safety	3
CON	424	Structural Design	3
CON	463	Foundation and Concrete Structures	3
CON	472	Land Development Feasibility	2
		Total Secondary Core Required	26

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

The course work for the first two years is the same for the general, heavy, and speciality options. The specific lower division requirements are shown below:

			Semester Hours
First Semester			
CON	101	Introduction to Construction	3
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	270	Calculus with Analytical Geometry	4
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
		Total	17
Second Semester			
CON	244	Construction Graphics	2
ECN	112	Microeconomic Principles	3
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First-Year Composition	3
PHY	112	General Physics	3
PHY	114	General Physics Laboratory	1
		Total	15
Third Semester			
CON	221	Applied Engineering Mechanics: Statics	3
CON	252	Construction Equipment	2
COM	225	Public Speaking	3
ECE	106	Introduction to Computer Aided Engineering	3
STP	226	Elements of Statistics	3
Basic Science Elective			3
		Total	17
Fourth Semester			
ACC	211	Introductory Financial Accounting	3
CON	243	Introduction to Construction Materials and Specifications	3
CON	251	Microcomputer Applications for Constructors	3
CON	273	Electrical Construction Fundamentals	3
CON	323	Strength of Materials	3
Humanities Electives			3
		Total	18

[1] See pages 55 87 for the requirements and the approved list.

One of the following five options is to be selected by each student.

Option in General Building Construction

The general building option 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.

Requirements			Semester Hours
BLW	411	Real Estate Law	3
CON	472	Land Development Feasibility	2
CON	483	Advanced Building Estimating	3
REA	251	Real Estate Principles	3
		Total	11

Option in General Development

The general development option prepares the student to participate in the development of land and buildings. Courses equip the student to understand the economics, acquisition, financing, marketing, and managing of developments, which normally vary with location, projected "highest and best" use, and owner requirements.

Requirements			Semester Hours
BLW	411	Real Estate Law	3
CON	472	Land Development Feasibility	2
CON	484	Internship	2
CON	494	ST: Construction Process	3
		Total	10

Option in Heavy Construction

The heavy construction option 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.

Requirements			Semester Hours
BLW	307	Business Law	3
CON	344	Route Surveying	3
CON	482	Cost Engineering	2
CON	486	Heavy Construction Estimating	3
		Total	11

Option in Military Construction

The military construction option is open only to students in the four-year ROTC program leading to a commission in the U.S. Army. It prepares students for careers in either the military or engineering/highway construction field.

Requirements	Semester Hours
Approved Military Science Courses	18

Option in Specialty Construction

Specialty construction includes areas such as mechanical, electrical, air conditioning, roofing, concrete, commercial and industrial refrigeration, and fire protection systems. This option is also intended to provide a program for those students interested in such areas as utility contracting, quarrying, and land development 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 department chair.

Requirements			Semester Hours
CON	455	Construction Office Methods	3
CON	468	Conceptual and Electrical Estimating	3
CON	482	Cost Engineering	2
Approved Technical Elective			3
		Total	11

CONSTRUCTION

CON 101 Introduction to Construction. (3 S F
Review the history of construction and the impact on Society An introductory course to the emerging disciplines Lecture, speakers and field trips

221 Applied Engineering Mechanics: Statics. (3) F S SS
Vectors forces and moments force systems equilibrium analysis of basic structures and structural components, friction, centroids, moments of inertia Cross listed as ETC 211. Prerequisites. MAT 261 or equivalent PHY 111, 113

243 Introduction to Construction Materials and Specifications. (3) F S
Construction materials and components Emphasizing material descriptions, usages, and incorporation into the structure. Lab field trips. Prerequisite: sophomore standing

244 Construction Graphics. (2 F S
Sketching and architectural drafting of building materials and systems Computer graphic applications for construction Field trips Lecture, lab Prerequisite ECE 106 or equivalent

251 Microcomputer Applications for Constructors. (3) F, S
Application of the microcomputer as a prob em solving tool for the constructor Characterist cs of m crocomputer hardware and operat ng systems. Use of spreadsheets stat st ca packages, database management and soft ware. Prerequ s tes. ECE 106; STP 226.

252 Construction Equipment. (2) F, S
Characteristics, capabi ties, m tat ons and employment of genera bu' d ng and heavy construct on equ pment Fleet operat ons, maintenance programs F e d trips Prerequ's te: sophomore stand ng

273 Electrical Construction Fundamentals. (3) F, S
Circuits and mach nery Power transm ss on and d stribution, with emphasis on secondary d str bution systems Measurements and nstrumentat on Fie d tr ps. Prerequi s tes: MAT 261 or 270; PHY 112 114

323 Strength of Materials. (3) F, S
Analys s of strength and rigid ty of structural members n resist ng app ed forces. Stress, stra'n, shear, moment, def ect ons, comb ned stresses connect ons, moment d s tribution Both US and SI un ts of measurement Prerequi s te: CON 221.

341 Surveying. (3) F, S
Theory and f e d work n construct on and land surveys Lecture, ab Prerequ s te MAT 118

344 Route Surveying. (3) F
S mple, compound, and trans tion curves reconna s sance pre minary, and locat on surveys. Ca culat on of earthwork D mensiona contro for construction projects. Lecture ab Prerequ s te· CON 341.

345 Mechanical Systems. (3 F S
Heat ng and cool ng systems for bu dings Sanitary and water piping ayout and simp e des gn Computer a ded ca cu at ons Fie d trips, ecture, ab Prerequ s tes CON 243, 251; PHY 111, 113.

366 Construction Methods. (3) F S
Ana ysis of construct on projects for the determ nat on of the most appropriate and econom c methods. Job organ zat on prep ann ng, and s te ayout. F e d tr ps, ecture ab Prerequ s tes: CON 243 244 252, or equ va ent.

371 Construction Management and Safety. (3) F, S
Organ zat on and management theory app ed to the con struct on process. Leadership funct ons. Safety proce dures and equ pment OSHA requ rement for construc t on. Prerequisite jun or standing or nstructor approval

383 Construction Estimating. (3) F, S
Methods and techn ques used n est mat ng construction costs Standard approach to quant ty surveys empha sized Pract ce in take offs, cost ng and fina bid prepara tion Microcomputer usage for semester project Lecture, project workshop Prerequ s tes: CON 243, 244 251; con struct on major or nstructor approva

389 Construction Cost Accounting and Control. (3) F S
Nature of construct on cost Deprec at on and tax theory var able equipment costs Cash f ow theory, nvestment mode s prof tab ty and analysis. Computer app cat ons Fund ng sources and arrangements Bu lder's nsurance Prerequis tes· ACC 211 CON 251 or equivalent; CON 383 *[Satisfies General Studies Requirement· N3]*

424 Structural Design. *(3) F S*
Econom c use of stee re nforced concrete, and wood in bu d ng and eng neered structures. Des gn of beams, co umns, and connect ons. E ast c and u t mate strength de s gn Student design projects. Fie d tr ps Prerequ s te CON 323

453 Construction Labor Management. (3) F, S
Labor and management history un on and open shop organ zat on of build ng and construct on workers appl cab e aws and government regulat ons; goals, econom c power, jur sdict ona d sputes and gr evance procedures Lecture, ab. Prerequis tes: CON 371 ECN 112. *[Satis fies General Studies Requirement: H]*

455 Construction Office Methods. (3) S
Adm n strative systems and procedures for the construc t on company office includ ng methods improvement and work s mpl f cat on, office ayout business forms and de s gn office manua s Prerequ s te CON 389

463 Foundations and Concrete Structures. (3) F S
Subsurface construction theory and pract ce for founda t ons of bu d ngs and eng neered faci t es Concrete form des gn for foundat ons and structural frames. Underp n n ng, p ing, dry and wet excavating, dewatering, coffer dams, ca ssons F e d tr ps ecture, rec tat on Prerequ s tes CEE 450 CON 323 424.

468 Conceptual and Electrical Estimating. (3) F
System of estimat ng construct on costs before des gn has been in tiated Cost est mat ng for large projects Ana ys s and organizat on of e ectrica estimate. Pre requ s te· CON 383

472 Land Development Feasibility. (2 S
Econom c ocat on theory Analysis of the profitabi ty of land deve opments M crocomputer applicat ons n the ana ysis process. F eld tr ps. Prerequ s tes: CON 251, 383, 389

477 Residential Construction. (3) F
Study of des gn concerns, construct on material and con tract administrat on prob ems re ated to res dent a con struct on. Owner and contractor relationsh p. Fie d tr ps Prerequ s te. jun'or stand ng or instructor approva .

482 Cost Engineering. (2) S
The time va ue of money. Compar son of a ternative, de prec ation methods and impact on taxes, rep acement and break even analys s Construct on financ ng and analys s Prerequ s te: CON 389

483 Advanced Building Estimating. (3) F S
Concepts of pr cing and markup deve opment of h storic costs, ife cycle cost ng, change order and conceptua es t mat ng emphas z ng m crocomputer methods Prerequi sites CON 251, 383

486 Heavy Construction Estimating. (3) F S
Methods analys s and cost est mat on for construct on of h ghways, bridges tunnels, dams and other eng neering works. *Field trips. Prerequ s tes. CON 344, 383;* or n structor approval

495 Construction Planning and Scheduling. (3) F S
Var ous network methods of project schedu ing such as AOA, AON Pert, bar charting ne of ba ance and VPM techniques M crocomputers used for scheduling, re source a locat on and t me cost ana ys s Prerequ sites CON 251 383, 389; construct on major or nstructor approva *[Satisfies General Studies Requirement: N3]*

496 Construction Contract Administration. (3) F, S
Case stud es Effects of organ zat on on construct on con tract operations. Essent als of construction aw. Pr me contracts, subcontracts joint venture and consortium agreements, and change orders Documentat on Cla ms, arb trat on and t gat on Qua ty contro requirements Bond ng insurance indemnif cat on procedures Ethica practice, l censing, codes etc F e d tr ps. Prerequ s tes senior stand ng, CON 374, TCE 400; or instructor ap proval

531 Economics of the Construction Industries. (3) F The economic environment of construction w th emphasis on un que aspects critical rev ew of econom c l terature dea ng w th the construct on industr es. Prerequ s tes CON 496; ECN 500; or instructor approva .

551 Facilities Operation and Maintenance. (3) S Analysis of ma ntenance work. Structure of the mainte nance work and organization. Contract maintenance and force account econom cs. Maintenance control and super vision of operations Field trips Prerequ s tes CON 389, 495; or instructor approval.

577 Construction Systems Engineering. (3) F Systems theory as app ied to the construct on process Alternates for structur ng nformation flows and the control of projects. Prerequ s te: IEE 476 or equ valent

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

Departments of Technology

Degree Requirements—B.S.

All baccalaureate degree programs in the departments of technology require completion of the university English proficiency requirement, a General Studies component, and a technology core component. The engineering technology programs also require completion of an engineering technology core in addition to the technology core of the chosen major and option. All programs require a minimum of 132 semester hours.

The specific course requirements for the English proficiency, General Studies, technology core, and the engineering technology core are listed below. Refer to the individual majors or options for their additional required courses.

English Proficiency — *Semester Hours*

† ENG 101, 102 First-Year Composition 6
or ENG 105 Advanced First Year Composition (3)

General Studies

*Literacy and Critical Inquiry**
(6 semester hours minimum)
One course must be chosen from the university-approved list. The course must be sophomore level and include a series of formal, graded written *or spoken* assignments in composing critical discourse 3

† TCE 400 Technical Communications 3

Numeracy
(6 semester hours minimum)

† MAT 118 Precalculus Algebra and Trigonometry 3

† ECE 106 Introduction to Computer Aided Engineering 3

Humanities and Fine Arts
*Social and Behavioral Sciences**
(15 semester hours minimum)
(At least one course must be of upper-division level; two courses must be from the same department, and two or more departments must be represented in total selection.)
Humanities and Fine Arts ..... 9 to 6
Social and Behavioral Sciences ..... 6 to 9

† ECN 111 Macroeconomic Principles (3)
or ECN 112 Microeconomic Principles (3)

Natural Sciences
8 semester hours minimum)

† PHY 111 General Physics 3
† PHY 112 General Physics 3
† PHY 113 General Physics Laboratory 1
† PHY 114 General Physics Laboratory 1

Total General Studies 35

NOTE: One course in the area of global awareness* and one course in historical awareness* *must* appear in the final list of courses offered in the student's graduation program of study. These can be included in the humanities and fine arts social and behavioral sciences course selections. See the list of acceptable courses.

* See pages 55–87 for the requirements and the approved list.

† Graduation requirement for the baccalaureate degree

Technology Core

The following courses constitute the technology core and are required in all baccalaureate degree programs in the departments of technology:

			Semester Hours
CHM	101	Introductory Chemistry ..... or CHM 113 General Chemistry (4) or CHM 114 General Chemistry for Engineers (4)	4
ECE	105	Introduction to Languages of Engineering	3
MAT	260	Technical Calculus I ..... or STP 420 Introductory Applied Statistics (3)	3
TCE	201	Applied Electrical Science	4
TCE	230	Engineering Materials and Processing ..... or TCE 250 Digital Systems and Microprocessors (3)	3
		Total Technology Core	17

Engineering Technology Core

The following courses constitute the engineering technology core and are required in all baccalaureate degree programs in the engineering technologies:

			Semester Hours
ETC	205	Electronic Devices and Circuits	4
		or ETC 325 Electrical Power Source Analysis (4)	
ETC	211	Applied Engineering Mechanics: Statics	3
ETC	313	Applied Engineering Mechanics: Materials	3
		or ETC 312 Applied Engineering Mechanics: Dynamics (3)	
ETC	340	Applied Thermodynamics and Heat Transfer	3
		or ETC 331 Semiconductor Materials Science/Devices (3)	
MAT	261	Technical Calculus II	3
MAT	262	Technical Calculus III	3
		or STP 420 Introductory Applied Statistics (3)	
		Total Engineering Technology Core	19

TECHNOLOGY CORE

TCE 201 Applied Electrical Science. (4) F, S, SS
Principles of electricity, passive elements and d-c and a-c circuit analysis. Laboratory exploration of circuit concepts and techniques using instrumentation and the computer as a tool. Lecture, lab. Prerequisites: ECE 105; MAT 118.

230 Engineering Materials and Processing. (3) F, S, SS
Materials, their structures, properties, fabrication characteristics and applications. Material forming, joining and finishing processes. Automation and quality control. Prerequisites: CHM 101, 113 or 114.

250 Digital Systems and Microprocessors. (3) F, S
Fundamentals of digital systems and microprocessors, with Boolean Algebra and combinational logic. Microprocessor programming and applications. Lecture, demonstration. Prerequisites: ECE 105; TCE 201. *[Satisfies General Studies Requirement: N3]*

400 Technical Communications. (3) F, S, SS
Planning and preparing technical publications and oral presentations based on directed library research related to current technical topics. Prerequisites: senior standing as a CEAS major; completion of first-year English requirements plus sophomore critical writing course. *[Satisfies General Studies Requirement: L2]*

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

ENGINEERING TECHNOLOGY CORE

ETC 205 Electronic Devices and Circuits. (4) F, S
Active device characteristics, models, and basic electronic circuit design principles. Lecture, lab. Prerequisites: TCE 201; MAT 260.

211 Applied Engineering Mechanics: Statics. (3) F, S, SS
Vectors, forces and moments, force systems, equilibrium, analysis of basic structures and structural components, friction, centroids, moments of inertia. Cross-listed as CON 221. Prerequisites: MAT 261 or equivalent; PHY 111, 113.

312 Applied Engineering Mechanics: Dynamics. (3) S
Masses; motion kinematics; dynamics of machinery. Prerequisites: ETC 211; MAT 261.

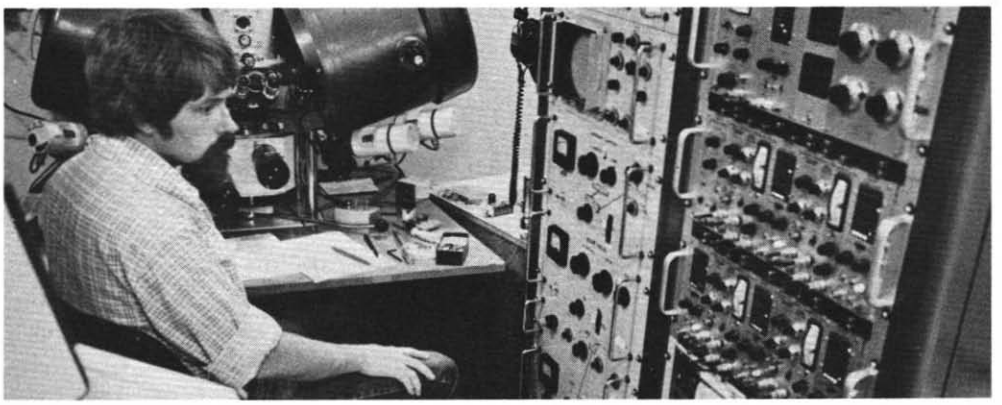
313 Applied Engineering Mechanics: Materials. (3) F, S, SS
Stress, strain, relations between stress and strain, shear, moments, deflections, combined stresses. Lecture, lab. Prerequisite: ETC 211.

325 Electrical Power Source Analysis. (4) N
Design and operating characteristics of electrical power sources and related equipment. Equipment selection, setup and troubleshooting procedures covered. Lecture, lab. Prerequisites: MET 302; PHY 112, 114; TCE 201; or instructor approval.

331 Semiconductor Materials Science/Devices. (3) F S
Introduction to mechanical and electro-magnetic properties of materials used in electronics. Semiconductor physics and solid state device characteristics, material properties. Lecture. Prerequisites: CHM 101 or 113; ECE 105; EET 310; PHY 112, 114.

340 Applied Thermodynamics and Heat Transfer. (3) F, S
Thermodynamic systems and processes, first and secor laws of thermodynamics, properties of pure substanc applications to heat engines and special systems. Fundamentals of conduction, radiation, and convection. Prerequisites: MAT 261; PHY 112, 114.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



Aeronautical Technology

PROFESSOR:
MATTHEWS (TCB 206)
ASSOCIATE PROFESSORS:
LATIGO, REED, ROPER, SALMIRS
ASSISTANT PROFESSORS:
CARLSEN, GESELL
INSTRUCTOR:
ROGERS
PROFESSORS EMERITI:
COX, PEARCE, SCHOEN, THOMASON

The Department of Aeronautical Technology offers two majors leading to a Bachelor of Science degree. The options within these majors are as follows:

Aeronautical Engineering Technology

Aeronautical Technology
Helicopter Technology

Aeronautical Management Technology

Aircraft Flight Management
Airway Science Management

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 application of technical knowledge as well as current technology, preparing the graduate to adapt to the rapid and continual changes in aerospace technology.

Aeronautical Engineering Technology—B.S.

The Aeronautical Engineering Technology degree program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology. The 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 fixed wing aircraft and aerospace vehicle design, helicopter applications, internal combustion engines, combustion processes, turbomachinery, systems analysis, computer modeling, quality assurance and non destructive testing, and low speed wind tunnel applications.

Aeronautical Engineering Technology students are required to complete a minimum of 132 semester hours, including at least 50 semester hours of upper division courses. All degree requirements are shown on the student's Curriculum Check Sheet. These requirements include English proficiency, General Studies, technology core, engineering technology core, and specific additional courses listed in the following section.

Degree Requirements

In the General Studies requirement (see page 306), the following course is required:

			Semester Hours
ECN	111	Macroeconomic Principles	3

In the technology core (see pages 307 308), the following courses are required:

			Semester Hours
CHM	114	General Chemistry for Engineers	4
MAT	260	Technical Calculus I	3

In the engineering technology core (see pages 307 308), the following courses are required:

			Semester Hours
ETC	313	Applied Engineering Mechanics: Materials	3
ETC	340	Applied Thermodynamics and Heat Transfer	3
MAT	262	Technical Calculus III	3

The following additional courses are required in both options: AET 280, 281, 287, 288, 300, 310, 320, 321, 409, 414, 487; CSC 183; ETC 312; IEE 300; MET 432; STP 420.

The following courses are also required for the option listed:

Aeronautical technology. AET 415, 417, three elective hours.

Helicopter technology. AET 360, 461, 462, 463, 464.

Suggested Course Pattern for Freshmen

			Semester Hours
First Semester			
CHM	114	General Chemistry for Engineers	4
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	230	Engineering Materials and Processing	3
		Total	16
Second Semester			
CSC	183	Applied Problem Solving with FORTRAN	3
ECE	105	Introduction to Languages of Engineering	3

ENG	102	First-Year Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
		Total	16

Aeronautical Management Technology—B.S.

The Aeronautical Management Technology curriculum is designed to combine a thorough technical training with an interdisciplinary general university education. The graduate is prepared to assume responsibilities in a wide area of managerial and technically related areas of aviation. The student gains a background in aircraft structures, reciprocating and turbine engines, performance, design, management skills, business principles, systems analysis, and a variety of course work specific to aircraft flight, airport operations, and air transportation systems. The degree offers two options: airway science management and aircraft flight management. These curricula have the approval of the Federal Aviation Administration and can lead to employment in that agency. The two options are described separately below.

Option in Aircraft Flight Management

Flight training is certified by the Federal Aviation Administration

Aircraft flight management 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.

This curriculum concentrates on flying, plus the technical, management, and computer-related applications necessary to operate aircraft in the high-density environment of modern airspace. This career option leads to the development, administration, and enforcement of safety regulations, including airworthiness and operational standards in civil aviation. The program emphasizes critical thinking, and cognitive, analytical, and communication skills.

While enrolled at Arizona State University, students do 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 is given for flight experience and certificates received before enrollment at the university.

Flight instruction costs are not included in university tuition.

Aircraft flight management students are required to complete a minimum of 132 semester hours, including at least 50 semester hours of upper division courses. All degree requirements are shown on the student's Curriculum Check Sheet. These requirements include English proficiency, General Studies, technology core, and specific additional courses listed in the following section:

Degree Requirements

In the General Studies requirement (see page 306), the following courses are required:

			Semester Hours
COM	225	Public Speaking	3
ECN	111	Macroeconomic Principles	3
HIS	414	Modern American Economy	3
PGS	100	Introduction to Psychology	3

In the technology core (see pages 307 308), the following courses are required:

			Semester Hours
CHM	113	General Chemistry	4
		or CHM 114 General Chemistry for Engineers	
MAT	260	Technical Calculus I	3

In addition, the following listed courses are required: AET 182, 183, 220, 222, 280, 281, 287, 288, 300, 308, 314, 342, 382, 383, 385, 386, 387, 389, 392, 393, 395, 408, 410, 444, 489, 498; CSC 181; MGT 301 or IST 346; MGT 311 or IST 452; MGT 352 or IST 480; STP 420.

Suggested Course Pattern for Freshmen

			Semester Hours
First Semester			
AET	100	Primary Flight Course	0
AET	182	Private Pilot Ground School	3
CHM	113	General Chemistry	4
		or CHM 114 General Chemistry for Engineers (4)	
CSC	181	Applied Problem Solving with BASIC	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
		Total	16
Second Semester			
AET	183	Private Pilot Certificate	1
AET	220	Aviation Meteorology	3
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
		Total	17

Option in Airway Science Management

The airway science management option is designed to prepare graduates for managerial and supervisory positions throughout the air transportation industry. A depth of technical training is included along with a broad exposure to business and management courses. This program of study, interdisciplinary in nature, prepares the aeronautical career-oriented student for such positions as air traffic control specialist, air carrier manager, airport manager, and general aviation operations manager.

Airway science management students are required to complete a minimum of 132 semester hours, including at least 50 semester hours of upper-division courses. All degree requirements are shown on the student's Curriculum Check Sheet. These requirements include English proficiency, General Studies, technology core, and specific additional courses listed in the following section.

Degree Requirements

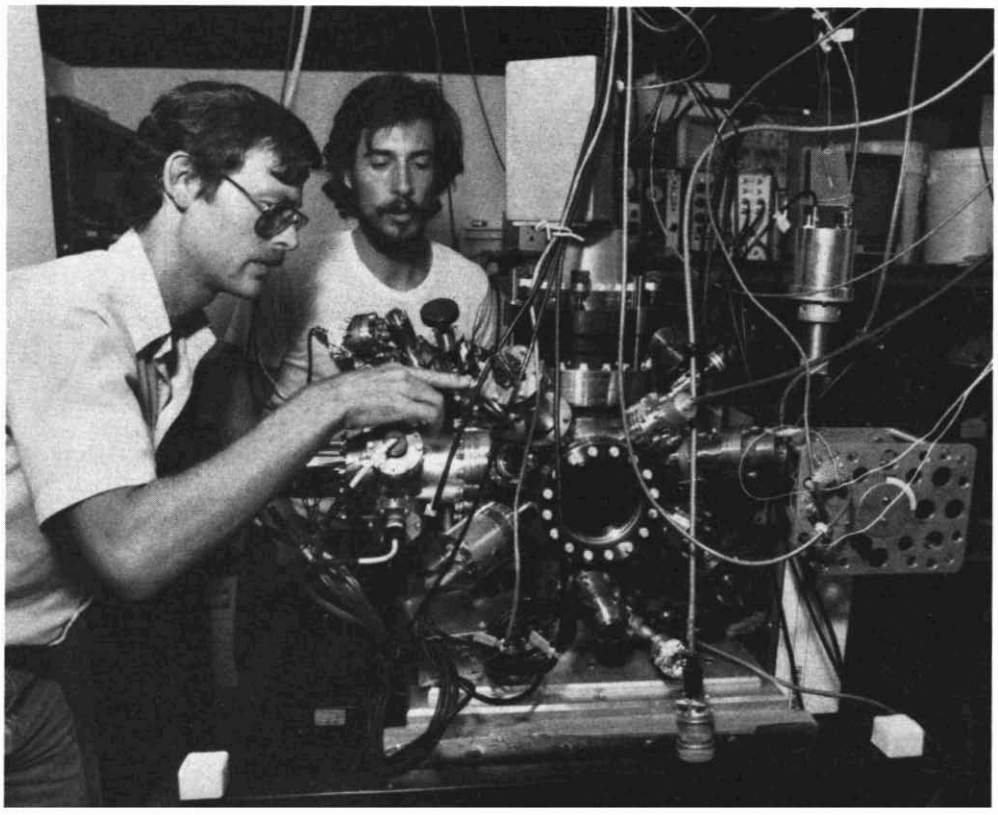
In the General Studies requirement, (see page 306), the following courses are required:

			Semester Hours
COM	225	Public Speaking	3
ECN	111	Macroeconomic Principles	3
ECN	112	Microeconomic Principles	3
SOC	301	Principles of Sociology	3

In the technology core (see pages 307–308), the following courses are required:

			Semester Hours
CHM	113	General Chemistry or CHM 114 General Chemistry for Engineers (4)	4
MAT	260	Technical Calculus I	3

In addition, the following listed courses are required: ACC 211; AET 182, 201, 280, 281, 287, 288, 308, 342, 408, 410, 444, 489; BLW 305 or IST 498; COM 410; CSC 181; HIS 414; IEE 431; MGT 352 or IST 480; MGT 301, or IST 346; MGT 311 or IST 452; MGT 423 or IST 491; PGS 100; STP 420; five elective hours.



Suggested Course Pattern for Freshmen

First Semester			Semester Hours
AET	182	Private Pilot Ground School	3
CHM	113	General Chemistry or CHM 114 General Chemistry for Engineers (4)	4
CSC	181	Applied Problem Solving with BASIC	3
ENG	101	First-Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	102	First-Year Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
		Total	16

General Information

Student Organizations. The department hosts the local chapter of Alpha Eta Rho, the international professional aviation fraternity. Students also are eligible for membership in Tau Alpha Pi, the national honor society for engineering technology, and the Precision Flight Team, which competes in regional and national flying safety competitions.

AERONAUTICAL TECHNOLOGY

(Flight instruction costs are not included in university tuition.)

AET 100 Primary Flight Course. (0) F, S, SS
Allows student to accrue flight time in preparation for the Private Pilot Certificate. Flight participation required Pre- or corequisite: AET 182 or equivalent

101 Introduction to Aeronautics. (3) F
Evolution of aviation Aircraft types and uses Principles of flight. Technical development of equipment/systems Airspace use.

182 Private Pilot Ground School. (3) F, S, SS
Ground school leading to FAA Private Pilot Certificate. Student may begin flight training when concurrently enrolled in AET 100. Aerodynamics, navigation, performance regulations

183 Private Pilot Certificate. (1) F, S, SS
Flight training for the FAA private pilot certificate. Satisfactory completion of FAA tests is required Prerequisites: AET 182; passed FAA written.

200 Interim Flight Course. (0) F S SS
Allows students to accrue flight time in preparation for advanced ratings and certificates. Flight participation is required. Prerequisite: Private Pilot Certificate or instructor approval

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 Prerequisite. AET 182.

220 Aviation Meteorology. (3) F, S
Evaluation analysis, interpretation of atmospheric phenomena Low and high altitude weather from the pilot's viewpoint. Nephology. Prerequisite AET 182.

222 Instrument Pilot Ground School. (3) F
Ground school leading to the FAA Instrument Pilot Rating Ten hours ground trainer included. Prerequisite: Private Pilot Certificate. Pre- or corequisite: AET 220.

280 Aerospace Structures and Materials. (3) F
Basic aerodynamics, aerospace vehicle structural design and materials Manufacturing processes, assembly and repair techniques, and hardware selection Lecture, lab Prerequisites PHY 111, 113

281 Aerospace Systems. (3) S
Modern aircraft and aerospace vehicle systems (hydraulics pneumatics auxiliary, control, instrument etc.) weight and balance inspection requirements and methods Lecture, lab Prerequisites PHY 111 113

283 Instrument Pilot Rating. (1) F, S, SS
Flight training for the FAA Instrument Pilot Rating. Satisfactory completion of FAA Instrument Rating required. Not for Aeronautical Technology majors Prerequisites: AET 222; passed FAA written.

287 Aircraft and Aerospace Powerplants. (3) F S
Theory of internal combustion engines, components, performance analysis, engine accessories, systems and environmental control. Lecture, lab. Prerequisites: PHY 111, 113, CHM 113 or 114

288 Gas Turbine and Turbomachinery. (3) F, S
Development and theory of gas turbine engines. Thrust and performance analysis Engine components, systems, aerodynamic problem application and environmental control Lecture, lab. Prerequisites PHY 111, 113, CHM 113 or 114.

300 Aircraft Design I. (3) F, S
Basic applied aerodynamics, propeller performance and airplane performance analysis Prerequisites: AET 280, 287, 288; ECE 106; MAT 260, PHY 112, 114

308 Air Transportation. (3) F
Air commerce related to the transportation system. Historical development of air transportation, regs, the regulators and the regulatory climate within the National Airspace System. Prerequisite. junior standing. *[Satisfies General Studies Requirement. G]*

310 Instrumentation. (2) F
Measurement system responses and the characteristics of experimental data Methods of collecting and analyzing data. Prerequisites MAT 261 TCE 201

314 Commercial Pilot Ground School. (3) S
Ground school leading to Commercial Pilot certification Ten hours ground trainer included Prerequisite Private Pilot Certificate Pre or corequisites. AET 220, 222

320 Applied Aerodynamics I. (3) F
Introduction to potential and viscous flows and their relation to aircraft lift and drag Prerequisites AET 300, ECE 106· MAT 262

321 Applied Aerodynamics II. (3) S
Wind tunnel theory, measurements and analysis Aircraft stability and control. Lecture, lab Prerequisite AET 320

342 Aviation Law/Regulations. (3) F, S
Study which encompasses the f e d of av ation with n the context of the U S Common Law system Pub c law ad m nistrative ru e mak ng, sovere gnty, enforcement, and case aw ana ysis. Prerequ s te junior stand'ng.

360 Introduction to Helicopter Technology. (3 S
Introduct on to the work ng funct ons of modern rotary w ng a rcraft Rotary w ng f ght theory aerodynam cs, controls, f ght and power requ rements Prerequis tes jun or stand ng, PHY 112, 114.

382 Air Navigation. (3 F
Advanced D R theory app cat on of modern nav gat on systems pressure pattern, gr d nav gat on Prerequ s te AET 222

383 Commercial Pilot Certificate and Instrument Rating. (2) F S SS
F ght tra n ng for the FAA Commerc a P ot Cert ficate w th A rp ane Sing e Eng ne Land and Instrument A rp ane Rat ngs Sat sfactory comp et on of FAA Cert f cate Rat ng required Prerequ s tes: AET 222, 314; passed FAA wr t ten f y ng t me, 150 hours m n mum.

385 Flight Instructor Ground School. 3 F
Ground schoo n preparat on for the FAA F ght Instructor Cert ficate Prerequ s te AET 383

386 Flight Instructor Certificate. (1) F S SS
F ght tra n ng for FAA F ght nstructor Cert f cate Cert f cate requ red for course complet on. Prerequ s tes: AET 385 passed FAA wr tten

387 Multi-Engine Ground School. (1 F
Ground schoo preparation for the FAA Mu t Eng ne Rat ng Prerequ s te· AET 383 or nstructor approva

389 Multi-Engine Rating. 1) F S SS
F ght train ng for add t on of an unrestr cted FAA Mu t Eng ne Rating to a commerc al p ot cert'ficate FAA rat ng required for course complet on Corequ s te· AET 387

392 Flight Instructor Instrument Ground School. (2) S
Ground schoo preparat on for FAA Instrument F ght n- structor Rat ng Prerequis te AET 386 or nstructor ap prova

393 Flight Instructor Instrument Rating. (1) F, S SS
F ght tra n ng for the FAA CF . CF Rat ng required for course complet on Prerequ s tes AET 386 392 passed FAA wr tten.

395 Multi-Engine Land, Airplane Flight Instructor Rating. 1 F, S, SS
Normal and emergency fl ght operations. Instruct on tech niques and procedures assoc ated w th ght mu t eng ne and a rp ane CF AME Rat ng requ red for course com p et on Prerequ s tes AET 386 389

408 National Airspace System. 2) S
A rway fac t es Operat ons and commun cations a r route traff c control centers and f ght serv ce stat ons Nav gation a ds a rport env ronment, cert ficat on and se cur ty Prerequ s te AET 201 or 222

409 Nondestructive Testing and Quality Assurance. 3 F S
Purpose of nspect on and qua ty assurance Theory, appl cation of nondestructive nspection methods. Appl cation of pert nent standards, specif cat ons and codes Lecture ab. Prerequ site AET 280 or TCE 230 Pre or corequ s te TCE 400.

410 Aviation Safety. (2) F
Aviat on acc dent prevention human factors, fe support, f re prevent on and crash surv vab ty Deve opment and ana ys s of av at on safety programs Prerequ s te jun or stand ng

411 Aircraft Accident Investigation. (3) S
Deve opment and eva uat on of ev dence, analysis, and recommendat ons for prevent ve pract ces. Prerequis te· junior stand ng

414 Applied High Speed Aerodynamics. (3) F
Bas c concepts of compress b e f u d mechan cs nc ud ng interna and externa flows Prerequ s tes ETC 340; MAT 262

415 Propulsion. (3 S
Pr nc p es thrust, performance cyc es combust on sys tems mechan ca , material and other des gn cons dera t ons ram jets, rockets and advanced propu s on systems Prerequ s te AET 414.

417 Aerospace Systems Design. (3) F
Ana ysis and design of rockets m ssi es, and satell tes Therma des gn of aerospace systems. Introduct on to orb ta mechan cs. Computer s mu at ons and app ca tions Prerequ s tes AET 300 ETC 312, 340, MAT 262

444 Airport Management and Planning. 3) S
Career or entat on nto adm n strat on and management o modern pub c a rports to nc ude an overv ew of p an n ng funding and deve opment of airport fac it es Pre requisite· AET 308 or nstructor approva .

461 Applied Helicopter Aerodynamics and Performance Measurements. 3 F
Hover ng theory, vertical f ght b ade mot on and rotor control Aerodynam cs of forward f ght stab ty. Pre requ s tes AET 300 360

462 Aerodynamics of Wind Tunnel Models. (3) S
He copter mode types, des gn considerat ons propul s on, loads surfaces, mount ngs, nstrumentat on Pre requ s tes AET 321, 461

463 Aircraft/Helicopter Handling Qualities. (3 F
FAR's, M LSPEC s human resources, ana ytical tech n ques simu ator and f ght test techn ques. W nd tunne data acqu s t on and ana ys s Prerequ s te AET 461

464 Flow Modeling Validation. 3 S
F ow mode concepts, f ow mode s n a rp ane and he copter des gn Test requ rements data ana ys s erro ana ys s Prerequ site AET 462

472 Applied Linear Analysis. 3
L near a gebra, d fferent a equat ons and computer meth ods app ed to prob ems n eng neer ng techno ogy Pre requ sites: ECE 106 MAT 262 *[Satisfies General Stud es Requ rement N1]*

484 Aeronautical Internship. 1 3 F, S SS
Work exper ence ass gnment at a rports or w th aero space industry commensurate with student's program Spec a projects gu dance by industry w th un'versity su perv s on Prerequ s tes adv sor approval junior stand ng

487 Aircraft Design II. (3) F S
Bas c aerodynam cs and a rp ane performance ana ys s methods app ied to pract ca des gn project Prerequ s te AET 300.

489 Airline Administration. 2 S
Adm n strat ve organ zat ons, economics of a r ne adm n strat on operat ona structure, relat onsh p w th federa government agenc es Prerequ site AET 308 or nstruc tor approva

490 Mathematical Modeling of Aerospace Systems. 2) S
Methods of ana yz ng and opt m z ng aerospace systems us ng bas c stat st cs and we l known numer cal methods w th emphas s on computer s mu ation Prerequ s te MAT 261 *[Sat sf es General Stud es Requirement N2]*

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Electronics and Computer Technology

PROFESSORS:
McHENRY (TC 301A), MA SEL
ASSOCIATE PROFESSORS:
FORDEMWALT, McBRIEN MUNUKUTLA, STRAWN WOOD, YOUNG
ASSISTANT PROFESSOR:
PETERSON
VISITING ASSISTANT PROFESSORS:
KAHN SADDLER
PROFESSORS EMERITI:
BAXTER, EDWARDS

Purpose. Electronics engineering technology is a technological field of specialization that requires the application of scientific and engineering knowledge and methods combined with technical skills in support of electrical/electronic 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 electronics engineering technologist is a member of the electrical engineering team that consists of electrical engineers, electronics engineering technologists, and electronics engineering technicians.

The electronics engineering technologist is applications oriented, building upon a background of applied mathematics including the concepts and applications of calculus. Utilizing applied science and state of-the art technology, the electronics technologist is able to produce practical, workable, and safe results quickly and economically, to install and operate technical systems, to configure hardware for unique applications from proven concepts, to develop and produce products, to service machines and systems, to manage construction and production processes, and to provide customer support to technical products and systems.

Degrees. The Department of Electronics and Computer Technology offers the Bachelor of Science degree with a major in Electronics Engineering Technology (B.S./EET). Four options are available: computer systems, electronic systems, microelectronics, and telecommunications.

The *computer systems* option combines applied electronics and computer hardware software concepts and applications. It has been formulated to meet the needs of persons who wish to engage in digital and computer systems applications as a career focus.

The *electronic systems* option is aimed at preparing persons for careers in instrumentation, control, and power systems applications. This option allows a student to develop a broad based knowledge of electrical/electronic fundamentals with an applications perspective. Sixteen of the 23 specialization hours are specified and the remaining seven hours are approved technical electives. The Department of Electronics and Computer Technology has had a concentration in electronic systems or instrumentation and systems control for many years. The course patterns in support of these emphasis areas have been well developed and continue to provide strong support for the electronic systems option under the B.S./EET program.

The *microelectronics* (UET) option combines applied electronics, monolithic and hybrid integrated circuit processing and applications, device and component fabrication, and manufacturing. The objective of this option is to prepare persons to assume positions in the area of microelectronics manufacturing with immediately applicable knowledge as well as to develop a strong foundation of electronic fundamentals and methods. Students should be 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. 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 semiconductor and related technologies and their applications to electronic and computer related products offers unique and challenging opportunities. Graduates of this program option secure positions in processing, manufacturing, operations, and applications areas in industry as members of the diverse scientific engineering team.

The *telecommunications* option has been structured to take advantage of the recent changes in the telecommunications industry The program encompasses the fundamentals of information and signal processing, modern bandwidth efficient digital radio analysis with RF and microwave circuits and systems. Applications include telephone pulse code modulation, cable TV, fiber optic links, and satellite transmission circuits and systems.

A Master of Technology degree program with a concentration in electronics engineering technology is available for qualified B.S. graduates. The undergraduate program options are supported as emphasis areas in the master's degree program. See the *Graduate Catalog* for more information.

Electronics Engineering Technology—B.S.

The departmental curriculum is organized into two categories, technical studies and General Studies. Technical studies consist of core areas and the option specialty area. General Studies consist of courses selected to meet the University General Studies requirement as well as the math/science requirement of TAC/ABET. A minimum of 50 upper division hours is required, including at least 24 semester hours of 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 option.

The technical studies curriculum component consists of 91 semester hours of course work, which includes the technology core (17 hours), engineering technology core (19 hours), electronics engineering technology core (28 hours), and an option (27 hours). The General Studies portion of the B.S./EET curriculum has been carefully structured to meet the specific requirements of the university and to include the content required by TAC/ABET, the professional accrediting agency for such curricula.

Degree Requirements

In addition to the General Studies required courses listed on page 306, the following courses are required:

			Semester Hours
Literacy and Critical Inquiry Elective:			
	COM	225 Public Speaking	3
Social and Behavioral Science Elective			
	ECN	112 Microeconomic Principles	3

The following courses are required as part of the technology core:

			Semester Hours
CHM	101	Introductory Chemistry or CHM 113 General Chemistry (4)[1]	4
TCE	250	Digital Systems and Microprocessors	3

[1] CHM 113 required of students in microelectronics option.

The following courses are required as part of the engineering technology core:

			Semester Hours
ETC	205	Electronic Devices and Circuits	4
ETC	312	Applied Engineering Mechanics: Dynamics or ETC 340 Applied Thermodynamics and Heat Transfer (3)[1]	3
ETC	331	Semiconductor Materials Science/ Devices	3

[1] ETC 340 required of students in microelectronics option

Electronics Engineering Technology Core Requirements:

			Semester Hours
CET	350	Digital Logic Principles	4
CET	354	Microcomputer Principles	4
CSC	183	Applied Problem Solving with FORTRAN	3
EET	208	Electric Circuits	3
EET	301	Electric Networks I	3
EET	310	Electronic Circuits	4
EET	372	Communication Systems	3
EET	396	Professional Orientation*	1
UET	415	Electronics Manufacturing Engineering Principles	3
		Total	28

* Students must take EET 396 the semester in which they are enrolled in the 87th hour of credit (ASU plus transfer hours). If this occurs in summer session, students should take EET 396 the prior spring semester.

Electronics Engineering Technology Options

Computer systems. Required courses: CET 452, 456, 457, 473, 483; plus nine hours of *approved* technical electives.

Electronic systems. Required courses: EET 307, 406, 430, 460; plus 11 hours of *approved* technical electives.

Microelectronics. Required courses: CHM 116; UET 416, 418, 432; plus 12 hours of *approved* technical electives.

Telecommunications systems Required courses: CET 473; EET 304, 470, 478; plus 11 hours of *approved* technical electives.

Electronics Engineering Technology
Program of Study
Typical First- and Second-Year Sequence
Freshman Year

First Semester			Semester Hours
CHM	113	General Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	101	First-Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
		Total	16
Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
ENG	102	First Year Composition	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
MAT	260	Technical Calculus I	3
TCE	201	Applied Electrical Science	4
		Total	17

Sophomore Year

First Semester			
CSC	183	Applied Problem Solving with FORTRAN	3
EET	208	Electric Circuits	3
ETC	205	Electronic Devices and Circuits	4
MAT	261	Technical Calculus II	3
PHY	112	General Physics	3
PHY	114	General Physics Laboratory	1
		Total	17
Second Semester			
COM	225	Public Speaking	3
ECN	112	Microeconomic Principles	3
ETC	211	Applied Engineering Mechanics: Statics	3
MAT	262	Technical Calculus III	3
TCE	250	Digital Systems and Microprocessors	3
		Total	15

General Information

Student Organizations. The department hosts one of the local chapters of the Institute of Electrical and Electronics Engineers (IEEE), the International Society for Hybrid Microelectronics (ISHM), and the Instrument Society of America (ISA). Students may also be elected to membership in Tau Alpha Pi, the national honor society for engineering technology.

ELECTRONICS ENGINEERING TECHNOLOGY

EET 208 Electric Circuits. (3) F, S
Graphical and analytical analysis of electric circuits transient and sinusoidal excitation. Application of circuit theorems and computer solutions. Prerequisite: TCE 201. Corequisite: MAT 261

301 Electric Networks I. (3) F, S
Analytical and graphical analysis of electric networks, transients steady-state sinusoidal frequency response and transfer functions using calculus essentials and Laplace transforms. Prerequisites: EET 208; MAT 261

304 Transmission Lines and Waveguides. (4) S
Theory and application of transmission lines, waveguides, fiber optics, and microwave components. Analysis and matching using the Smith Chart. With lab. Prerequisite: EET 301

307 Electrical Power Circuits and Machines. (4) F, S
Principles and analysis of electrical power circuits and components transformers, rotating machines and related control equipment Lecture lab Prerequisites. TCE 201; PHY 112, 114.

310 Electronic Circuits. (4) F S
Analysis and design of bipolar and FET electronic circuits using the model approach Amplifier and transfer function principles. With lab Prerequisites EET 208· ETC 205.

372 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 EET 301, 310.

396 Professional Orientation. (1) F, S
Technical, professional, economic and ethical aspects of electronics/computer engineering technology practice and industrial organization. Lectures, projects. Prerequisite· junior standing.

401 Electric Networks II. (3) A
Graphical and analytical analysis of discrete systems. Time, frequency and transform domain techniques waveform analysis Software Applications Prerequisites· EET 301· MAT 262

406 Control System Technology. (4) S
Control system components analysis of feedback control systems, stability performance, application. Lecture, lab and computer simulations Prerequisites EET 301, MAT 262

410 Linear Filters and Applications. (4) F
Frequency response and feedback design of multistage electronic circuits. Active and passive filter design. Computer analysis. Lecture lab. Prerequisites: EET 301, 310.

420 Operational Amplifier Theory and Application. (4) A
Differential and operational amplifier circuitry feedback configurations, op-amp errors and compensation, linear and nonlinear circuitry. Applications. Lecture, lab Prerequisites· EET 301, 310

422 Electronic Switching Circuits. (4) S
Analysis and design of electronic circuits operating in a switching mode Waveshaping, timing logic. SPICE analysis Lecture, lab. Prerequisites CET 350; EET 301, 310.

430 Instrumentation Systems. (4) F
Measurement princip es and instrumentat on, techniques S gna and error ana ysis. Lecture ab Prerequ s tes: CET 350 EET 301 310.

440 Electrical Power Systems Technology. (3) S
E ectrical power systems analys s, transm ss on, distr bu t on, nstrumentat on, protect on and re ated system com ponents Prerequis te EET 307

460 Power Electronics. (4) S
Ana ysis of circu ts for control and convers on of electrical power and energy. Lecture ab. Prerequ s tes: CET 350; EET 301, 310

470 Communication Circuits. (4) S
Ana ys s and design of passive and act ve commun cat on circu ts. Coupl ng networks f lters, mpedance match ng Modu at on and demodu at on techniques. Computer so ut ons. Lecture, lab Prerequ s tes EET 372 MAT 262

478 Communication Transmission System Design. 4) S
App ied des gn of transmission and propagat on systems antennas cable TV and f ter optics Lecture ab Pre requ sites EET 304 372 MAT 262.

482 Industrial Practice: Internship Coop. (1–4) F, S, SS
Spec a y ass gned or approved act v ties n e ectron c n dustr es or nstitut ons Report requ red. Max mum of 10 credits. Prerequ s te majors on y enro led at jun or-senior eve .

490 Electronics Project. (1–4) F S SS
nd vidual or sma l group projects n app ed electron cs w th emphas s on laboratory practice or hardware so u t ons to pract ca problems Prerequis te nstructor ap prova

501 Digital Signal Processing and Application I. (3) A
Fundamenta s and app cat on of discrete signa s and sys tems app ication of DFT and FFT, des gn of recurs ve f l ters using computer techn ques. Prerequ sites. EET 401 or instructor approva ; MAT 262

502 Digital Signal Processing and Applications II. (3) S
Design and app cation of nonrecurs ve d screte f lters convo ution w th FFT, power spectrum analys s, random s gna s Prerequ s te EET 501.

506 System Dynamics and Control. (3 S
Time, frequency and transform doma n ana ys s of phys cal systems Transfer funct on ana ys s of feedback con trol systems performance and stab l ty. Compensat on Prerequis tes: EET 301 EET 501 or MAT 262.

510 Linear Integrated Circuits and Applications. (3) F
Ana ysis, design, and appl cations of inear integrated cir cuits and systems. Prerequ s tes CET 350; EET 301 310

522 Digital Integrated Circuits and Applications. (3) S
Ana ys s, des gn and appl cat ons of integrated circuits and systems. Prerequ s tes. CET 350 EET 301, 310

530 Electronic Test Systems and Applications. (3) F
Analys s des gn and appl cation of e ectron c test equ p ment, test systems, spec fica ons documentat on Pre requ sites: CET 354; EET 301, 310

540 Electrical Power Systems. (3) S
E ectrical power system analys s, transmiss on distr bu tion, nstrumentat on, protect on and related system com ponents Prerequ sites EET 301, ETC 307

560 Industrial Electronics and Applications. (3) A
Ana ys s, design and appl cat on of specia electron c de vices and systems to ndustr a contro , power, communi- cat ons and processes. Prerequ s tes: CET 350 EET 301, 310

574 Communication Circuits and Applications. (3) F
Analys s and design of microwave c rcu ts us ng s para meters and computer aided design Matching networks, couplers, f ters and amp if ers Prerequ sites: EET 304 372

576 Modern Telecommunication Systems. (3) S
App ed ana ys s and des gn of d g tal sate l te commun cat on systems. Appl cations of coherent systems design and compensat on Prerequis tes. CET 473; MAT 262 or nstructor approva

578 Communication Transmission Systems. (3) S
E ectromagnet c s gna propagat on and transm ssion, an tenna pr nc p es and applicat on Cab e TV and other communicat on transm ss on systems Prerequ sites: EET 304 372; MAT 262

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered

COMPUTER ENGINEERING TECHNOLOGY

CET 350 Digital Logic Principles. 4) F, S
Comb nat onal og c ana ys s and design and sequential c rcuit ana ys s and design w th laboratory Lecture ab Prerequ s tes ECE 106, TCE 250

354 Microcomputer Principles. (4) F S
M crocomputer organization pr nc p es, and assembly language programm ng w th aboratory. Prerequ site: TCE 250

408 Digital Control and Simulation. (3) F
D g tal systems ana ysis, contro techniques, and com puter simulation and des gn. Prerequ s tes· CET 354, CSC 183 EET 310

452 Digital Logic Applications. (4 S
Des gn of sequent al mach nes using system des gn tech n ques and comp ex MSI LS dev ces w th laboratory. Pre requ s tes CET 350, CSC 183.

456 Minicomputer Systems and Programming. (3) S
Assemb y anguage programm ng Input output and off ne d agnost cs Ut ity operat ng system and software Pre- requis tes· CET 354, CSC 183 or 100.

457 Microcomputer Systems and Applications. (4) S
App cat ons of m ni and/or m crocomputer hardware and software Spec a purpose controllers, interface des gn. Lecture, lab. Prerequ sites· CET 350, 354, CSC 183, EET 310.

473 Digital Data Communication Systems. (4) F S
S gnals, d stortion no se, error detect on correction Transm ss on and systems des gn nterface techn ques and standards D g tal hardware. Appl cations w th ab Prerequisites· CET 350, 354· EET 372.

483 Unix Utilities Using C Language. (3) S
App ication ons of C anguage to the deve opment of practi cal programs for the Unix operating system Prerequisite: sen or stand ng in techno ogy or equ valent.

485 Digital Testing Techniques. (3) S
Hardware software aspects of dig ta testing technology; systems, board, and logic test ng and equipment Lec ture, lab Prerequ s tes. CET 350, 354; CSC 183 EET 310

486 Electronics Computer Aided Design. (3) F
CAD/CAM for electronics manufacturing. Printed-circuit layout, documentation, schematic plotting. Prerequisites: CSC 183; EET 310; TCE 250.

508 Computer Process Control Technology. (3) F
Process computer control hardware, software. Sampled-data control systems, process modeling, microprocessor control techniques, computer-aided design, simulation. Process applications. Prerequisites: CET 354; EET 401 or 406.

552 Digital Systems and Applications. (3) S
Analysis, design and applications of digital networks and systems. Prerequisites: CET 350, 354; CSC 183.

556 Computer Software Technology. (3) S
Assembly language programming techniques and operations, operating system characteristics, systems software applications. Prerequisite: CET 354.

557 Microcomputers and Applications. (3) F
Applications of small computer systems, mini- and microcomputer hardware and software. Prerequisites: CET 354; CSC 100 or 183; EET 310.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

MICROELECTRONICS ENGINEERING TECHNOLOGY

UET 415 Electronic Manufacturing Engineering Principles. (3) F, S
Electronic equipment design and fabrication principles and practice. Completion of electronics hardware design project and report. Lecture, lab. With lab fee. Prerequisite: EET senior standing (113 hours).

416 Monolithic Integrated Circuit Technology. (3) F
Processing and fabrication of monolithic bipolar and MOS integrated circuits. Lecture, lab. Prerequisite: ETC 331.

418 Hybrid Integrated Circuit Technology. (4) S
Layout, fabrication, design, and manufacture of thin and thick film hybrid circuits. Lecture, lab. Prerequisites: EET 310; ETC 331.

432 Semiconductor Packaging and Heat Transfer. (3) S
Packaging theory and techniques; hermetic and plastic assembly; thermal management; electrical characteristics and reliability. Prerequisites: ETC 331, 340; or equivalent.

437 Integrated Circuit Testing. (3) F
Principles, techniques and strategies employed in wafer level and final product testing; both destructive and non-destructive. Prerequisite: UET 416.

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: instructor approval.

516 IC Technology and Applications. (3) F
Advanced processing and fabrication technology of monolithic integrated circuits. Lecture, lab. Prerequisite: UET 416.

518 Hybrid IC Technology and Applications. (3) S
Theory, processing, fabrication, and manufacturing of hybrid microelectronics devices and products. Applications. Prerequisite: ETC 331 or equivalent, or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

Industrial Technology

PROFESSOR:
COLL NS (TC 201F)
ASSOCIATE PROFESSORS:
BOWERS, DAHL, HIRATA, HOROWITZ, HUMBLE, LAWLER, MATSON, MICKOLAJAK, SCHILDGEN
ASSISTANT PROFESSORS:
BARCH LON, GAFFORD
PROFESSORS EMERITI:
AUTORE, BROWN, BURDETTE, BURK, KEITH, KIGIN, LITTRELL, PARDINI, PRUST, ROE, ROOK, STADMILLER, WATKINS, WILCOX

Purpose. Technology is the study of the application of science, systematic methods, techniques, procedures, materials, and devices for the development, improvement, and implementation of state of the-art solutions to industrial problems.

The mission of the Department of Industrial Technology is to provide students with a broad technical and managerial background in a variety of disciplines related to industry. To accomplish this mission, three technology options are available: interactive computer graphics, graphics communications, and industrial management. Industrial Technology also supports the engineering technology core.

These programs are applications oriented to include functional knowledge and understanding of material and production processes, industrial management and human relations, problem solving, the physical sciences, mathematics, computer technology, computer graphics, and current technology skills.

The goal of the department is to prepare graduates who can: develop technological solutions to industrial problems; perform management functions in systems operations, product improvement, production evaluation, and customer support; and serve as industrial trainees to facilitate technical transfer in industry and government.

Degrees. The Department of Industrial Technology offers three options leading to a Bachelor of Science degree. The three options are: graphic communications, industrial management, and interactive computer graphics.

Industrial Technology—B.S.

Degree Requirements

In addition to the technology core courses, option core courses, area of emphasis courses, English proficiency, and General Studies requirements, the following industrial technology core courses are required:

			Semester Hours
ITC	200	Impact of Communications Technology on Society	3
ITC	202	Creative Thinking and Design	3
ITC	343	Occupational Safety	3
ITC	444	Industrial Organization	3
		Total	12

A minimum of 132 semester hours of approved credits are required to complete this major.

Each student is advised to seek assistance in planning transferable courses.

Option in Graphic Communications (GRC)

The purpose of the graphic communications option is to prepare people for a wide variety of professional positions in the printing and graphic communications industry. The graphic communications option offers a blend of technological and managerial skills and knowledge. It has been specifically designed to prepare graduates to address the opportunities and increased competitive challenges taking place in the industry as a result of technological change and turbulent economic and human relations concerns.

All courses are industry responsive. The students are exposed to case histories and problems related to actual industry issues. Throughout the entire four-year curriculum, students are exposed to practical, situational analysis and effective problem solving techniques. As a prerequisite for graduation, students are expected to acquire job-related industry experience as practical preparation for making an immediate contribution to an employer's business.

Students are required to take designated graphic communications courses during the first two years of the program. After the sophomore year, each student must select an area of emphasis in consultation with an advisor. The areas of emphasis are: operations management, sales/marketing and technology.

Graphic Communications Core

To achieve its objectives, the graphic communications option offers the following required and technical elective courses:

			Semester Hours
GRC	135	Graphic Communications	3
GRC	237	Image Preparation	3
GRC	331	Quality Assurance for the Reproduction Processes	3
GRC	332	Film Assembly and Platemaking	3
GRC	333	Sheet-Web Press Technology	3
GRC	334	Photo-Mechanical Reproductions	3
GRC	336	Color Separation	3
GRC	339	Estimating and Cost Analysis	3
IST	346	Management Dynamics	3
		Total	27

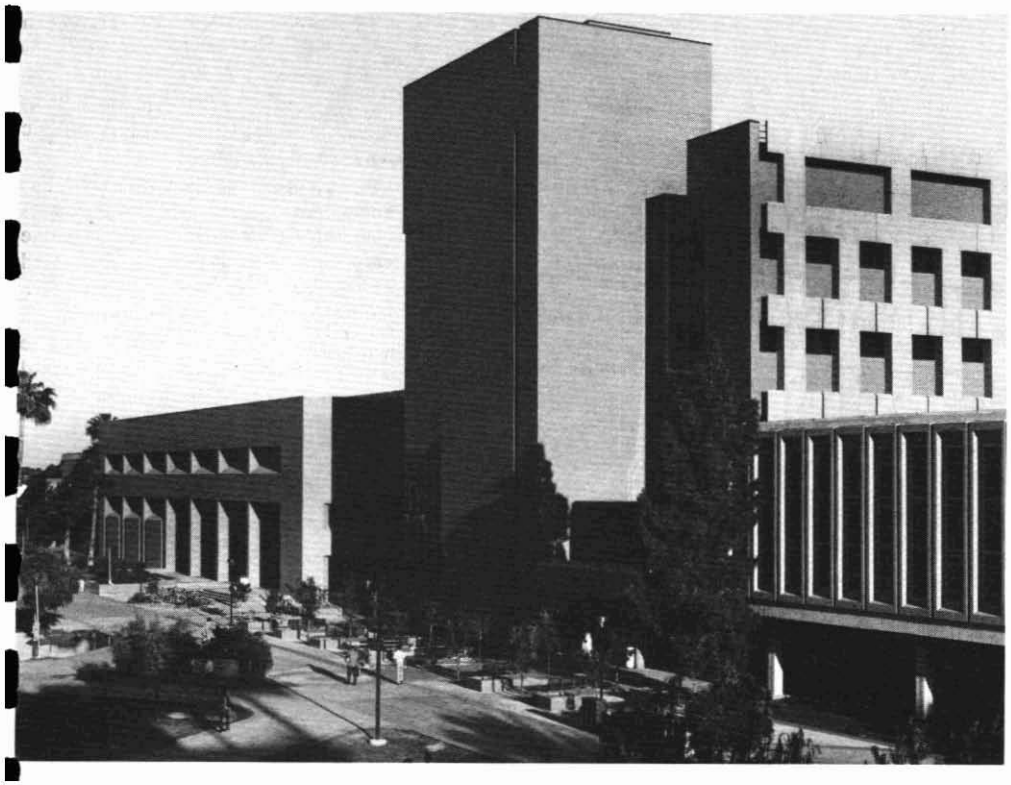
Areas of Emphasis (Technical Electives)
35 semester hours

After selecting the area of emphasis that best suits the student's interests, courses are to be selected, with an advisor, that relate to the following topics:

Operations management. Production management; plant information systems; planning and scheduling for manufacturing; plant design, organizations and layout; conformance requirements for government regulation; optimization of production systems; industrial cost accounting; supervisory techniques; computer graphics applications; decision making in a manufacturing environment; product development and management; printing systems maintenance; manufacturing strategy; instrumentation for graphic arts manufacturing; materials testing and performance prediction; production coordination; traffic management.

Sales/marketing. Markets for printing; print and electronic media; finance, personnel and human relations; sales management; strategic planning; market planning; sales service; customer education; estimating and job costing.

Technology. Scientific properties of graphic communications materials; evaluation of new technologies; creation, management and transmission of digital imaging information; integrated computer graphics; quality management and process control; analytical modeling for manufacturing systems; applied electronics for the graphic communications industry; technological planning and forecasting; printing plant engineering; environmental control.



Typical Freshman Year
Course Pattern
(Faculty Advisor Approval Required)

First Semester			Semester Hours
ENG	101	First Year Composition	3
ECN	111	Macroeconomic Principles	3
GRC	135	Graphic Communications	3
MAT	118	Precalculus Algebra and Trigonometry	3
PGS	100	Introduction to Psychology	3
		Total	15
Second Semester			
CHM	101	Introductory Chemistry or CHM 113 General Chemistry (4) or CHM 114 General Chemistry for Engineers (4)	4
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
GRC	237	Image Preparation	3
Humanities and Fine Arts Elective[1]			3
		Total	16

[1] See pages 55 87 for the requirements and the approved list.

Option in Industrial Management (IST)

The purpose of this option is to prepare supervisors and high-level personnel for management and marketing functions in marketing, industry, manufacturing, and public service organizations.

The industrial management option is articulated with the Maricopa County Community College District, Pima Community College, and Yavapai College. Consulting an advisor is required to coordinate the course selection for transfer to the industrial management areas of emphasis.

Classes are scheduled to accommodate the student who is employed in a full time position. Classes may be scheduled at facilities where the demand is sufficient to justify a class.

Before completion of the degree, the student must show evidence of adequate and appropriate occupational experience.

Industrial Management Core

To achieve its objectives, the industrial management option requires the following courses:

			Semester Hours
IST	346	Management Dynamics	3
IST	402	Industrial Laws, Contracts and Regulations	3
IST	451	Materials Control	3
IST	452	Industrial Management	3
IST	453	Safety Management	3
IST	461	Production Supervision Principles	3
IST	480	Organizational Effectiveness	3
IST	491	Introduction to Labor Concerns	3
PGS	430	Industrial Psychology	3
		Total	27

Areas of Emphasis (Technical Electives)
35 semester hours

A technical support area must be chosen by the student in consultation with an advisor. Typical areas of emphasis are: aeronautics, construction, electronics, fire science, graphic communications, hazardous materials, safety and health, interactive computer graphics, and manufacturing. Articulation agreements are to be followed by consulting an advisor.

Electives must be approved by the advisor to fulfill the graduation requirements of 132 semester hours.

Typical Freshman Year
Course Pattern
(Faculty Advisor Approval Required)

First Semester			Semester Hours
CHM	101	Introductory Chemistry	4
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
PGS	100	Introduction to Psychology	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
ITC	200	Impact of Communications Technology on Society	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
Area of Emphasis Elective			3
		Total	16

Option in Interactive Computer Graphics (ICG)

The purpose of the interactive computer graphics (ICG) program of study is to prepare students for entry into the diverse field of computer graphics. The ICG option provides a strong academic foundation in the technological, managerial, and discipline specific applications of graphics analysis, communication, databases, design, documentation, image generation, modeling, programming, and visualization.

Graduates are qualified computer graphics technologists who have acquired extensive knowledge and technical competency in their respective areas of emphasis, therein preparing them to advance into professional positions of leadership within the industry. The ICG courses are industry responsive and provide a high level of technical applicability in the use of computer graphics systems, hardware, and software within a variety of discipline environments.

Typical areas of emphasis leading to specialized career paths may include: applications development, testing, and implementation; applications supervision and management; business and analytical graphics; design (specialty areas such as electronics, advertising/graphics design, mechanical, manufacturing, animation, rendering and illustration, and computer aided design and drafting); field engineering, service and support; graphics systems and database analysis; sales and marketing; technical graphics and publication; and training (administration and instruction).

Typical career paths may include:

Applications Supervision and Management
Design (specialty areas such as electronics, graphics design, mechanical, manufacturing, illustration, etc.)
Training (administration/instruction)
Operational Services and Support Supervision
Applications Development/Testing/ Implementation
Graphics System Analysis
Sales/Marketing/Field Service
Technical Graphics and Publications

Interactive Computer Graphics Core

			Semester Hours
ICG	212	Design Documentation	3
ICG	310	Computer Graphics Fundamentals	3
ICG	312	Computer Aided Design and Drafting Graphics	3
ICG	313	Technical Illustration	3
ICG	314	Computer Graphics Database	3
ICG	361	Business and Analytical Graphics	3
ICG	412	Computer Graphics Modeling	3
ICG	417	Graphics Systems Management	3
ICG	461	Computer Animation	3
		Total	27

Areas of Emphasis (Technical Electives)

35 semester hours

Technical support areas and courses must be chosen by the student in consultation with an advisor. Certain courses may be required in some areas.

Typical Freshman Year Course Pattern (Faculty Advisor Approval Required)

			Semester Hours
First Semester			
CHM	101	Introductory Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
Humanities and Fine Arts Elective[1]			3
		Total	16
Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	102	First-Year Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
		Total	16

See pages 55 87 for the requirements and the approved list.

INDUSTRIAL TECHNOLOGY CORE

ITC 200 Impact of Communications Technology on Society. (3) F, S
Develop ng an awareness of ssues such as pr vacy, de persona zat on and contro of nformat on that have been affected by recent deve opments n communicat ons tech nology. Activ t es nc ude research ng, eva uat ng f nd ngs and presenting arguments n support of pos tions Prerequ s te ENG 102, 105, or 108 *[Satisfies General Stud es Requ rement L1]*

202 Creative Thinking and Design. 3 F S
Fundamenta methods concepts and techn ques of creat ve th nk ng, des gn, and prob em solv ng A so nc udes commun cat on manager a , cu tura , and soc etal nf u ences Lecture ab Prerequ s te ECE 106 or instructor approval.

343 Occupational Safety. 3) F
Acc dent prevent on acc dent factors, methods of record ng and reporting, ana ys s, psycho og ca aspects, att tudes recent leg s at on, safety consc ousness, and ab ty. Prerequ s te: jun or status

444 Industrial Organization. (3) S
ndustr a organ zat on concepts Top cs re ate to ndus tr a re at ons governmenta regu at ons organ zat ona structure, abor re at ons, human factors and current n dustr a pract ces F e d tr ps Prerequ s te: junior status

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

GRAPHIC COMMUNICATIONS

GRC 135 Graphic Communications. (3) F S
ntroduct on to the techno og es nvo ved n the design m age generat on transm ssion and production of multiple mages for consumer ut zation Lecture, ab F eld trips.

136 History of Printing n the Western World. 3 N
H stor ca per pect ve of techno og ca deve opments n pr nt ng and soc a mpacts on Western c v zat on n re a t on to other forms of commun cat on F e d tr ps

237 Image Preparation. 3 F
Bas c pr nc p es of typograph c ayout Preparat on of thumbna s roughs comprehens ves and mechan ca s Introduct n to photocompos t on systems Lecture, ab

331 Quality Assurance for the Reproduction Processes. 3 S, SS
nstrumentat on and methodo og es for mater a s test ng and qua ty contro n the ma or reproduct on processes F e d tr ps

332 Film Assembly and Platemaking. 3 S
Str pp ng negat ves and pos t ves ne ha ftone, duo tone fu co or contact ng f ats onto var us types of mage car r ers F e d t ps Lecture ab Pre equ s te GRC 135

333 Sheet-Web Press Technology. 3 F
Funct on of the offset pr nt ng equ pment. L t ograph c dynam cs of both sheet fed and web systems Lecture ab Prerequ s te GRC 332 or nstructor approva

334 Photo-Mechanical Reproductions. 3 F
Theory and product on of l ne work ha ftones contact work and spec a effects for the graph c arts nd stry Lec ture ab

335 Printing and Finishing Techniques. 3 S
Ana ys s of major pr nt ng pro esses of f exography screen pro ess, and re ef, product on b ndery and f n sh g procedures Prerequ s te GRC 135

336 Co or Separation. 3 S
Methods of produc ng separat o negat ves and po t ves Prerequ s te GRC 334

337 Production Management. 3 F
P ann ng and contro ng work f ow of graph c arts pr d ucts F e d tr ps Prerequ s te GRC 135

339 Estimating and Cost Analysis. 3 S
Management re at onsh p between f nanc a product on and sa es departme ts n pr t ng ndustr es ana ys s of equ pment ab r and mater a costs use of paper and standa d pr c ng cata gs Prerequ s te GRC 135

433 Product on Techniques. 3 N
Systemat c product on p ann ng exper ence Lecture ab Prerequ s tes GRC 333 334

435 Plant Management. 3 S
Concepts, pract ces and processes used by the commer a pr nt ng p ant manager e at ng to the ope at on of the p ant Prerequ s te GRC 135 or n tructor approva

436 Gravure Technology. 3 S
In depth study of the market prof e and product on se quences re ated to the gravure method of pr nt ng Pre requ s te GRC 336

437 Advanced Color Reproduction. 3 F
Sc ent f c ana ys s for the eng eer ng of co or reproduc t on systems used n the graph c arts ndustry F e d tr ps Prerequ s te GRC 336

438 Graphic Arts Techniques and Processes. 3 F, S, SS
Survey of product on sequences and prof e of the pr nt ng and pub sh ng nd stry Lecture ab. Prerequ site jun or stand ng

439 Electronic Imaging for Publications. 3 S
Introduct on and n depth nvest gat on nto e ectronic pub sh ng systems used n pr nt ng and pub sh ng ndustry for transm ss on and generat on of copy

537 Current Issues in Quality Assurance. 3 N
D rected group study of se ected ssues re at ng to qua ty assur nce n the pr t g and pub sh ng ndustry

Omnibus Courses See page 48 49 for omn bus courses that may be offered

INDUSTRIAL MANAGEMENT

IST 346 Management Dynamics. 3 S
E ements of h man re at on tra n ng and the conse quences of superv ory behav ora pattern n effect ve y dea ng w th emp oyees

402 Industrial Laws, Contracts and Regulations. 3 F
Rev ew of c ty state county and federa aw that affect' ndustr a and construct on operat ons mater a s supp es and acqu s t n proced res

445 Industrial Internship. 1 10 F S SS
Work exper ence ass gnme t ndustry commensurate w th student s program Spec a zed nstruct on by ndustry w th n vers ty superv on Prereq s te adv sor ap prova jun r status 2 50 GPA

451 Materials Control. F
Activ t es of mater a hand ng nc ud ng purchas ng, re ce v ng warehous ng traff c p ant ay ut nventory, and product n contro a d sh pp ng re at ng to te hn ca pro cedure

452 Industria Management. 3 S
Co cepts and pract ces of eadersh p n the ndustr a en v ronment n ud ng product on p ann ng qua ty enhan e ment, prob em o v ng and p cy nterpretat Prerequ s te IST 346 or nstruct r approva

453 Safety Management. 3 S
Deve opment and management of safety programs edu cat on and tra n ng re at onsh p w th n orga zat on Pre requ te TC 343 or nstructor approva

454 Occupational Hygiene 3 S
Fundamenta concepts and pr nc p es of dustr a hy g ene and ccupat ona env onmenta hea th nc udes OSHA and EPA aws egu at o s standards chem ca and phys ca haza ds a samp ng equ pment and contro measurers Prerequ te TC 343 or nstruct r approva

455 Industr al Sales and Demand. 3 F
Customer and sa es trateg es for ndustr a rgan za t ons n ud g curre t pract ce and future p ann ng Pre requ s tes ECN 111 adv sor and nstructor approva jun or stand ng

460 Legal Aspects of Safety 3 F
OSHAct adm n strat on c v and cr m na t gat on ndus tr a nsurance worke s co pensat on and othe safety and hea th aws

461 Production Supervision Principles. 3 F
ntroduct on to supe v sory pr c p es as app ed to pro duct on of goods and serv ce Prerequ s te TC 444

480 Organizat onal Effect veness. 3 F
Human aspects of superv so y behav or n the ndustr a sett ng and how they nf uence eff c e y mora e and or gan zat ona pract ce

491 Introduction to Labor Concerns. 3 S
ntroduct on to abor e at ons, organ zat on of abor un ons and federat ons co ect ve barga n ng gr evances and arb trat on and app cab e abor eg s at on

542 Global Management Philosophies. 3 F
Ana ys s and compar son of s gn f cant superv s on ph osoph es deve oped n var ous ndustr a nat ons and the r potent a app cat on n the Un ted States

549 Research Techniques and Applications. (3) F, S
Selection of research problems, analysis of literature, individual investigations, preparing reports, proposal writing.

550 Industrial Training. (3) S
Training techniques and learning processes. Planning, developing, and evaluating training programs in industry and governmental agencies. Prerequisite: advisor approval.

570 Project Management. (3) S
Planning, organizing, coordinating, and controlling staff and project groups to accomplish the project objective.

598 Special Topics. (1–2) F, S
Special topics courses, including the following which are regularly offered, are open to qualified students:
(a) Principles of Hazardous Materials and Waste Management
(b) Regulatory Framework for Toxic and Hazardous Substances
(c) Principles of Toxicology
(d) Technologies for Storage, Treatment, and Disposal of Hazardous Materials
(e) Quantitative Analysis and Practical Laboratory Techniques
(f) Industrial Hygiene
(g) Air Pollution and Toxic Chemicals
(h) Groundwater Hydrology: Monitoring Protection and Clean-up
(i) Emergency Preparedness, Response and Planning for Hazardous Materials
(j) Risk Assessment for Hazardous Materials
(k) Fate of Toxic Substances in the Environment

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

INTERACTIVE COMPUTER GRAPHICS

ICG 212 Design Documentation. (3) S
Using microcomputer-based graphics systems for product design and documentation. Geometric shape analysis and description. Documentation techniques and standards. Dimensioning. Field trips. Lecture, lab. Prerequisite: ECE 106.

310 Computer Graphics Fundamentals. (3) S
Computer image creation, transformation and manipulation. Current techniques for database generation. Concepts of applications software development. Hands-on experience. Field trips. Lecture, lab. Prerequisite: programming background helpful but not necessary. *[Satisfies General Studies Requirement: N3]*

312 Computer Aided Design and Drafting. (3) F
Using computer-aided design and drafting application software for advanced geometric construction. System and workstation configuration and productivity. Modeling applications. Field trips. Lecture, lab. Prerequisite: ICG 212. *[Satisfies General Studies Requirement: N3]*

313 Technical Illustration. (3) F
Pictorial drawing, shades and shadows and multimedia rendering techniques. Lecture, lab. Prerequisite: ICG 212.

314 Computer Graphics Database. (3) S
Preparing the product definition database for computer-integrated manufacturing. Documentation and process requirements, systems and standards. Precision dimensioning. Field trips. Lecture, lab. Prerequisite: ICG 212; TCE 230, 250 or equivalent.

412 Computer Graphics Modeling. (3) F
Establishing and manipulating 3D computer models. Applications including solids modeling concepts, design analysis, dynamic simulation, and graphic data exchange files. Field trips. Lecture, lab. Prerequisite: ICG 312. *[Satisfies General Studies Requirement: N3]*

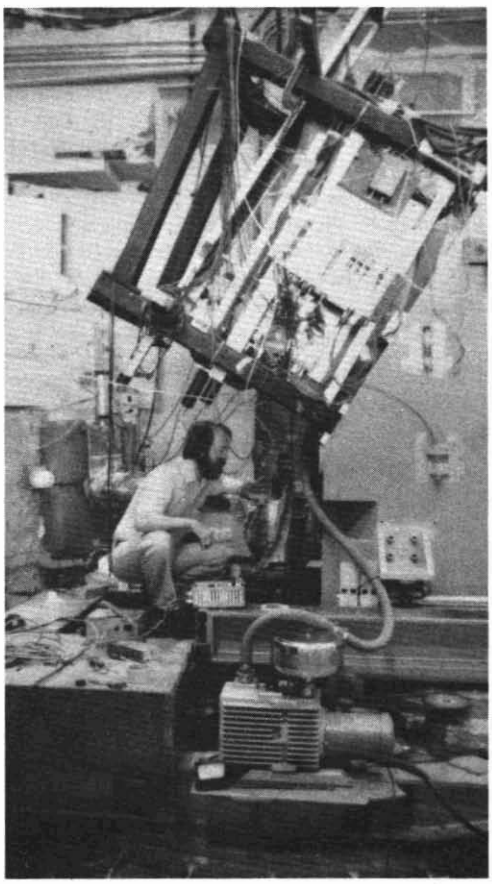
413 MicroCadd Applications. (3) F
Student selected modules: architectural, construction, civil utility, electronic drawing; mechanical manufacturing, animation, computer graphics, and others. Field trips. Lecture, lab. Prerequisite: ICG 212.

417 Graphics Systems Management. (3) S
Planning, implementing, managing computer graphics systems. Applications, needs assessment, analysis of components, system ergonomics, interfacing, maintenance, and human resources management. Field trips. Lecture, lab. Prerequisite: instructor approval.

461 Computer Animation. (3) F
Fundamental technology used in creating 2D and 3D animation through modeling, scripting, and rendering as related to engineering simulation. Field trips. Lecture, lab. Prerequisite: ICG 310 or instructor approval.

517 Graphics Systems Development. (3) S
Research and development in computer graphics systems. Applied project management, development, evaluation and implementation. Field trips. Lecture, lab. Prerequisite: ICG 412 or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



Manufacturing Technology

ASSOCIATE PROFESSORS:
KELLEY (TC 100B), KISIELEWSKI, MEITZ, SCHMIDT
ASSISTANT PROFESSORS:
LAMERAND, McCLELLAND, PALMGREN, PELT ER
LECTURER:
KRINGS
PROFESSORS EMERITI:
CAVALLIERE, MINTER, SHELLER

Increased technological complexity and sophisti cation 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, five options are available as listed below.

Degrees. The faculty of the Department of Manufacturing Technology offer a program of study leading to the Bachelor of Science degree with a major in Manufacturing Engineering Tech nology (B.S./MET). The five available options are computer integrated manufacturing engineer ing technology, manufacturing engineering tech nology, mechanical engineering technology, robotic and automation engineering technology, and welding engineering technology.

Manufacturing Engineering Technology—B.S.

The program appeals to persons interested in de veloping a career in the field of manufacturing with a primary focus on practice-oriented appli cations of existing or state of the art manufactur ing techniques.

The faculty maintain proficiency through con tact with industry both by maintenance of the in dustrial advisory committee and through working directly in an appropriate field.

Those students who seek admission to the pro- gram from other programs within the College of Engineering and Applied Sciences may be admit- ted with a minimum GPA of 2.00. Students ad mitted to the program are required to develop an area of specialization.

Degree Requirements

	Semester Hours
Technology Core	13
Engineering Technology Core	13
General Studies requirements	45
University English requirements	6
Manufacturing Engineering Technology Core	16
Selected option	39
Total Semester Hours Required	132

The following courses are required as part of the technology core:

			Semester Hours
CHM	114	General Chemistry for Engineers	4
ECE	105	Introduction to Languages of Engineering	3
ECE	106	Introduction to Computer Aided Engineering	3
MAT	260	Technical Calculus I	3
TCE	201	Applied Electrical Science	3
TCE	230	Engineering Materials and Processing	3

The following courses are required as a part of the engineering technology core:

			Semester Hours
ETC	211	Applied Engineering Mechanics: Statics	3
ETC	313	Applied Engineering Mechanics. Materials	3
ETC	325	Electrical Power Source Analysis	4
ETC	340	Applied Thermodynamics and Heat Transfer	3
MAT	261	Technical Calculus II	3
MAT	262	Technical Calculus III	3
		or STP 420 Introductory Applied Statistics (3	

Manufacturing Engineering Technology Core

			Semester Hours
MET	231	Manufacturing Processes	3
MET	300	Applied Metallurgy	3
MET	302	Welding Survey	4
MET	401	Statistical Process Control	3
MET	460	Manufacturing Capstone Project or MET 461 Mechanical Capstone Project (3) or MET 462 Capstone Project/Weldment Design 3) (for Robotic and CIM projects, see department chair)	3
		Total	16

Option in Computer Integrated Manufacturing Engineering Technology

Computer integrated manufacturing (CIM) has proved to be a powerful tool for increasing pro ductivity in manufacturing. This impact will be greater in the future as the full potential of computers is integrated into the manufacturing factory. Computer integrated manufacturing engi neering technology is concerned with the coordi nation of computer information and computer implementation in manufacturing.

Required courses: IST 452; MET 303, 341, 345, 416, 443, 448, 451, 453; plus 11 hours *approved* technical electives.

Option in Manufacturing Engineering Technology

This option is designed to prepare technologists with both conceptual and practical applications of processes, materials, and products related to met alworking industries. Accordingly, this concentration is intended to prepare students to meet the responsibilities in planning the processes of pro duction, developing the tools and machines, and integrating the facilities of production or manu facturing.

Required courses: AET 409; MET 303, 341, 344, 345, 346, 416, 442, 444; plus 11 hours *approved* technical electives.

Option in Mechanical Engineering Technology

The primary objective of the mechanical engi neering technology option is to prepare the student for entry level work in mechanical design and test either in engineering or manufacturing departments in product oriented industries. Major emphasis is placed on reducing the amount of time required by industry to make the graduate productive in any area of work. The student ob tains a well rounded academic background in the General Studies, basic sciences, mechanics, and thermal sciences.

Required courses: ETC 312; MET 303, 331, 432, 433, 434, 436, 438; plus 13 hours of *approved* technical electives.

Option in Robotic and Automation Engineering Technology

The challenges to improve productivity, product quality, and reliability and to reduce costs must be addressed by integrating robots and automa tion in manufacturing. This option addresses the field of automating manufacturing processes.

Required courses. MET 303, 341, 345, 346, 416, 444, 451, 452, 453; plus 11 hours *approved* technical electives.

Option in Welding Engineering Technology

This option is designed primarily to prepare indi viduals for technical positions in industries utilizing welding and related processes. The focus is on the application of welding technology as ap plied to current and near future industrial needs. The program is structured to provide the individual with a balance of theory, application, and hands on experience. The general areas covered by the courses are welding processes, materials, nondestructive testing, and weldment design. The student also has the opportunity to work with robots in robotic welding applications. Also, a laser is available for investigating the area of high energy welding processes.

Graduates of this program have the capability to function in a variety of technical positions related to welding and manufacturing. Typically, a graduate from this program may work in the areas of robotic welding, metallurgy, quality control, nondestructive evaluation, welding process evaluation, and technical sales.

The industries where graduates may find employment are aerospace, automotive, heavy ma chinery, heavy fabrication, and energy production.

Required courses: AET 409; MET 321, 322, 341, 344, 346, 420, 421, 425; plus 12 hours of *approved* technical electives.

First Two-Year Typical Curriculum for Manufacturing Engineering Technology

Freshman Year

First Semester			*Semester Hours*
CHM	114	General Chemistry for Engineers	4
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
General Studies Elective (HU or SB)[1]			6
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
MAT	260	Technical Calculus I	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
TCE	230	Engineering Materials and Processing	3
		Total	16

Sophomore Year

First Semester

ECE	106	Introduction to Computer Aided Engineering	3
MAT	261	Technical Calculus II	3
MET	231	Manufacturing Processes	3
PHY	112	General Physics	3
PHY	114	General Physics Laboratory	1
TCE	201	Applied Electrical Science	4
		Total	17

Second Semester

ECN	111	Macroeconomic Principles	3
ETC	211	Applied Engineering Mechanics Statics	3
MAT	262	Technical Calculus III	3
MET	345	Advanced Manufacturing Processes	4
General Studies Elective (HU or SB)[1]			3
		Total	16

[1] See pages 55 87 for the requirements and the approved list

MANUFACTURING TECHNOLOGY

MET 110 Welding Survey. (3) N
Oxy acety ene, arc, brazing resistance, and gas tungsten arc welding procedures for ferrous and nonferrous metals Lecture lab.

116 Aeronautical Welding. (2) F
Oxy acety ene and tungsten gas tungsten arc welding procedures and brazing techniques used for aircraft structures Lecture lab

231 Manufacturing Processes. (3) F
Metal removal processes emphasizing drilling, milling and lathe processes including tool bit grinding. Emphasis on production speeds and feeds. Lecture, lab. Prerequisites ECE 106, TCE 230.

300 Applied Metallurgy. (3 F
Principles of metallurgy emphasizing concepts most relevant to typical manufacturing requirements, factors affecting properties and evaluation methods· metallography experiences Lecture lab Prerequisite TCE 230 or instructor approval

302 Welding Survey. (4) F
Theory and application of industrial welding processes introductory welding metallurgy and welding design SMAW GTAW GMAW, Oxy acetylene, brazing experiences Lecture, lab Prerequisite· upper class standing

303 Machine Control Systems. 3 N
Theory and application of electromechanical hydraulic pneumatic fluidic and electrical control systems for manufacturing Lecture lab Prerequisites MAT 260, TCE 201 or PHY 112.

321 Engineering Evaluation of Welding Processes. (3 N
Theory and application of the arc welding processes and oxy fuel cutting fixturing, procedures safety codes, and experimental techniques are covered Lecture, lab. Prerequisites MET 302 PHY 112.

322 Engineering Evaluation of Nontraditional Welding Processes. 3 N
Theory and application of EBW LBW, solid state bonding brazing and soldering. Lecture lab. Prerequisites MET 302, PHY 112

331 Design for Manufacturing I. (3 S
Introduction to design of machines and structures with emphasis on layout design drawing Basics of gears, cams, fasteners springs, bearings linkages, cylindrical fits, flat pattern development and surface finish requirements emphasized. Prerequisite. ETC 313.

341 Manufacturing Analysis. (3) S
Introduction to the organization and functional requirements for effective production Includes writing production operation plans Prerequisite: MET 231

343 Material Processes. 4) S
Industrial processing as applied to low, medium, and high volume manufacturing Basic and secondary processing fastening and joining coating quality control Lecture lab

344 Casting and Forming Processes. (3) S
Analysis of various forming processes to determine load requirements necessary for a particular metal forming operation This information is used to select equipment and design tooling. Metal casting processes and design of castings. Introduction to powder metallurgy Prerequisites ETC 313; MET 300; or instructor approval.

345 Advanced Manufacturing Processes. (4) S
Metal removal processes emphasizing milling grinding, turret and tracer lathe and cutter sharpening. Application of machinability theory to practice Production feeds speeds and tool wear measurement Lecture lab. Prerequisites MET 231, 300, or instructor approval.

346 Numerical Control Point to Point and Continuous Path Programming. (3) N
Methods of programming set up and operation of numerical control machines emphasizing lathe and mill systems Lecture, lab Prerequisite MET 231

354 Mechanics of Materials. 4) F
Vectors force systems friction equilibrium, centroids and moment of inertia Concepts of stress strain and stress analysis applies to beams, columns and combined loading Nonmajors only Prerequisites MAT 118; PHY 111

401 Statistical Process Control. (3) S
Introduction to statistical quality control methods as applied to tolerances process control, sampling and reliability. Prerequisite MAT 118

407 Aerospace Materials. (2) N
Materials used for aircraft powerplants and airframes emphasis on criteria for selection in terms of mechanical properties and manufacturing processes. Prerequisite· TCE 230 or equivalent

416 Applied Computer Integrated Manufacturing. (3 F S
Techniques and practices of Computer Integrated Manufacturing with an emphasis on Computer Aided Design and Computer Aided Manufacturing Prerequisite MET 346 or instructor approval *[Satisfies General Studies Requirement N3]*

420 Welding Metallurgy. 4 N
Metallurgical principles applied to structural and alloy steel and aluminum weldments laboratory emphasis on welding experiments, metallography and mechanical testing Lecture lab Prerequisites CHM 114, MET 300 302.

421 Welding Metallurgy. (3) N
Metallurgical principles as applied to stainless steel superalloy titanium and other refractory metal weldments and brazed joints Prerequisites: CHM 114; MET 300

425 Welding Codes. (2) N
Familiarization with and application of the various codes, standards, specifications applicable to weldments Prerequisite: MET 302 or equivalent

432 Applied Thermodynamics and Heat Transfer. (3) F, S
Thermodynamics of mixtures. Combustion process. Applications of thermodynamics to power and refrigeration cycles. Heat transfer: steady state conduction, convection and radiation. Prerequisite: ETC 340.

433 Thermal Power Systems. (4) N
Analysis of gas power, vapor power and refrigeration cycles. Components of air conditioning systems. Direct energy conversion. Psychrometry. Analysis of internal combustion engines and fluid machines. Lecture, lab. Prerequisite: MET 432 or instructor approval.

434 Applied Fluid Mechanics. (3) N
Fluid statics. Basic fluid flow equations. Viscous flow in pipes and channels. Compressible flow. Applications to fluid measurement and flow in conduits. Prerequisite: ETC 340.

436 Turbomachinery Design. (3) N
The application of thermodynamics and fluid mechanics to the analysis of machinery design and power cycle performance predictions. Prerequisite: MET 432 or instructor approval.

438 Design for Manufacturing II. (4) N
The application of mechanics in the design of machine elements and structures. The use of experimental stress analysis in design evaluation. Lecture, lab. Prerequisites: ETC 312; MET 231, 331; or instructor approval.

442 Specialized Production Processes. (3) S
Nontraditional manufacturing processes emphasizing EDM, ECM, ECG, CM, PM, HERF, EBW, LBW, etc. Prerequisite: TCE 230.

443 N/C Computer Programming. (3) F
Theory and application of computer-aided N/C languages with programming emphasis with APT and suitable postprocessors. Lecture, lab. Prerequisite: MET 346 or instructor approval.

444 Production Tooling. (3) F
Fabrication and design of jigs, fixtures and special industrial tooling related to manufacturing methods. Lecture, lab. Prerequisite: MET 345.

448 Expert Systems in Manufacturing. (3) S
Introduction to expert systems through conceptual analysis with an emphasis on manufacturing applications. Prerequisite: MET 231.

451 Introduction to Robotics. (3) F
Introduction to industrial robots. Topics included are: robot geometry, robot workspace, trajectory generation, robot actuators and sensors, design of end effectors and economic justification. Prerequisite: MET 303 or instructor approval.

452 Implementation of Robots in Manufacturing. (3) S
Robotic workcell design including end effectors, parts presentors and optimum material flow. Prerequisite: MET 451 or instructor approval.

453 Robotic Applications. (3) S
Lab course utilizing robots and other automated manufacturing equipment to produce a part. Students are required to program robots, as well as interface the robots with other equipment. Prerequisite: ETC 325 or MET 303 or instructor approval.

460 Manufacturing Capstone Project. (3) S
Small group project applying manufacturing techniques with an emphasis on demonstrating state-of-the-art technology. Prerequisite: MET 416. *[Satisfies General Studies Requirement: L2]*

461 Mechanical Capstone Project. (3) S
Integration of materials, mechanics and power into analysis of engineering design of system components. Prerequisites: MET 432, 438.

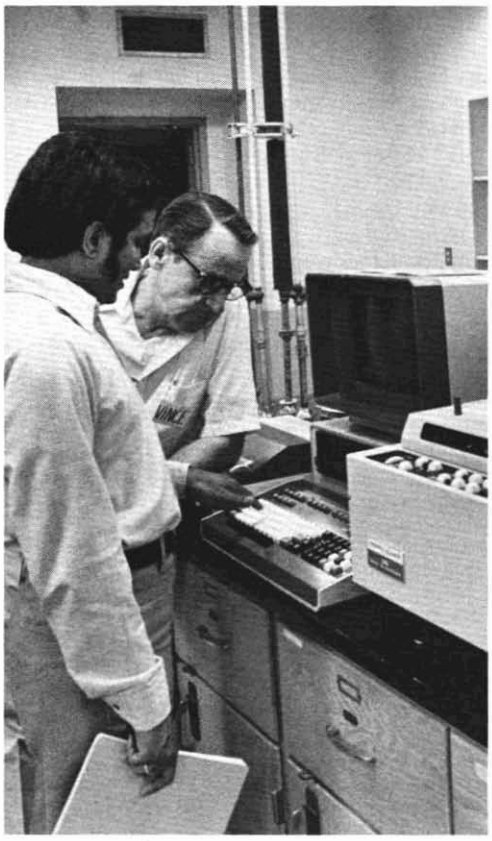
462 Capstone Project/Weldment Design. (3) S
Design of welded structures and machine elements in terms of allowable stresses, joint configurations, process capabilities and cost analysis; welding procedures emphasized. Prerequisites: ETC 313; MET 302.

517 Applied Computer Integrated Manufacturing. (3) F, S
Techniques and practices of Computer Integrated Manufacturing with an emphasis on Computer Aided Design and Computer Aided Manufacturing. Prerequisite: MET 346 or instructor approval.

542 N/C Computer Programming. (3) S
Theory and application of computer-aided N/C languages with programming emphasis with APT and suitable postprocessors. Application case studies are included. Lecture, lab. Prerequisite: MET 346 or instructor approval.

552 Introduction to Robotics. (3) F
Introduction to industrial robots. Topics included are: robot workspace, trajectory generation, robot actuators and sensors, design of end effectors and economic justification. Application case studies. Prerequisite: MET 303 or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



School of Engineering

George C. Beakley Jr., 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 serves 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.

Admission

See pages 31–38, 53–55, 283–284, and 289 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

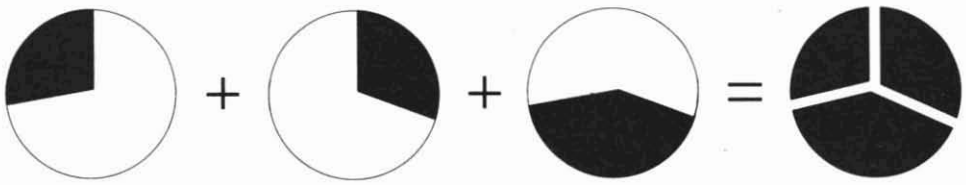
In addition, college students who are beginning their initial college work in the School of Engineering should present certain secondary school units in addition to the minimum university requirements. A total of three units is required in mathematics. College algebra, geometry, and trigonometry must be included. 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 that may not be applied toward an engineering degree. One or more of the courses—CHM 113 General Chemistry, ENG 101 First-Year Composition*, MAT 118 Precalculus Algebra and Trigonometry, PHY 111 and 113 College Physics (or PHY 105)—are taken to satisfy omissions or deficiencies.

Degrees/Majors

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 charts shown on pages 328 and 329.

* See statement on English examinations under "Placement Examinations for Proficiency," page 43.



The General Studies satisfy a university requirement and include literacy and critical inquiry, humanities and fine arts, social and behavioral sciences, numeracy and natural sciences (see pages 55–59). In addition, there are requirements in the areas of historical awareness and global awareness. These courses constitute approximately 28% of the degree program.

The engineering core is a specific and organized body of knowledge that serves as a foundation to engineering and for further specialized studies in a particular engineering major. These courses constitute approximately 33% of the degree program.

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 majors available are of two types: (1) those associated with a particular department within the School of Engineering (for example, Electrical Engineering and Civil Engineering), and (2) those offered as special and interdisciplinary studies (for example, nuclear sciences and pre medical engineering). In general, all curricula are extensions beyond the engineering core and cover a wide variety of subject areas within each field. 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."

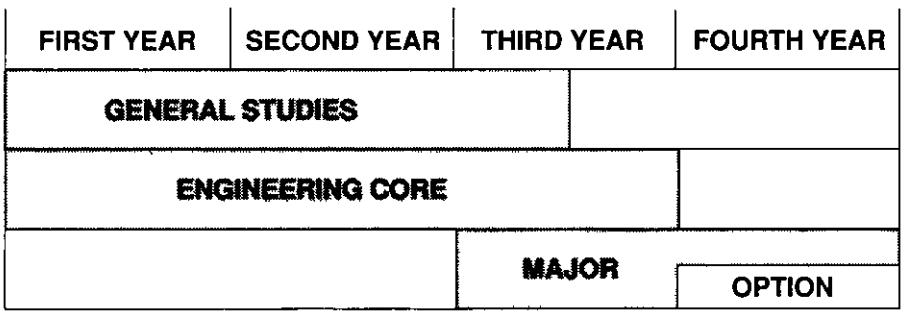
Majors and areas of emphasis are offered by the six engineering departments: Chemical, Bio and Materials Engineering, Civil Engineering, Computer Science and Engineering, Electrical Engineering, Industrial and Management Systems Engineering, and Mechanical and Aerospace Engineering. The majors of the Engineering Special Programs and Engineering Interdisciplinary Programs 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 376–384).

The first two years of study are concerned primarily with the General Studies and the engineering core, with more time being spent on 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 on 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 varies from one field to another. An example of a typical freshman engineering schedule is shown below.

Typical Freshman Year

			Semester Hours
First Semester			
CHM	114	General Chemistry for Engineers[1]	4
		or CHM 116 General Chemistry (4)	
ECE	105	Introduction to Languages of Engineering[2]	3
MAT	290	Calculus I[3]	5
General Studies Electives (HU or SB)[4]			6
		or ENG 101 First-Year Composition (3)	
		Total	18
Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
ENG	102	First Year Composition	3
		or ENG 105 Advanced First Year Composition (3)[5]	
MAT	291	Calculus II[3]	5



PHY	121	University Physics I Mechanics[6]	3
PHY	122	University Physics Lab I	1
General Studies Elective (HU or SB)[4]			3
		Total	18

Chemical Engineering, Bioengineering, Materials Science and Engineering, and Pre medical engineering students take CHM 113 and CHM 116.

[2] Students with no computer background should enroll in CSC 181 Applied Problem Solving with BASIC before enrolling in ECE 105.

[3] MAT 270, 271, 272 may be taken in lieu of MAT 290, 291 (only 10 hours may be used to satisfy graduation requirements) A math placement exam must be taken before enrollment in MAT 106, 117, 270, or 290

[4] See pages 55 87.

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

[6] Students who have not completed one unit of physics in high school should complete PHY 111 and 113 (or PHY 105) 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 less 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, e.g., in chemistry, English, mathematics, and physics, the student must complete more than the minimum of 133 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 or more years.

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 the following areas:

1. *Competency in oral and written English.* This 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 133 semester hour course requirements, all students must satisfy the university English proficiency requirements (see page 43).
2. *General Studies.* This is to ensure that the engineering student acquires a satisfactory level of basic knowledge in the humanities and fine arts, social and behavioral sciences, literacy and critical inquiry, numeracy and natural sciences. 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.

   School of Engineering students must use caution in selecting their lower division literacy and critical inquiry course (L1) because of accreditation requirements. The course selected must be one that is evaluated by the University General Studies Council as "L1" and "HU" or "L1" and "SB." The following courses meet this requirement: ENG 200, PHI 103, REL 210 and LIA 171H, 172H. Otherwise, the student must complete a total of 16 semester hours of humanities and social and behavioral sciences to satisfy the baccalaureate degree requirements in engineering.

   Because of accreditation requirements, aerospace studies (AES) courses are not acceptable for engineering degree credit as a social and behavioral science.
3. *Fundamental studies.* Studies in engineering and related subjects further develop the foundation for engineering and provide the base for specialized studies in a particular engineering discipline.
4. *Major studies.* These 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 with the assistance of an advisor.

Also refer to the individual engineering department material for any additional specific departmental requirements.

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
English Proficiency			
ENG	101, 102	First Year Composition	6
		or ENG 105 Advanced First Year Composition (3)	

General Studies

*Literacy and Critical Inquiry**
(6 semester hours minimum
One course to be chosen from the university-approved list that is designated as L1 and HU or L1 and SB (see pages 60–87 for General Studies list) 3
† ECE 400 Engineering Communications 3

Numeracy
(6 semester hours minimum)
† ECE 106 Introduction to Computer Aided Engineering 3
† MAT 290 Calculus I 5
or MAT 270 Calculus with Analytic Geometry I (4)

Humanities and Fine Arts
*Social and Behavioral Sciences**
(15 semester hours minimum)
(At least one course must be of upper division level, two courses must be from the same department and two or more departments must be represented in total selection.)
(If L1 course is not also an HU or SB course 16 hours may be required.)
Humanities and Fine Arts ..... 9 to 6
Social and Behavioral Sciences** ..... 6 to 9
† ECN 111 Macroeconomic Principles (3)
or ECN 112 Microeconomic Principles (3)

Natural Sciences
(8 semester hours minimum)
† PHY 121 University Physics I: Mechanics 3
† PHY 122 University Physics Laboratory I. 1
† PHY 131 University Physics II Electricity and Magnetism 3
† PHY 132 University Physics Laboratory II 1

Total General Studies 37

NOTE: One course in the area of global awareness* and one course in historical awareness* *must* appear in the final list of courses in the student's graduation program of study. These can be included in the humanities and fine arts/social and behavioral sciences course selections.

* Refer to pages 55–87 for the specific requirements and the approved list.

** Aerospace studies (AES) courses are not acceptable for engineering degree credit.

† Required for graduation.

Engineering Core *Semester Hours*

CHM 114 General Chemistry for Engineers 4
or CHM 116 General Chemistry (4)
ECE 105 Introduction to Languages of Engineering 3
ECE 210 Engineering Mechanics I Statics 3
or PHY 321 Newtonian Mechanics(3)[1]
ECE 301 Electrical Networks I 4
MAT 291 Calculus II 5
or MAT 271 (4) and MAT 272 (4)
MAT 274 Elementary Differential Equations 3
Approved Mathematics Content Electives 4
Basic Science Elective 3
Minimum five of the following six courses are required[2] 15
ECE 312 Engineering Mechanics II: Dynamics 3
or PHY 322 Analytical Mechanics (3)[1]
ECE 313 Introduction to Deformable Solids 3
ECE 333 Electrical Instrumentation 3
or ECE 334 Electronic Devices and Instrumentation (4)
ECE 340 Thermodynamics 3
or CHM 441 General Physical Chemistry (3)
ECE 350 Structure and Properties of Materials 3
or ECE 351 Engineering Materials (3) or ECE 352 Properties of Electronic Materials (3) or CHM 442 General Physical Chemistry (3)
Microcomputer/Microprocessor Elective 3
Select one:
CHE 461 Process Control (3)
CEE 400 Microcomputer Applications in Civil Engineering (3)
CSC/EEE 225 Assembly Language Programming (Motorola) (3)
CSC/EEE 226 Assembly Language Programming (Intel) (3)
IEE 463 Computer Aided Manufacturing and Control (3)
MAE 405 Microcomputer Aided Processes for MAE (3)
Total Required Minimum Engineering Core 44

[1] Subject to department approval If PHY 321 is selected, PHY 322 must also be completed.

[2] Courses to be selected are subject to department approval. See departments' requirements

A summary of the degree requirements is as follows:

	Semester Hours
General Studies	37
Engineering Core	44
Major (including area of emphasis)	52
The requirements for each of the majors offered are described on the following pages.	
Total Degree Requirements	133
Plus university English proficiency requirements	

Graduation Requirements

In order to qualify for graduation from the School of Engineering, a student must have a cumulative GPA of 2.00 in addition to having a GPA of at least 2.00 for the 52 semester hours of required courses in the major field.

Professional Accreditation

The undergraduate program majors—Aerospace Engineering, Bioengineering, Chemical Engi neering, Civil Engineering, Computer Systems Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Engineering Special Programs and Engineering Interdisci plinary Programs are accredited by the Engi neering Accreditation Commission of the Ac creditation Board for Engineering and Technol ogy (ABET).

ANALYSIS AND SYSTEMS

ASE 100 College Adjustment and Survival. (2) F, S
Exp oration of career goa s and majors Emphas s on or ganization and deve opment of study ski ls inc ud ng time management stress management and use of the brary.

399 Cooperative Work Experience. (1) F, S, SS
Usual y involves two 6 month work per ods w th ndustria f rms or government agenc es alternated w th full time semester and summer sess ons studies. Not open to stu dents from other colleges on campus. Prerequis tes: at east 45 hours completed 'n major area w'th m nimum 2 50 GPA, nstructor approval

485 Engineering Statistics. (3) F, S SS
Statist ca methods app ied to eng neering problems. Esti mat on tests of hypotheses, regression correlat on, ana ys s of var ance and nonparametr c statistics Prerequ site ECE 383 *[Satisfies General Studies Require ment N2]*

490 Project in Design and Development. (2 3) F, S, SS
Ind vidual project in creative design and synthes s. Pre requisite senior standing

496 Professional Seminar. (0) F S
Topics of nterest to students n the eng neering spec a and interdisc p nary stud es

500 Research Methods: Engineering Statistics. (3) F, S, SS
Statistica methods app ied to eng neer ng prob ems. Es t'mat on, tests of hypotheses regress on corre ation, ana ysis of var ance and nonparametr c stat stics Open on y to students w thout prev ous cred t in ASE 485. Prerequis te. ECE 383 or 500.

582 Linear Algebra in Engineering. (3) F
Deve opment and solut on of systems of l near algebra c equat ons. Appl cations from mechan cal, structura and e ectrical f elds of eng neering Prerequis te MAT 242 or equ valent

586 Partial Differential Equations in Engineering. (3) S
Development and so ution of partia d fferential equations in engineering. App cations in so id mechanics v bra tions heat transfer. Prerequisites: ECE 386, MAT 242, 274.

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

ENGINEERING CORE

ECE 105 Introduction to Languages of Engineering. (3) F S, SS
Computer programm ng us ng C, freehand draw ng, visu al zat on and computer graph cs. Lecture, rec tat on, lab Prerequ sites algebra· CSC 181 or BASIC programm ng experience.

106 Introduction to Computer-Aided Engineering. (3) F, S
Computer a ded analysis and design, computer graph cs, mode ing opt m zation and graphic documentation. Lec ture, recitation, ab Prerequisites ECE 105; 1 year h gh school phys cs (or corequ s te of PHY 105, 112, or 131) *[Satisfies General Studies Requirement: N3]*

107 Freehand Drawing and Visualization. (1) F, S SS
Representat onal drawing from d rect observat on to as s st visua zation spat al awareness and percept on. Techniques nc ude contour, gesture and value drawing. Med a nclude penc l and computer graph cs. 3 hours lab

210 Engineering Mechanics I: Statics. (3) F S, SS
Force systems resultants, equ librium, distributed forces, area moments, flu'd statics, 'nternal stresses, fr ction, en ergy cnter'on for equ l brium and stabi ity Lecture, rec ta t on. Prerequ sites: ECE 106, MAT 271 or 291; PHY 121, 122.

301 Electrical Networks I. (4) F S, SS
ntroduct on to electrica networks. Component mode s, transient and steady state analysis Lecture rec tation, ab. Prerequ s tes ECE 106 PHY 131, 132. Corequ site· MAT 274

312 Engineering Mechanics II: Dynamics. (3) F S SS
K nemat cs and k netics of part cles, translating and rotat ng coordinate systems, rig d body kinematics, dynam cs of systems of part cles and rigid bod es, energy and mo mentum princip es Lecture, rec tation. Prerequ site· ECE 210, MAT 274.

313 Introduction to Deformable Solids. (3) F, S, SS
Equ l br um stra n displacement relations, stress stra n-temperature re ations. App cat ons to force transm ss on and deformat ons 'n axial, tors ona and bend ng of bars. Combined loadings Lecture rec tat on. Prerequ sites. ECE 210 MAT 274

333 Electrical Instrumentation. (3) F, S, SS
Survey of electronics as app ed to instrumentation/meas urements D odes/transistors/basic trans stor amp if ers op amps dig ta ogic gates as appl ed to e ectrica and e ectronic instruments E ectr ca sensors transducers. Lecture, lab Prerequisite ECE 301.

334 Electronic Devices and Instrumentation. (4) F, S, SS
Appl cation of e ectr c network theory to sem conductor d screte and ntegrated c rcuits. E ectron c dev ce and c r cu t app ications, laboratory c rcu t design, test ng and ver f cat on. Lecture, recitation lab Prerequ site ECE 301

340 Thermodynamics. (3) F S, SS
Work heat and energy transformat ons, re at onships be tween propert es; aws, concepts and modes of ana ysis common to a appl cations of thermodynamics n engi neer ng. Lecture, rec tation. Prerequis tes CHM 114 or 116; ECE 210; PHY 131. CoreqU s te MAT 274

350 Structure and Properties of Materials. (3) F, S, SS
Bas'c concepts of mater a structure and its relat on to properties Appl cat on to eng neering problems. Prerequ sites. CHM 114 or 116; PHY 121.

351 Engineering Materials. (3) F S
Structure and behavior of civil eng neering materials. Laboratory invest gations and test criter a Lecture, lab. Prerequ s te· ECE 313

352 Properties of Electronic Materials. (3) F, S, SS
ntroduct on of Schrod nger wave equation, treatment of potent a barrier problems n wave mechanics, hydrogen atom and the period c tab e bonds of crystals, free e ectron mode the band theory of sol ds, sem conductors, introduction of sem conductor dev ces superconductor die ectric and magnetic properties of electronic mater als Prerequisites: ECE 333 or 334; MAT 274.

383 Probability and Statistics for Engineers. (2) F S, SS
Probability random variab es discrete and continuous distr'butions, descript ve statistics and samp ing distribut ons. Prerequ site. MAT 272 or MAT 291. *[Satisfies General Studies Requirement: N2]*

384 Numerical Analysis for Engineers I. (2) F, S
Numerical so ut on of algebra c and transcendental equa tions and systems of near equat ons Numerical integra tion. Curve fitting. Error bounds and error propagation Emphas s on use of dig tal computer Prerequisites ECE 105; MAT 272 or 291.

385 Numerical Analysis for Engineers II. (2) S
Continuat on of ECE 384 Numer cal solution of part a differential equat ons and m xed equation systems. Intro duct on to exper menta des gn and optimization tech niques Prerequ s te. ECE 384.

386 Partial Differential Equations for Engineers. (2) F, S
Boundary value problems, separation of variables, Fourier series as app ied to initial boundary va ue problems Prerequisite: MAT 274.

400 Engineering Communications. (3) F, S, SS
P ann ng and preparing eng'neering pub ıcat ons and oral presentations, based on d rected library research re ated to current eng neer ng top cs Prerequ site. sen or stand ing in an eng neering fie d and comp etion of f rst year Eng ish requ rements p us sophomore crit ca wr ting course. *[Satisfies General Studies Requirement L2]*

500 Research Methods: Probability and Statistics for Engineers. (2) F S, SS
Probabil ty, random var ab es, discrete and cont nuous distributions, descript ve statistics and sampl ng d str but ons. Open only to students w thout previous cred t for ECE 383 Prerequ s te· MAT 272 or 291

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

SOCIETY, VALUES AND TECHNOLOGY

STE 201 Technology and Social Change. (2) A
Technology as related to soc'al change, contemporary mpact of techno ogy on soc ety Cross sted as HPS 201. *[Satisfies General Studies Requirement HU]*

310 Man and Machine. (2) A
Re at on of man to mach ne examined n h storical, po iti cal, and soc al terms. Compar'sons with a look at art f c al intel gence studies Cross l sted as HPS 321 *[Satisfies General Studies Requirements. HU, H]*

311 Science and Technology in History. (3) F, S
Development and app ıcat on of scient fic th nking from ancient t mes through the 17th century. Cross isted as HPS 322 *[Satisfies General Studies Requirements. HU, H]*

312 Science and Technology in History. (3) F, S
Development and appl cation of sc'ent fic th nking from the 18th century to the present. Cross isted as HPS 323. *[Satisfies General Studies Requirements. HU, H]*

402 Technology, Society and Human Values. (3) A
Values wh ch motivate mankind to create techno ogy. Ar eas of conf ict and reso ution between bas c human val ues and technology. Read ng and d scuss on with vis t ng lecturers. Cross- sted as HPS 402. Prerequisite· jun or stand ng or above *[Satisfies General Studies Requirement: HU]*

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered

Chemical, Bio and Materials Engineering

Joseph D. Henry, Ph.D., Chair
(COB B210L)

Historically, materials have had a tremendous impact on the advancement of civilization, as reflected in the words "stone," "bronze," "iron," and "paper" attached to the various ages in the development of society. Until recently an arbitrary distinction was made between chemically reactive materials and relatively inert solid phase materials. As our technological know-how advances, we recognize that the fundamental principles, the molecular level mechanisms, and the processing techniques are very similar regardless of the state, phase, or shape of the materials. Understanding of these principles and their application to real systems is the key to future progress as specially designed materials are sought for the solution of complex technological problems. Therefore, it is logical that the educational program of future scientists and engineers dealing with the engineered materials be comprehensive, covering all aspects of the materials world.

Similarly, the human body and other living systems process materials by analogous steps as do the chemical industries. These living systems are small, sophisticated integrated plants utilizing pumps, aerators, separators, and reactors involving fluid flow, thermodynamics, heat and mass transfer, and other familiar principles. Therefore, it is appropriate that chemical, bio-, and materials engineers work together in both education and research.

Students aspiring to be engineers in either the chemical, bio , or materials engineering areas must prepare to solve a wide variety of problems

utilizing chemistry, physics, mathematics, life sciences, and engineering sciences. As professionals in industry, they apply these fundamentals to creatively develop, economically design, and productively operate systems, constituent equipment, and specialized analytical facilities.

The department offers three B.S.E. degrees, in Chemical Engineering, in Bioengineering, and in Materials Science and Engineering. A B.S.E. degree program in pre-medical engineering is also available at ASU; it is described separately on pages 381 383.

Chemical Engineering—B.S.E.

PROFESSORS:
BERMAN, DORSON, GUILBEAU HENRY, KUESTER, SATER ZWIEBEL
ASSOCIATE PROFESSORS:
BECKMAN, BELLAMY, CALE, TORREST
ASSISTANT PROFESSORS:
BEZANSON, BURROWS, GARCIA, RAUPP
PROFESSORS EMERITI:
REISER, SHAW

Chemical engineers are generally concerned with chemical change. They design and operate processes that accommodate such changes, including the chemical activation of materials. Typically this involves complex multicomponent systems wherein the interactions between species have to be considered and analyzed. The new challenge in chemical engineering is to apply the principles of mass transfer, solution thermodynamics, reaction kinetics, and separation techniques to technological endeavors such as integrated circuit design, solid state surface treatments, and materials processing.

Consequently, in addition to the chemical and petroleum industries, chemical engineers find challenging opportunities in the plastics, solid state, electronics, computer, metals, space, food, drug, and health care industries, where they practice in a wide variety of occupations, such as environmental control, surface treatments, energy and materials transformations, biomedical applications, fermentation, protein recovery, extractive metallurgy, and separations. While a large percentage of the industrial positions are filled by graduates with bachelor's degrees, there are lucrative and creative opportunities in research and development for those who acquire postgraduate education.

Subspecializations have developed within the profession. However, 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.

Degree Requirements

The course work for the undergraduate degree can be classified into the following categories (in semester hours):

General Studies 39
Must include 16 hours of HU and SB type courses (see page 288, General Studies, for special requirements) since CHE 351 and 352 must be taken to satisfy literacy and critical inquiry elective.

Engineering core 44
CHE 461; CHM 116, 331, 441, 442, ECE 105, 210, 301, 313, 333, 384, 385; MAT 291 (or 271 and 272), 274

Major 50
CHE 311, 312, 331, 332, 333, 342, 432, 442, 451, 462; CHM 113, 332, 335, 343, plus 12 hours technical electives

The technical electives must be selected from among CHE upper division or graduate level courses or technical courses in other departments with advisor's approval. One elective course must have chemical content and be selected from CHE 458, CHM 361, or any three semester hour 400 level CHM course

To fulfill accreditation requirements and to prepare adequately for the advanced chemistry courses, Chemical Engineering majors are required to take the CHM 113 and 116 introductory chemistry sequence (CHM 117 and 118 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 116.

The Department of Chemical, Bio and Materials Engineering 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

Students who wish to specialize may develop an area of interest through the use of technical electives and selective substitutions for required courses. Substitutions must be approved by the advisor and the Department Standards Committee and must be consistent with ABET accreditation

criteria. No substitution of CHE 462 is allowed. The following are possible elective areas of em phasis with suggested courses. A student may choose electives within the general department guidelines and does not have to select one of the areas listed.

Biomedical. Students interested in biomedical engineering but wish to maintain a strong, broad chemical engineering base should select from:

Chemical content elective: CHM 361, 461.

Technical electives: CHE 411, 412, 413; BME 318, 414, 416, 435.

Pre medical Students planning to attend medi cal school should select courses from those listed under the biomedical emphasis. In addition, BIO 181 and 182 must be taken to satisfy medical school requirements but are not counted toward the Chemical Engineering bachelor's degree.

Biochemical Students wishing to prepare for a career in biotechnology, pharmaceuticals, fer mentation, food processing, and other areas within biochemical engineering should select from:

Chemical content elective: CHM 361, 461

Technical electives: AGB 425, 426; CHE 475, 476, 477.

Environmental Students interested in the management of hazardous wastes and air and water pollution should select from:

Chemical content elective· CEE 361; CHM 361, 461, 481.

Technical electives: CEE 362, 561, 563, 564; CHE 494, 533, 552, 553; EEE 461.

Materials. Students interested in the develop ment and production of new materials such as ceramics, polymers, semiconductors, composites, superconductors, and alloys should select from:

Chemical content elective: CHE 458; CHM 438, 453, 471.

Technical electives· BME 318; ECE 350, 352; MSE 431, 470, 471, 472.

Semiconductor processing Students who are in terested in the development and manufacturing of semiconductor and other electronic devices should select from:

Chemical content elective: CHE 458.

Technical electives· ECE 352; EEE 435, 436; MSE 472.

Process engineering The engineering core and required chemical engineering courses serve as a suitable background for students intending to en ter the traditional petrochemical and chemical process industries. Students can build on this background by selecting courses with the ap proval of their advisor. Examples:

Energy conversion and conservation: CHE 552, 553, 554, 556; MAE 436, 437, 438.

Plant administration and management: CHE 528, 553; IEE 300, 431.

Simulation, control, and design: CHE 527, 528, 556, 562, 563.

Chemical Engineering
Program of Study
Typical Four-Year Sequence

First Year

First Semester			*Semester Hours*
CHE	496	Professional Seminar	0
CHM	113	General Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First Year Composition	3
MAT	290	Calculus I	5
General Studies Elective (HU or SB)[1]			3
		Total	18

Second Semester			
CHM	116	General Chemistry	4
CHE	496	Professional Seminar	0
ECE	106	Introduction to Computer-Aided Engineering	3
MAT	291	Calculus II	5
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
		Total	16

Second Year

First Semester			
CHE	311	Material Balances	3
CHE	496	Professional Seminar	0
CHM	331	General Organic Chemistry	3
ENG	102	First Year Composition	3
MAT	274	Elementary Differential Equations	3
PHY	131	University Physics II· Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
		Total	16

Second Semester			
CHE	312	Introduction to Thermodynamics	3
CHE	331	Transport Phenomena I Fluids	3
CHE	496	Professional Seminar	0
CHM	332	General Organic Chemistry	3
CHM	335	General Organic Chemistry Lab	1
ECE	210	Engineering Mechanics I Statics	3
ECE	384	Numerical Analysis for Engineers I	2
General Studies Elective HU or SB)[1]			3
		Total	18

Third Year

First Semester			
CHE	332	Transport Phenomena II: Energy Transfer	3
CHE	342	Applied Chemical Thermodynamics	3

CHE	351	Measurements Laboratory	2
CHE	496	Professional Seminar	0
CHM	441	General Physical Chemistry	3
CHM	343	Physical Chemistry Lab	1
ECE	385	Numerical Analysis for Engineers II	2
General Studies Elective HU or SB [1]			4
		Total	18

Second Semester

CHE	333	Transfer Phenomena III: Mass Transfer	3
CHE	352	Transport Laboratories	2
CHE	496	Professional Seminar	0
CHM	442	General Physical Chemistry	3
ECE	301	Electrical Networks I	4
ECE	313	Introduction to Deformable Solids	3
General Studies Elective (HU or SB)[1]			3
		Total	18

Fourth Year

First Semester

CHE	432	Principles of Chemical Engineering Design	3
CHE	442	Chemical Reactor Design	3
CHE	451	Chemical Engineering Laboratory	2
CHE	461	Process Control	3
CHE	496	Professional Seminar	0
Technical Elective			6
		Total	17

Second Semester

CHE	462	Process Design	3
CHE	496	Professional Seminar	0
ECE	333	Electrical Instrumentation	3
ECE	400	Engineering Communications	3
Technical Elective			6
General Studies Elective HU or SB)			3
		Total	18

Degree Requirements 133 semester hours plus English proficiency

See pages 55 87 for requirements and approved list

Bioengineering—B.S.E.

PROFESSORS:
CHEN, DORSON, GU LBEAU
ASSOCIATE PROFESSOR:
TOWE
ASSISTANT PROFESSORS:
P ZZICON , SWEENEY,
W NTERS, YAMAGUCHI

Bioengineering (synonyms: biomedical engineering, medical engineering) is the discipline of engineering that applies principles and methods from engineering, the physical sciences, the life sciences, and the medical sciences to understand, define, and solve problems in medicine, physiology, and biology. Bioengineering bridges the engineering, physical, life, and medical sciences. More specifically, the bioengineering program at ASU educates engineering students to use engineering principles and technology to develop instrumentation, materials, diagnostic and therapeutic devices, artificial organs, and other equipment needed in medicine and biology and to discover new fundamental principles regarding the functioning and structure of living systems. The multidisciplinary approach to solving problems in medicine and biology has evolved from exchanges of information between specialists in the concerned areas.

Because a depth of knowledge from at least two diverse disciplines is required in the practice of bioengineering, students desiring a career in bioengineering should plan for advanced study beyond the bachelor's degree. The bioengineering major at ASU is especially designed for students desiring advanced study in bioengineering in graduate programs, a career in the medical device industry, a career in biomedical research, a career in biotechnology research, or entry into a medical college.

Graduate degree programs in Bioengineering are now offered at ASU at both the master's and doctoral levels. For more information concerning these degree programs, consult the *Graduate Catalog*.

Academic Requirements

In addition to the General Studies requirement, CHM 116 Chemistry and BIO 181 General Biology (basic science elective) must be selected in the engineering core. Other engineering core requirements are outlined in the area of emphasis descriptions The following courses are required in the undergraduate bioengineering major. They have been selected to meet all university requirements and ABET accreditation requirements:

			Semester Hours
BIO	182	General Biology	4
BME	318	Biomaterials	3
BME	331	Transport Phenomena I: Fluids	3
BME	334	Heat and Mass Transfer	3
BME	411	Biomedical Engineering I	3
BME	412	Biomedical Engineering II or CHM 331 General Organic Chemistry 3)	3
BME	413	Physiological Instrumentation	3
BME	417	Biomedical Engineering Design	3
BME	423	Physiological Instrumentation Lab	1
BME/AGB	435	Animal Physiology I	4
BME	490	Biomedical Engineering Projects	2

BME 496	Professional Seminar 0
CHM 113	General Chemistry 4
Technical Electives	15
Total	51

Bioengineering Areas of Emphasis

Students interested in a career in bioengineering may elect to emphasize either biochemical, bio electrical, biomechanical, bionuclear, biosystems, or pre medical engineering. Although organic chemistry and biochemistry are not required in the bioelectrical, biomechanical, bionuclear, and biosystems engineering areas of emphasis, students selecting these areas are encouraged to include organic and biochemistry in their advanced degree programs of study.

Biochemical engineering. This emphasis is designed to strengthen the student's knowledge of chemistry and transport phenomena and is particularly well suited for students interested in biotechnology. The following courses are required in the engineering core: CHE 461 and ECE 333, 340, and 350. Technical electives must include CHM 331, 332, and 361 (or 461 or 462). ECE 312 is not required in the engineering core. The remaining technical electives must be upper division engineering courses of suitable engineering science and design content.

Bioelectrical engineering. This emphasis is designed to strengthen the student's knowledge of electrical systems, signal processing, and medical imaging. It emphasizes bioelectrical phenomena, medical instrumentation, noninvasive imaging, and electrophysiology. The following courses are required in the engineering core: ECE 333, 340, and 352, and a microcomputer elective. ECE 312 is not required in the engineering core. Technical electives must include BME 414, ECE 334, and EEE 302 and 303. Remaining technical electives are selected from BME 412, 419, and 520, and any 400-level EEE course with acceptable engineering science and design content.

Biomechanical engineering. This emphasis is designed to strengthen the student's knowledge of mechanics, materials science, control theory and mechanical design. It emphasizes the design of orthopedic load bearing joint replacement devices, orthotic devices, and other mechanical devices important in the practice of medicine. It also provides the fundamentals for the study of neuromuscular control and the study of human motion. The following courses are required in the engineering core: ECE 340, 350, and 384 and MAE 405. ECE 333 (or 334) is not required in the engineering core. Technical electives may be selected from one of the following two groups:

Biomechanics: BME 416; MAE 404 (or MSE 440), 422 and 441.

Biocontrols: BME 416, 419; MAE 317 and 417 (or 447).

Bionuclear engineering This emphasis is designed to strengthen the student's knowledge of radiation interactions and shielding, health physics, radiation biology, and nuclear instrumentation. It emphasizes radiological imaging, medical physics, nuclear medicine, radiotherapy, and radiation protection. The following courses are required in the engineering core: ECE 334, 340, and 352, and a microcomputer elective. ECE 312 is not required in the engineering core. Technical electives include: BME/EEE 461 and 465 and PHY 361. Remaining technical electives are selected from EEE 464 and BME 414 (or any 400-level BME, MAE [nuclear], or EEE courses with acceptable engineering science and design content).

Biosystems engineering. This emphasis is designed to strengthen the background of students interested in physiological systems analysis and design of artificial organs and medical devices that are based on chemical reactions and include momentum, heat, or mass transfer phenomena. Analyzing or designing flowing and reacting systems requires a background in transport phenomena, thermodynamics, and reaction engineering. Whether the system involves the microcirculation and physiological events or an artificial organ and extracorporeal circulation, there is a core of bioengineering sciences and design common to both applications. The following courses are required in the engineering core: CHE 461; CHM 441, 442; ECE 313, 333. Technical electives must include: BME 419; CHE 311, 312, 342; ECE 312.

Pre-medical engineering. This emphasis is designed to meet the needs of students desiring entry into a medical or dental school. The course sequence provides an excellent background for advanced study leading to a career in research in the medical or life sciences. The following courses are required in the engineering core: ECE 333, 340, and 350. ECE 312 is not required in the engineering core. Technical electives must include CHM 331, 332, 335, and 336. Remaining technical electives must consist of BME prefix courses plus biology or biochemistry courses, which must meet engineering science and design content requirements.

Bioengineering Program of Study

Typical Four-Year Sequence

First Year

First Semester			Semester Hours
BME	496	Professional Seminar	0
CHM	113	General Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	290	Calculus I	5
		Total	18
Second Semester			
BME	496	Professional Seminar	0
CHM	116	General Chemistry	4
ECE	106	Introduction to Computer Aided Engineering	3
MAT	291	Calculus II	5
PHY	121	University Physics I Mechanics	3
PHY	122	University Physics Lab I	1
		Total	16

Second Year

First Semester			
BIO	181	General Biology	4
BME	496	Professional Seminar	0
ENG	102	First Year Composition	3
MAT	274	Elementary Differential Equations	3
PHY	131	University Physics II Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
General Studies Elective (HU or SB [1]			3
		Total	17
Second Semester			
BIO	182	General Biology	4
BME	496	Professional Seminar	0
ECE	210	Engineering Mechanics I. Statics	3
ECE	301	Electrical Networks I	4
Literacy and Critical Inquiry Elective[2]			3
General Studies Elective (HU or SB)[1]			3
		Total	17

Third Year

First Semester			
BME	331	Transport Phenomena I Fluids	3
BME	435	Animal Physiology I	4
BME	496	Professional Seminar	0
ECE	312	Engineering Mechanics II Dynamics[3] or Technical Elective	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics or CHM 441 General Physical Chemistry (3	3
ECE	384	Numerical Analysis for Engineers I or ECE 386 Partial Differential Equations for Engineers (2) or MAT 242 Elementary Linear Algebra (2)	2
		Total	18
Second Semester			
BME	334	Heat and Mass Transfer	3
BME	318	Biomaterials	3
BME	496	Professional Seminar	0
ECE	333	Electrical Instrumentation or ECE 334 Electronic Devices and Instrumentation 4 or Technical Elective[4]	3
ECE	350	Structure and Properties of Materials or ECE 351 Engineering Materials 3) or ECE 352 Properties of Electronic Materials (3) or CHM 442 General Physical Chemistry (3)	3
Technical Elective			3
General Studies Elective (HU or SB)			3
		Total	18

Fourth Year

First Semester			
BME	411	Biomedical Engineering I	3
BME	413	Physiological Instrumentation	3
BME	423	Physiological Instrumentation Lab	1
BME	490	Biomedical Engineering Projects	2
BME	496	Professional Seminar	0
MAE	405	Microcomputer Aided Processes for MAE or CHE 461 Process Control 3) or IEE 463 Computer Aided Manufacturing and Control 3	3
Technical Electives			6
		Total	18
Second Semester			
BME	412	Biomedical Engineering II or CHM 331 General Organic Chemistry (3	3
BME	417	Biomedical Engineering Design	3
BME	496	Professional Seminar	0
ECE	383	Probability and Statistics for Engineers	2
ECE	400	Engineering Communications	3
General Studies Elective HU or SB)[1]			3
Technical Elective			3
		Total	17

Graduation requirements 133 semester hours plus English proficiency

See pages 55 87 for the requirements and the approved list of courses.

[2] See page 288 for special requirements and selection of an L1 elective.

[3] Except biosystems and biomechanics areas of emphasis

[4] For biomechanics area of emphasis only.

Materials Science and Engineering—B.S.E.

REGENTS' PROFESSOR:
WAGNER
PROFESSORS:
CARPENTER, JACOBSON, STANLEY
ASSOCIATE PROFESSORS:
HENDRICKSON, JINDAL, KRAUSE, SHIN
ASSISTANT PROFESSOR:
DEY

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 and Engineering 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.

Degree Requirements

The undergraduate curriculum requires that students take a series of interdisciplinary courses of fundamental importance to an understanding of all materials.

The courses for the undergraduate degree can be classified into the following categories (in semester hours):

General Studies 37
See pages 330–331 for School of Engineering requirements.

Engineering core 44
CHM 116, 441; IEE 463 or MAE 405 or ECE 333; ECE 105, 210 (or PHY 321), 301, 333 (or 312 or PHY 322), 313, 350, 383 (or 384 or 386); MAT 242, 274, 291 (or 271/272); PHY 361

Major 52
CHE 311, 351; CHM 113; MAE 351, 441; MSE 355, 420, 430, 431, 440, 450, 470, 472, 482, 490

In addition, six hours of electives must be selected from one of the areas of emphasis listed below.

Materials Science and 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.

Chemical processing and energy systems. CHE 432, 442, 451; MAE 371, 372, 430, 437, 438, 488; MSE 530, 531, 533.

Electronic materials. CHE 458, 548, 558; CHM 471; EEE 435, 539; MAE 437, 438; MSE 520, 521, 550, 562, 573; PHY 471, 481.

Manufacturing and materials processing. MAE 372, 403, 415, 422, 441, 442; MSE 441, 540, 549, 560.

Mechanical metallurgy. MAE 405, 415, 422, 441, 442, 520, 522, 524, 527, 557; MSE 441, 480, 520, 521, 540, 549, 550, 558, 560.

Physical metallurgy. CHM 471; MAE 372, 422, 488; MSE 441, 480, 520, 521, 550, 558, 559, 560, 561, 573; PHY 361, 362, 363, 471, 481.

Polymers and composites. CHM 331, 332, 438, 471; MAE 372, 520, 527; MSE 570.

Materials Science and Engineering
Program of Study
Typical Four-Year Sequence
First Year

First Semester			*Semester Hours*
CHM	113	General Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First-Year Composition	3

MAT	270	Calculus with Analytic Geometry I	4
MSE	496	Professional Seminar	0
General Studies Elective (HU or SB)[1]			3
		Total	17

Second Semester

CHM	116	General Chemistry	4
ECE	106	Introduction to Computer Aided Engineering	3
ENG	102	First Year Composition	3
MAT	271	Calculus with Analytic Geometry II	4
MSE	496	Professional Seminar	0
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
		Total	18

Second Year

First Semester

CHE	311	Material Balances	3
ECE	210	Engineering Mechanics I Statics or PHY 321 Newtonian Mechanics (3)	3
MAT	272	Calculus with Analytic Geometry III	4
MAT	274	Elementary Differential Equations	3
MSE	496	Professional Seminar	0
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
		Total	17

Second Semester

ECE	301	Electrical Networks I	4
ECE	312	Engineering Mechanics II Dynamics or ECE 333 Electrical Instrumentation (3) or PHY 322 Analytical Mechanics (3)	3
ECE	313	Introduction to Deformable Solids	3
ECE	350	Structure and Properties of Materials	3
MSE	496	Professional Seminar	0
General Studies Elective (HU or SB)[1]			3
Literacy and Critical Inquiry Elective[2]			3
		Total	19

Third Year

First Semester

CHM	441	General Physical Chemistry	3
IEE	463	Computer Aided Manufacturing and Control or MAE 405 Microcomputer Aided Processes for MAE (3), or ECE 333 Electrical Instrumentation (3)	3
MAT	242	Elementary Linear Algebra	2
MSE	355	Introduction to Metallurgy	3
MSE	496	Professional Seminar	0
PHY	361	Introductory Modern Physics	3
General Studies Elective (HU or SB)1			3
		Total	17

Second Semester

ECE	383	Probability and Statistics for Engineers or ECE 384 Numerical Analysis for Engineers I (2), or ECE 386 Partial Differential Equations for Engineers (2)	2
MAE	351	Manufacturing Processes Survey	3
MAE	441	Design Theory and Techniques	3
MSE	420	Physical Metallurgy	4
MSE	496	Professional Seminar	0
Technical Elective			3
General Studies Elective (HU or SB)[1]			3
		Total	18

Fourth Year

First Semester

CHE	351	Measurements Laboratory	2
MSE	430	Thermodynamics of Materials	3
MSE	450	X-Ray and Electron Diffraction	3
MSE	470	Polymers and Composites	3
MSE	482	Materials Engineering Design	3
MSE	496	Professional Seminar	0
General Studies Elective (HU or SB)[1]			3
		Total	17

Second Semester

ECE	400	Engineering Communications	3
MSE	431	Corrosion and Corrosion Control	3
MSE	440	Mechanical Properties of Solids	3
MSE	472	Integrated Circuit Materials Science	3
MSE	490	Capstone Design Project	3
MSE	496	Professional Seminar	0
Technical Elective			3
		Total	18

Degree requirements 133 semester hours plus English requirements

[1] See pages 55 87 for the requirements and the approved list

[2] See page 288 for special requirements and selection of an L1 elective.

CHEMICAL ENGINEERING

CHE 311 Material Balances. (3) F, S
Principles of physics and chemistry applied to the formulation of material balances Prerequisites CHM 116; ECE 106, MAT 271 or 291

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. Cross listed as BME 331. Prerequisites CHE 311 (except BME majors) MAT 274, PHY 131

332 Transport Phenomena II: Energy Transfer. (3) F, S
Continuation of transport principles with emphasis on energy transport in stationary and fluid systems Prerequisites. CHE 312, 331. Pre or corequisite ECE 385

333 Transport Phenomena III: Mass Transfer. (3) F, S
The appl cat on of transport phenomena to mass transfer. The des gn of mass transfer equipment, nclud ng staged processes. Pre or corequ s tes: CHE 332, 342.

342 Applied Chemical Thermodynamics. (3) F, S
Energy re at ons and equ br um convers ons based on chem ca potent a s and phase equ br a. Prerequ s tes: CHE 312; ECE 384.

351 Measurements Laboratory. (2) F
Introduct on to aboratory pract ces and the use of meas urement devices Prerequ s te: ENG 102 CHE 311. Pre or corequ s tes CHE 312 or ECE 340· CHM 335. *[Satis fies General Studies Requirement L1 (if taken with CHE 352)]*

352 Transport Laboratories. (2) S
The demonstrat on of transport phenomena pr nc ples w th exper ments n f u d f ow, heat and mass transfer Prerequ s tes CHE 331 351. Corequ s te CHE 332 *[Satisfies General Studies Requirement L1 (if taken with CHE 351)]*

411 Biomedical Engineering I. (3 F
Review of d agnost c and prosthetic methods us ng engi neering methodo ogy Introduction to transport metabol c and autoregu atory processes in the human body Cross listed as BME 411. Prerequis te: nstructor approva .

412 Biomedical Engineering II. (3) S
Review of e ectrophysio ogy and nerve pac ng app ica t ons, introduction to biomechan cs and jo nt/i mb rep ace ment techno ogy, card ovascular and pu monary f u d me chan cs, app cation of mathemat ca mode ng Cross listed as BME 412 Prerequisite instructor approva

413 Physiological Instrumentation. (3) S
Prob ems, concepts and techniques of b omedica nstru mentat on n stat c and dynam c env ronments Cross l sted as BME 413 Prerequ s tes AGB 435 or BME 435 ECE 333 or 334. *[Satisfies General Studies Require ment: L2]*

432 Principles of Chemical Engineering Design. (3) F
Multicomponent d st ation, eng neer ng economics, equ pment s z ng and costs, p ant operation econom cs, s mu ation and opt m zation techn ques. Prerequis tes· CHE 333, 342

442 Chemical Reactor Design. (3) F S
App ication of k net cs to chem ca reactor des gn Pre requ s te. CHE 342. Pre or corequisite CHE 333

451 Chemical Engineering Laboratory. (2) F
Operation, control and design of experimenta and ndus tria process equ pment; ndependent research projects 6 hours ab. Prerequ s te: CHE 352. Corequis tes· CHE 432 442

458 Semiconductor Material Processing. 3) N
Introduct on to the process ng and character zation of e ectron c materia s for sem conductor app 'cations. Pre requ sites CHE 333 342

461 Process Control. (3) F
Process dynamics, instrumentat on and feedback app 'ed to automat c process contro Lecture ab Prerequis te· ECE 301. *[Satisfies General Studies Requirement N3]*

462 Process Design. (3) S
Appl cat on of econom c pr nc p es to optim ze equ pment se ect on and des gn, development and design of process systems Prerequ s tes CHE 432 442.

475 Biochemical Engineering. (3) N
App cat on of chem ca eng neering methods mass trans fer, thermodynamics transport phenomena to ndustr a b otechno ogy. Prerequ s te: nstructor approval.

476 Bioreaction Engineering. (3) N
Pr nc p es of ana ys s and des gn of reactors for process ng w th ce s and other b olog cal y act ve materia s app cat ons of reaction eng neering in biotechnology Pre requ s te. nstructor approva .

477 Bioseparation Processes. (3) N
Pr nc p es of separat on of b o og ca y active chem ca s, the app ication, sca eup and des gn of separation proc esses in b otechnology Prerequ s tes nstructor ap prova

490 Chemical Engineering Projects. (1 5) F S SS
Ind v dua projects n chem ca eng neer ng operations and des gn Prerequ s te nstructor approva

496 Professional Seminar. (0) F S
Professiona and eth ca aspects with a discussion of em p oyment opportun t es and respons bi t es. Lectures fie d trips

501 Introduction to Transport Phenomena. (3) F, S
Transport phenomena w th emphasis on flu d systems. Prerequ s te: trans t on student w th nstructor approval

502 Introduction to Energy Transport. (3) F S
Cont nuation of transport pr nc p es w th emphas s on en ergy transport n stat onary and f u d systems Prerequ s te transition student w th instructor approva

503 Introduction to Mass Transport. (3) F S
The app cation of transport phenomena to mass transfer The des gn of mass transfer equipment, nclud ng staged processes Prerequis te transit on student w th nstructor approval

504 Introduction to Chemical Thermodynamics. (3) F S
Energy re at ons and equ brium convers ons based on chemica potent als and phase equilibr a. Prerequ s te trans t on student w th nstructor approva .

505 Introduction to Chemical Reactor Design. (3) F, S
Applicat on of kinet cs to chem cal reactor des gn. Pre requ s te· transit on student w th nstructor approval

515 Biomedical Transport Processes. 3 N
Pr nc ples of momentum heat and mass transport w th app ica ons to med ca and b olog ca systems and medi ca device des gn Cross- isted as BME 515 Prerequ site· nstructor approval.

517 Prosthetic and Diagnostic Engineering. (3) N
Cr ter a for mechanica replacement or assistance of or gan funct ons; d agnost c methods, equipment and usage· ex sting methodo ogy and future requ rements, includ ng deta led des gns Cross- isted as BME 517 Prerequ s te: nstructor approva

518 Introduction to Biomaterials. (3) F
Top cs inc ude structure property relationsh ps for syn thet c and natura b omater a s biocompat bi ity and uses of mater a s to rep ace body parts Cross l sted as BME 518 Prerequ s te ECE 313 or nstructor approval

527 Advanced Applied Mathematical Analysis in Chemical Engineering. 3) F
Formu ation and so ut on of comp ex mathemat cal re a t onsh ps resu ting from the descr ption of phys ca prob lems n mass energy and momentum transfer and chem ca k netics

528 Process Optimization Techniques. (3) S
Method for opt m z ng eng neer ng processes Exper men tal des gn and ana ys s, inear and nonl near regress on methods, c ass cal, search and dynamic programm ng al gorithms

533 Transport Processes I. 3) F
Un f ed treatment of momentum heat and mass transfer from mo ecu ar theory and cont nuum points of v ew Con t nuum equations of m croscopic and macroscop c sys tems mu ticomponent and mu t phase systems Cross sted as BME 533

534 Transport Processes II. (3) S
Cont nuat on of CHE BME 533 emphas z ng mass trans fer Cross sted as BME 534 Prerequ s te CHE 533 or BME 533

535 Turbulent Mixing. (3) N
Turbulence and m x ng n mu t component systems w th w thout chem ca react ons Computat ona mode s ap p ed to chem cal processes Prerequ s te CHE 533

536 Convective Mass Transfer. 3 N
Turbulent flow for mu ticomponent systems nc ud ng chemica react ons w th app cat ons n separat ons and a r po ution Prerequ s te. CHE 533 or MAE 571

543 Thermodynamics of Chemical Systems. 3 F
Class cal and stat stica thermodynam cs of nonidea phys cochemical systems and processes predict on of optimum operat ng cond tions Cross sted as BME 543

544 Chemical Reactor Engineering. 3 S
React on rates thermodynamics and tran port pr nc p es app ed to the des gn and operat on of chem ca reactors Cross sted as BME 544 Prerequ s te BME 543 or CHE 543

548 Topics in Catalysis. (3 N
Eng neer ng cata ys s emphas zes: adsorpt on k net cs, character zat on, d ffus ona cons derations and reactor des gn. Other top cs mechan sms, surface ana yses and e ectron c structure

552 Industrial Water Quality Engineering. 3) N
Water po utants qua ty criter a and control chem ca treatment process ng system des gn Case studies. Pre requ s te CHE 331 or equivalent.

553 Air Quality Control. 3 N
Air pol utant or g ns effects and contro Phys ca and chem ca processes inc ud ng d spers on combust on samp ing contro equ pment des gn, spec a top cs Pre requisite CHE 331 or equiva ent.

554 New Energy Technology. 3) N
Gas fica t on, quefact on pyro ys s and combust on proc esses for coal wastes and other raw mater als. n s tu processes for coa o sha e and geotherma energy En- v ronmenta qua ty ssues

556 Separation Processes. 3 N
Top cs n b nary mu t compo ent separat on rate gov erned and equ l bration processes, mass transfer cr ter a, energy requ rements separating agents and dev ces, staged operat ons

558 Electronic Materials. 3) N
Process ng and character zat on of e ectron c mater a s for sem conductor type uses Thermodynam cs and transport phenomena phase equ l br a and structure, mass trans fer d ffus'on and therma propert es

561 Advanced Process Control. 3 S
Dynam c process representat on i near opt ma contro opt ma state reconstruct on parameter and state estima t on techn ques for continuous and d screte t me systems

562 Chemical Systems Engineering. 3 N
Process dynam cs systems ana ys s, computer app ica tions, process contro

563 Chemical Engineering Design. 3 N
Computat ona methods the des gn of chem ca p ants and processes

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

BIOENGINEERING

BME 318 Biomaterials. 3) A
Mater al propert es of natural and art ficia b omater a s Tissue and b ood b ocompat b ty. Uses of mater a s to replace body parts Prerequ s te ECE 313

331 Transport Phenomena I: Fluids. 3) F, S
Transport phenomena w th emphas s on f u d systems Cross sted as CHE 331. Prerequ s tes· CHE 311 (ex cept BME majors) MAT 274 PHY 131

334 Heat and Mass Transfer. 3 A
App cat on of the pr nc p es of heat and mass transfer phenomena to so ut on of prob ems n med c ne and med ca dev ce des gn Prerequ s tes. MAT 274 PHY 131

411 Biomedical Engineering I. 3 F
Rev ew of d agnostic and prosthet c methods us ng eng neer ng methodo ogy ntroduction to transport metabo c and autoregu atory processes n the human body Cross sted as CHE 411 Prerequ s te nstructor approva

412 Biomedical Engineering II. 3) S
Rev ew of e ectrophys o ogy and nerve pac ng app ca t ons, ntroduct on to b omechan cs and jo nt/ mb rep ace ment techno ogy card ovascu ar and pu monary f uid me chan cs app cation of mathemat ca mode ng Cross sted as CHE 412 Prerequ s te. nstructor approva

413 Physiological Instrumentation. 3 F
Prob ems concepts and techniques of b omed ca nstru mentation n stat c and dynam c env ronments Cross sted as CHE 413 Prerequis tes BME 435 or AGB 435 ECE 333 or 334 *[Satisf es Genera Stud es Require ment L2]*

414 Biomedical Instrumentation. (3 F
E ectr ca phys cal and mechan cal pr nc ples govern ng the operat on of modern biomed ca nstrumentat on n c ud ng b osensors EEG ECG recorders, u trason c mag ng d agnost c dev ces Prerequ sites ECE 334 MAT 274

415 Biomedical Transport Processes. 4 A
Pr nc p es of momentum, heat and mass transfer w th ap p ications to med ca and b olog ca systems and med cal device des gn. Prerequ s tes· MAT 274 PHY 131

416 Biomechanics. 3 S
Mechan ca properties of bone muscle and soft t ssues Stat c and dynam c ana ys s of human movement tasks such as ocomotion. Prerequ s te ECE 313 Corequ site ECE 312

417 Biomedical Engineering Design. 3 A
Techn ca , regu atory, econom c lega , soc a and ethica aspects of med ca dev ce systems eng neer ng design Prerequ s te sen or stand ng in B oeng neer ng or nstruc tor approva

419 Biocontrol Systems. 3 F
Appl cation of near and nonl near contro systems tech n ques toward analys s of neuromusculoske eta , cardio vascu ar therma and mass transfer systems of body Prerequ s tes: ECE 301 MAT 274

423 Physiological Instrumentation Lab. (1) F
Laboratory exper ence with prob ems, concepts and tech niques of b omed cal nstrumentat on n static and dy nam c env ronments Lab. Corequ s te BME 413 or CHE 413. Prerequ s tes AGB 435 or BME 435, ECE 333 or 334

435 Animal Physiology I. (4) F
Contro and funct on of the nervous, muscu ar, card ovas cular, respiratory and renal systems of domest c an ma s Lecture, ab. Cross sted as AGB 435 Prerequ s tes· B O 181, CHM 113

436 Animal Physiology II. (3) N
Control and funct on of the endocr ne, d gestive and re productive systems of domest c anima s Pr nc p es of adaptation of animals to the r env ronment Prerequ s te· BME 435 or ZOL 360

437 Animal Physiology Laboratory. (1) N
Selected phys o og cal exper ments to accompany BME 436. Lab. Corequ s te· BME 436.

461 Health Physics Principles and Radiation Measurements. (3) S
Sources character st cs, dos metry, shie d'ng and meas urement techniques for cosmogenic, terrestr a and an thropogen c rad'at on oniz ng and non oniz ng rad at on theory ALARA concept. Emphas s on nstrumentation, detectors and environmental mon tor ng. Lecture, ab Cross sted as EEE 461 and NUC 461. Prerequis te ECE 301

465 Clinical Nuclear Engineering I. (3) N
Fundamenta s of cl n cal nuc ear eng neer ng and med cal health physics pract ce. Rad at on b ology dos metry and shie d ng for rad otheraphy and diagnost c procedures. Prerequ s te nstructor approval

490 Biomedical Engineering Projects. (1–5 F S SS
Ind vidua projects n medical systems or med ca dev ce design and deve opment

496 Professional Seminar. (0) F, S
Professiona and eth cal aspects w th a discuss on of em ployment opportun ties and respons bi it es Lecture, f eld trips

511 Biomedical Engineering. (3) A
Diagnostic and prosthet c methods us ng engineer ng methodo ogy Transport, metabo c and autoregu atory processes n the body

512 Biomedical Engineering II. (3) A
Electrophys ology and nerve pac ng app icat ons ntro duct on to b omechan cs and jo nt/ mb rep acement, tech no ogy, cardiovascular and pu monary f u d mechanics, mathemat ca mode ing

513 Physiological Instrumentation I. 3 A
Problems, concepts and techn ques of b omed ca nstru mentat on n static and dynam c env ronments

514 Biomedical Instrumentation. (3) F
E ectrical physica and mechan cal pr nc p es govern ng the operat on of modern b omed cal nstrumentat on Pre requisites ECE 334 MAT 274

515 Biomedical Transport Processes. (3) N
Princ ples of momentum heat and mass transport w th app ications to medica and b olog ca systems and med cal dev ce des gn. Cross l sted as CHE 515 Prerequ s te nstructor approva

516 Topics in Biomechanics. (3) S
Mechanica propert es of bone, musc e and soft tissues Static and dynamic ana ys s of human movement tasks ncluding in depth project Prerequisites ECE 312 313; or nstructor approva

517 Prosthetic and Diagnostic Engineering. (3) N
Criter a for mechan ca rep acement or ass stance of or gan funct ons; d agnost c methods equ pment and usage· exist ng methodo ogy and future requirements ncluding deta ed des gns Cross isted as CHE 517 Prerequ site· nstructor approval.

518 Introduction to Biomaterials. 3) F
Top cs nc ude structure property relat onsh ps for syn thetic and natura b omater als, b ocompat b ty and uses of materia s to rep ace body parts Cross l sted as CHE 518. Prerequ s te ECE 313 or nstructor approval

519 Topics in Biocontrol Systems. (3 F
L near and non near contro systems analysis of neu romusculoske eta card ovascu ar therma and mass transfer systems of body nc ud ng in depth project Pre requisite MAT 274

520 Bioelectric Phenomena. (3) N
Study of the or gin propagat on and interact ons of b o e ectr city n liv ng th ngs; vo ume conductor problem mathemat ca ana ysis of bioelectric nteract ons uses n med ca diagnost cs

521 Neuromuscular Control Systems. 3 S
Overview of sensorimotor bra n structures App ication of non inear adapt ve, opt ma and superv sory contro the ory to eye head hand coord nat on ocomot on

522 Biosensor Design and Application. 3 A
Theory and pr nc p es of b osensor des gn and app cation n medicine and b o ogy Pr nc p es of measurements w th b osensors Prerequ s te. nstructor approva

523 Physiological Instrumentation Lab. (1) F
Laboratory exper ence w th prob ems, concepts and tech n ques of biomed ca instrumentat on n static and dy nam c env ronments Lab. Corequ site BME 413 or CHE 413. Prerequ s te AGB 435 or BME 435; ECE 333 or 334

524 Fundamentals of Applied Neural Control. 3 A
Fundamenta concepts of e ectr ca st mu at on and re cord ng in the nervous system with the goa of funct ona contro restorat on Corequ s te BME 435 or instructor approval.

532 Prosthetic and Rehabilitation Engineering. (3) A
Ana ysis and cr t ca assessment of des gn and contro strategies for state of the-art med ca dev ces used in re hab i tation engineer ng Prerequ s tes· BME 416 or PED 610 BME 435 ECE 312, 313 Corequ s te BME 419

533 Transport Processes I. (3) F
Un fied treatment of momentum heat and mass transfer from molecu ar theory and cont nuum points of v ew Con t nuum equat ons of m croscopic and macroscop c sys tems, mult component and mu tiphase systems Cross sted as CHE 533.

534 Transport Processes II. (3 S
Continuation of BME CHE 533 emphas zing mass trans fer Cross sted as CHE 534. Prerequisite BME CHE 533.

543 Thermodynamics of Chemical Systems. 3 F
Class ca and stat stical thermodynam cs of non dea phys cochem ca systems and processes pred ct on of opt mum operat ng conditions Cross sted as CHE 543.

544 Chemical Reactor Engineering. 3 S
React on rates thermodynam cs and transport pr nc ples app ed to the des gn and operat on of chem cal reactors Cross listed as CHE 544 Prerequ s te BME CHE 543

566 Medical Imaging Instrumentation. 3) N
Des gn and analys s of imag ng systems and nuclear de· v ces for med ca d agnos s, therapy and research Labo ratory exper ments us ng diagnost'c rad o ogy, f uoros copy u trasound and CAT scanning. Lecture ab Cross isted as EEE 566 and NUC 566 Prerequ s te· BME EEE/ NUC 465 or nstructor approva

567 Radiation Shielding and Transport. (3) F
Shie d ng for radiation therapy, diagnostic radio ogy, cyc otrons and nuc ear reactors. Monte Car o and emp r ca computat ona methods, regulat ons, design prob ems Cross sted as EEE 567 and NUC 567. Prerequ s te BME 465 or EEE/NUC 465

568 Medical Tomography. (3 S
CT, SPECT, PET MRI Three d mens ona *in v vo* meas urements nstrument des gn phys o og ca mode ng cl n ca protocols reconstruct on a gor thms, quant tat on ssues Cross sted as EEE 568 and NUC 568 Prerequ s te· BME 465 or EEE/NUC 465

569 Radiochemistry and Radiopharmaceutical Production. 3 N
Advanced pr nc p es of cyclotron des gn targetry opera t on and ut ızat on. Nove synthes s, tracer preparat on, qua ty contro b od str but on stud es Cross l sted as EEE 569 and NUC 569 Prerequ site· BME 465 or EEE/ NUC 465.

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

MATERIALS SCIENCE AND ENGINEERING

MSE 355 Introduction to Metallurgy. (3) S
E ements of the structure of metals and a loys measure ment of mechan ca properties and opt cal meta ography. F e d tr ps Lecture, ab Prerequ s te. CHM 114 or 116

420 Physical Metallurgy. 4 F
Crysta structure and defects. Phase d agrams, meta o graphy so d f cat on and cast ng deformat on and an nea ing Lecture ab Prerequ s te: ECE 350

430 Thermodynamics of Materials. 3 N
Pr nc p es of stat st ca mechan cs, stat st ca thermody nam cs of s ng e crysta s so ut ons phase equ brium, free energy of react ons, free e ectron theory thermody nam cs of defects Prerequ site CHE 312 or ECE 340

431 Corrosion and Corrosion Control. 3 S
Introduct on to corros on mechan sms and methods of prevent ng corros on. Top cs. e ectrochem stry, po anza t on, corros on rates, oxidat on coat ngs cathod c protec t on. Prerequ s te ECE 350

440 Mechanical Properties of Solids. 3 S
Effects of environmenta and m crostructura vanab es of mechanical propert es p ast c deformat on fat gue, creep, br tt e fracture nterna fnct on Cross sted as MSE 516. Prerequ s te. ECE 350.

441 Analysis of Material Failures. (3 S
dent f cat on of types of fa lures. Ana ytica techn ques Fractography, SEM nondestruct ve nspect on, meta o graphy Mechan cal and e ectron c components Pre requ s te. ECE 350.

450 X-Ray and Electron Diffraction. 3 F
Fundamenta s of X ray diffract on transm ss on e ectron m croscopy and scann ng e ectron m croscopy Tech n ques for studying surfaces nterna m crostructures and f ourescence Lecture demonstrat ons Prerequ s te: ECE 350

470 Polymers and Composites. 3 F
Re at onsh p between chem stry, structure and propert es of eng neer ng po ymers Des gn propert es and behav or of f ber po ymer compos te systems Prerequis te ECE 350.

471 Introduction to Ceramics. 3) F
Princ p es of structure property re ations n ceram c mate na s Process ng techn ques Appl cat ons n mechan ca e ectron c and superconduct ng systems Prerequis te ECE 350

472 Integrated Circuit Materials Science. (3 N
Pr nc p es of mater a s sc ence app ed to sem conductor process ng and fabricat on n meta s ceram cs, po ymers and sem conductors Prerequ s te ECE 350

476 Nonmetallic Materials Laboratory. 3 S
Exper menta measurement of propert es of po ymer c ce ram c and e ectron c mater a s Structure charactenza tion Prerequ s tes: CHE 351· ECE 350

480 Manufacturing Engineering. 3 F
Ana ys s and opt m zat on of manufactur ng processes. Prerequisite: ECE 350.

482 Materials Engineering Design. 3 F S
Pr nc p es of the des gn process. Feas bi ty and opt m za t on. Manufactur ng processes mater a s se ection fa ure ana ys s and econom cs Prerequ s tes ECE 313, 350

490 Capstone Design Project. 1 3) F, S
For sma l groups n fundamenta or app ed aspects of eng neering mater a s; emphas s on exper mental prob ems and des gn. Prerequ s tes. MSE 430, 440 450

496 Professional Seminar. 0 F S
Profess ona and eth ca aspects w th a d scuss on of em p oyment opportun t es and respons b l t es Lectures fie d tr ps

510 X-Ray and Electron Diffraction. 3) F
Fundamenta s of X ray d ffract on, transm ss on e ectron m croscopy and scann ng e ectron m croscopy. Tech n ques for study ng surfaces nterna m crostructures and f uorescence. Lecture demonstrat ons Prerequ s te· trans t on student with nstructor approva

511 Corrosion and Corrosion Control. 3 S
Introduct on to corros on mechan sms and methods of prevent ng corros on Top cs e ectrochem stry, po ar za t on corros on rates, ox dat on, coat ngs cathod c protec t on Prerequ s te trans t on student w th nstructor ap prova

512 Analysis of Material Failures. 3 S
dent f cat on of types of fa ures Ana yt ca techn ques Fractography SEM, nondestruct ve nspect on meta o graphy Mechanica and e ectron c components Pre requ s te· transit on student w th nstructor approva

513 Polymers and Composites. 3 F
Re at onsh p between chem stry structure and propert es of eng neer ng polymers. Des gn, propert es and behav or of f ber po ymer compos te systems Prerequ s te trans t on student w th nstructor approva

514 Physical Metallurgy. 4 F
Crysta structure and defects Phase d agrams meta o graphy, so d f cat on and cast ng, deformat on and an nea ng Lecture ab Prerequ s te trans t on student w th nstructor approva

515 Thermodynamics of Materials. 3 N
Pr ncip es of stat st ca mechan cs stat st cal thermody nam cs of s ng e crysta s, so ut ons phase equ brium, free energy of react ons free e ectron theory thermody nam cs of defects Prerequ s te trans t on student w th nstructor approval

520 Theory of Crystalline Solids. (3) F
An sotrop c properties of crysta s, tensor treatment of elast c, magnet'c, e ectr c and thermal properties, crysta lography of Martens t c transformat ons

521 Defects in Crystalline Solids. 3) S
ntroduct on to the geometry, nteract on and equ br um between dis ocat ons and po nt defects Re at ons be tween defects and propert es w l be d scussed Prerequ s te ECE 350 or nstructor approva .

530 Metallurgical Thermodynamics and Kinetics. (3) S
Thermodynam cs of a oy systems, d ffusion n so ds k net cs of precip tat on and phase transformat ons n so ds Prerequis tes CHE 312 or ECE 340; ECE 350

531 Statistical Thermodynamics. 3 N
Cont nuat on of MAE 581 nc ud ng stat st ca and irre- versib e thermodynam cs Cross sted as MAE 582 Pre requ s te MAE 581

533 Direct Energy Conversion. 3 N
Advanced se ected top cs n d rect energy convers on heory, des gn and app cat ons Cross listed as MAE 537 Prerequ s te: MAE 581.

540 Fracture, Fatigue and Creep. (3) F
Relat onsh p between m crostructure and fracture fat gue nd creep properties of matena s Env ronmenta effects ecent deve opments Current theories and experimenta resu ts Prerequ s te MSE 440 or equ va ent

549 Manufacturing Analysis. 3 S
Ana ys's and opt mizat on of manufactur ng processes Prerequ s te MSE 480

550 Advanced Materials Characterization. (3) N
Analyt ca instrumentat on for character zat on of mater - ls, SEM, SIMS Auger, ana yt ca TEM and other ad anced research techn ques

556 Electron Microscopy Laboratory. 3 F
Laboratory to support MSE 558 Pre or corequ s te MSE 558 or SEM 558.

557 Electron Microscopy Laboratory. (3) S
Laboratory support for MSE 559 Pre or corequisite MSE 559 or SEM 559

558 Electron Microscopy I. 3 F
M croana ys s of the structure and compos t on of mater s us ng mages, d ffraction and X ray and energy oss pectroscopy Know edge of e ementary crysta ography ec proca attice stereograph c project ons and comp ex var ab es requ'red. Cross sted as SEM 558. Prerequ s te nstructor approva

559 Electron Microscopy II. 3 S
Microanalys s of the structure and composit on of mater a s us ng mages d'ffract on and X ray and energy oss spectroscopy. Know edge of e ementary crysta ography, ec proca att ce stereograph c project ons and comp ex ar ab es requ red Cross sted as SEM 559. Prerequi te: nstructor approva

560 Strengthening Mechanisms. (3) S
Deformat on of crysta ne matena s. Properties of d s o ations Theor es of stra n harden'ng so d so ut on pre p tat on and transformat on strengthen ng Prerequ s te ECE 350 or equ va ent

561 Phase Transformation in Solids. 3 N
Heterogeneous and homogeneous prec pitat'on reactions hear d sp ac ve react ons order d sorder transformat on

562 Ion Implantation. (3 S
nc udes defect product on and annealing Genera zed treatment inc ud ng on mplantat on neutron irrad at on damage and the nteract on of other nc dent beams Pre equ s te MSE 450.

570 Polymer Structure and Properties. (3 F
Relat onsh ps between structure and propert es of syn thet c po ymers g ass trans t on molecu ar relaxations crysta ne state v scoe ast city, morpho og ca characten- zat on process ng.

571 Ceramics. 3 A
nc udes ceram c process ng, cast ng molding, f r ng, s n tering, crysta defects, mechan ca , e ectron c and phys cal propert es w be nc uded Prerequisites MSE 521, 561

572 Semiconductor Phase Diagrams. 3) A
Analys s of b nary and ternary phase d agrams and app cation to sem conductor growth and vapor and quid phase ep taxy Prerequ s te MSE 521

573 Magnetic Materials. (3) A
Emphas s on ferromagnet c and ferr magnet c phenom- ena. Doma ns magnet c anisotrophy, magnetastr ct on Study of commerc a magnet c mater a s Prerequis te MSE 520 or equ valent.

Omnibus Courses: See pages 48–49 for omn bus courses that may be offered

Civil Engineering

PROFESSORS:
MAYS (ECG 136A), BETZ, W. HOUSTON, MATTH AS, O'BANNON, RUFF, SINGHAL, TUMA

ASSOCIATE PROFESSORS:
DUFFY, HAUSER, HINKS, S. HOUSTON, MAMLOUK, RADWAN RAJAN, UPCHURCH

ASSISTANT PROFESSORS:
FAF TIS, KREAMER, ZAN EWSKI

PROFESSORS EMERITI:
BLACKBURN, BORGO, KLOCK LUNDGREN, PIAN

Civil engineers are involved in some of the most critical and visible problems facing modern soci ety. Civil engineers are technical problem solvers, meeting such challenges as providing efficient transportation systems, energy and water conservation and development, urban planning, and flood and earthquake damage reduction.

Civil engineering is primarily concerned with the public domain. The profession involves analysis, planning, design, construction, and maintenance of many types of buildings for gov ernment, commerce and industry for example, high-rise office towers, factories, schools, airports, tunnels and subway systems, dams, canals, and water purification and environmental protection facilities such as solid waste and wastewater treatment systems. Civil engineers are concerned with the impact of their projects on the public and

the environment, and they attempt to coordinate the needs of society with technical and economic feasibility.

Civil Engineering—B.S.E.

Entrance Requirements. Entering freshmen into the Civil Engineering program 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 must take CHM 113 and 116 in lieu of CHM 114 and must take PHY 111 and 113 as prerequisites to PHY 121 and 122. For international students, an official TOEFL score of 550 is required.

Degree Requirements

Requirements for the bachelor's degree include the completion of the civil engineering core courses and 18 semester hours of design and technical electives with an average grade of "C" or better. Course selections are made by the student with the advisor's approval. 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 core courses (except CEE 296 and CEE 321) may not be taken without permission until.

1. The engineering core (except ECE 400) has been completed with an average grade of "C" or better;
2. MAT 290, 291, or MAT 270, 271, 272, and MAT 274; ECE 210, 312, and 313 have all been completed with minimum grades of "C."

Civil Engineering Core

The following courses are required as a part of the engineering core (only ECE 333 Electrical Instrumentation may be deleted):

			Semester Hours
CEE	400	Microcomputer Applications in Civil Engineering	3
ECE	351	Engineering Materials	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	341	Hydraulic Engineering	4
CEE	351	Soil Mechanics	4
CEE	361, 362	Environmental Engineering	6
CEE	372	Transportation Engineering	4
CEE	496	Topics in Civil Engineering Practice	1
IEE	300	Economic Analysis for Engineers	2
MAE	371	Fluid Mechanics	3
		Total	34

Civil Engineering Designated Design Electives

A minimum of two are required.

			Semester Hours
CEE	423	Structural Design	3
CEE	441	Water Resources Engineering	3
CEE	452	Foundations	3
CEE	466	Sanitary Systems Design	3
CEE	475	Highway Geometric Design	3

Civil Engineering Technical Electives

A minimum of 12 hours are required.

A maximum of six hours 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

Construction engineering. CON 344, 383, 495, 496. Only one course may be selected.

Environmental engineering. Water treatment, industrial and domestic waste treatment and disposal, public health engineering, industrial hygiene. CEE 466, 563; CHM 231; MIC 220 (or 205 and 206).

Geotechnical engineering. Assessment of engineering properties and design utilizing soils and rocks as engineering materials. CEE 452, 550, 552, 553, 554.

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

Transportation engineering. Analysis and design of transportation facilities, transportation planning and economics, transportation in the urban environment. CEE 412, 471, 475, 512, 573, 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 441, 540, 541, 542, 543, 545, 546.

Civil Engineering Program of Study
Typical Four-Year Sequence

Freshman Year

			Semester Hours
First Semester			
CEE	296	Introduction to Civil Engineering	1
CHM	114	General Chemistry for Engineers	4
ECE	105	Introduction to Languages of Engineering	3
MAT	290	Calculus I	5
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
		Total	17
Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
ENG	101	First Year Composition	3
MAT	291	Calculus II	5
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
Social and Behavioral Sciences Elective[1]			3
		Total	18

Sophomore Year

First Semester			
ECE	210	Engineering Mechanics I: Statics	3
ECE	301	Electrical Networks I	4
ECN	111	Macroeconomic Principles	3
ENG	102	First Year Composition	3
IEE	300	Economic Analysis for Engineers	2
MAT	274	Elementary Differential Equations	3
		Total	18
Second Semester			
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics	3
ECE	383	Probability and Statistics for Engineers	2
Basic Science Elective			3
Humanities and Fine Arts Elective[1]			3
		Total	17

Junior Year

First Semester			
CEE	321	Structural Analysis	3
ECE	351	Engineering Materials	3
ECE	384	Numerical Analysis for Engineers I	2
MAE	371	Fluid Mechanics	3
Literacy and Critical Inquiry Elective[2]			3
Humanities and Fine Arts Elective[1]			3
		Total	17
Second Semester			
CEE	322	Steel Structures	3
CEE	341	Hydraulic Engineering	4
CEE	351	Soil Mechanics	4
CEE	361	Environmental Engineering	3
CEE	372	Transportation Engineering	4
		Total	18

Senior Year

First Semester			
CEE	323	Concrete Structures	3
CEE	362	Environmental Engineering	3
CEE	400	Microcomputer Applications in Civil Engineering	3
CEE	496	Topics in Civil Engineering Practice	1
Design Elective			3
Technical Elective			3
		Total	16
Second Semester			
ECE	400	Engineering Communications	3
Design Elective			3
Technical Elective			9
Social and Behavioral Science Elective[1]			3
		Total	18

[1] See pages 55–87 for the requirements and the approved list.

[2] See page 288 for special requirements and selection of an LI elective

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 School of Architecture (pages 210–211).

Graduate. Qualified students may develop a program of study that leads to the concurrent degrees Master of Architecture and M.S.E. 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.

CIVIL ENGINEERING

CEE 296 Introduction to Civil Engineering. (1) F, S
ntroduct on to the profess on. Descript on of areas of spe c a zat on Degree requirements academ c standing, and advising procedures ntroduction to ab fac ties Pre requ s te· freshman stand ng.

310 Testing of Materials for Construction. (3) F, S
Structura and behav ora characterist cs eng neer ng propert es measurements and app icat on of construction matena s. Lecture, lab Not open to eng neer ng students Prerequis te CON 323.

321 Structural Analysis. (3) F, S
Stat cally determinate and ndeterminate structures by classica and matr x methods: trusses beams and frames 2 ecture, 2 hours rec'tat'on. Prerequ site. ECE 313

322 Steel Structures. (3) F, S
Behavior of structural components and systems Design of stee members and connect ons Part a des'gn of a steel bu ding system Lecture, recitat on. Prerequ s tes· CEE 321; comp et on of eng neer ng core (except ECE 400), m'n mum core grade requ rements sat sf ed.

323 Concrete Structures. (3) F, S
Behav or of concrete structures des gn of re nforced and prestressed concrete members nc ud ng foot ngs Part a design of concrete bu d ng system Lecture recitation Prerequ sites· CEE 321 complet'on of eng neering core (except ECE 400) m n mum core grade requ rements sat sfied.

340 Hydraulics and Hydrology. (3) F, S
Appl cation of hydrau ic eng neer ng principles to flow of l qu ds n p pe systems and open channe s hydrostat cs, characteristics of pumps and turb nes ntroduction to hydrology Not open to eng neering students Lecture lab Prerequisite CON 221.

341 Hydraulic Engineering. (4) F, S
Fundamenta princ p es and methods of flu d mechan cs form ng ana ytica bas s for water resources eng neer ng. F ow n conduits and open channe s Introduction to hy dro ogy. Lecture, ab. Prerequ s tes: MAE 371· comple tion of eng'neering core (except ECE 400); m nimum core grade requirements satisfied

351 Soil Mechanics. (4) F, S
ndex properties and eng'neering character st cs of so s Compact on permeab ity and seepage, compress b ty and sett ement and shear strength Lecture, ab Prerequ site: CEE 321; comp etion of eng neering core (ex cept ECE 400); m nimum core grade requ rements sat s fied.

361 Environmental Engineering. (3) F, S
Natura environment, water resources hydro og c cyc e chem'stry of natura waters, quality requ rements and wa ter treatment water d strbut on systems Corequ site CEE 341

362 Environmental Engineering. (3) F, S
Natural env ronment, the carbon cyc e and biochem stry of wastes pr nc ples of waste treatment dra nage systems Prerequisite CEE 361

371 Introduction to Urban Planning. (3) N
Theoret ca and pract cal aspects of c ty plann ng. Interre at onsh ps among phys'ca planning environment, gov ernment and society. Not acceptab e as a techn ca e ec t ve for CEE students *[Satisfies General Studies Re quirement· L1]*

372 Transportation Engineering. (4) F, S
H ghway, ra , water and air transportat on. Operat ona character st cs and traff c contro dev ces of each trans port mode Impact on urban form Prerequ s tes: CEE 321 comp et on of eng neering core (except ECE 400), m n mum core grade requirements sat sfied.

400 Microcomputer Applications in Civil Engineering. (3 F S
Development of m crocomputer l teracy n c v l eng neering app cations Prerequ s tes. 3 of the follow ng CEE courses: 321 341, 351, 361 372; ECE 106 *[Satisfies General Stud es Requirement: N3]*

412 Pavement Analysis and Design. (3) F
Des gn of f ex ble and r gid pavements for highways and airports. Surface, base, subgrade courses. Cost ana ysis and pavement se ect on. Prerequ s tes: CEE 351; ECE 351

423 Structural Design. (3 F
Ana ys s and design of structura systems. Lecture, lab. Prerequ s tes CEE 322, 323

432 Matrix and Computer Applications in Structural Engineering. (3) S
Matrix and computer app cat ons to structural eng neering and structural mechanics. St ffness and flexibility meth ods fin te elements differences. Prerequ s te CEE 321.

441 Water Resources Engineering. (3) S
App cation of the princ ples of hydrau ics and hydro ogy to the engineer ng of water resources projects design and operation of water resources systems water qua ity. Prerequisite CEE 341

450 Soil Mechanics in Construction. (3) F, S
So l mechan cs as app ied to the construction fie d· foun dat ons, highways, retain ng wa ls, and slope stabi ity Re ationsh p between so character st cs and geo og c format ons Not open to engineer ng students Lecture, ab Prerequ s te CON 323

452 Foundations. (3) F, S
App cat ons of so mechan cs to foundat on systems bear ng capac ty, ateral earth pressure, s ope stabil ty. Prerequ s te CEE 351.

466 Sanitary Systems Design. (3) F
Capacity, plann ng and des gn of water supply, domestic and storm dra nage and sol d waste systems. Prerequi s te CEE 361 or 362

471 Planning and Design of Urban Systems. (3) F
For students n city p ann ng, urban systems c vi eng neering and related areas work'ng as nterd sc p nary planning and design teams. Effect of economic base, employment and popula t on on urban and use requ rements. Location and requ red capacity of urban systems to serve urban and uses Lecture, ab. Prerequ site: sen or stand ng.

475 Highway Geometric Design. (3) S
Design of the vis ble elements of the roadway Fundamenta des gn controls w'th app cat on to rural roads at-grade ntersect ons, freeways and nterchanges Lecture, rec tation. Prerequisite: CEE 372

496 Topics in Civil Engineering Practice. (1) F S
Professiona eng neer ng pract ce Interview ng and résumé wr t ng, profess onal reg stration requirements continuing educat on, graduate study, f nancial p ann ng and emp oyment. Prerequis'te sen or standing

512 Pavement Performance and Management. (3) S
Pavement management systems nc uding data co ec t on, eva uation, opt m zation, economic analys s, and computer appl cations for h ghway and a rport design. Prerequisite: CEE 412.

514 Bituminous Materials and Mixture. (3) F
Types of b tum nous materials used in pavement m x tures. Chem ca composition and phys ca propert es, de- s rab e aggregate characterist cs, opt mum aspha t con tents. Lecture, lab. Prerequ s te: ECE 351.

515 Design and Behavior of Portland Cement Concrete Mixtures. (3) S
Properties of cements and aggregates. M x design for strength and durab l ty requirements. Fa' ures caused by chemica reaction, weathering, and load ng. Prerequis te· ECE 351.

521 Stress Analysis. (3) F
Advanced topics in the analyt ca determ nation of stress and strain Prerequ s te CEE 321.

524 Advanced Steel Structures. (3) S
Strength propert es of stee and the r effects on structural behav or. E astic des gn of steel structures. P astic ana y- sis and des gn of beams frames and bents. Plast c de flect ons. P ast c des gn requirements Mult story bu d ings. Prerequisite CEE 322

526 Finite Element Methods in Civil Engineering. (3) F
Fin te element formu ation for solut ons of structural ge- otechnica , and hydraul'c problems Prerequ site· CEE 432.

527 Advanced Concrete Structures. (3) F
Ultimate strength design Comb ned shear and torsion. Serviceabil ty Plast c ana ys s Spec a systems. Pre requ s te. CEE 323.

528 Stability of Structures. (3) F
E astic and ne ast c buckl ng of rolled and cold formed columns and beams. Stab l ty of p ates, ng d frames, and trusses. Prerequ sites· CEE 322; nstructor approva

529 Complex Structures. (3) S
Classica and numerical investigat ons of near and non l near structures composed of flat and curved surfaces and near or curvilinear e ements. Prerequ site nstructor approva .

530 Prestressed Concrete. (3) S
Mater als and methods of prestress ng Analysis and de- sign for flexure, shear, and tors on. Prestress osses due to fnct'on, creep, shrinkage, and anchorage set Statica ly indeterm nate structures. Design of flat slabs bridges and composite beams. Prerequ site· CEE 323

531 Theory of Structures. (3) F
Genera theorems relat ng to elastic systems; def ect on of trusses and beams; statical y ndeterm nate trusses beams, rings, arches, and frames by cons stent deforma tion, least work and elast'c center hor zontally curved members n bend ng and tors'on. Prerequ s te: CEE 321

533 Applied Optimal Design. (3) S
Linear and nonl near programm'ng. Problem formu ation Design sens t v ty analysis. FEM-based optima des gn of structural and mechan'cal systems Prerequ s te· gradu ate stand ng or nstructor approval.

536 Dynamics of Structures. (3 S
Structures and structura members subjected to dynamic load ngs, response spectra theory emphas z ng earth quake appl cations; nvestigat ons of the response of mu t degree of freedom structures; matrix methods of analy- sis. Lecture, rec tat on Prerequ sites CEE 321, nstruc tor approva .

537 Topics in Structural Engineering. (1 3) F, S
Advanced topics inc uding w nd engineer ng, earthquake eng neering, probab stic concepts, opt m zation and be hav'or of structural systems. Prerequis te· nstructor ap proval.

540 Groundwater Hydrology. (3) F
Phys ca properties of aqu fers, groundwater exp oration we l construction and pumping; subsurface f ow mode ng; and subs dence, groundwater pol ution and water r ghts Prerequ s te. CEE 341 or nstructor approva

541 Surface Water Hydrology. (3) S
Hydro og c cyc e and mechanisms, including prec p tat on evaporation and transp rat on, hydrograph ana ys s, flood rout ng; stat st ca methods in hydrology, hydrologic de s gn Prerequisite CEE 341 or nstructor approval.

542 Water Resources Systems Planning. (2) S 91
Ph osophy of water resources p ann ng; econom c, socia and engineer ng interaction; introduct'on to the theory and app ication of quant tative p anning methodolog es n wa ter resources p ann ng Guest lecturers and case stud es Prerequ s te: nstructor approva

543 Water Resources Systems I. (3) F 91
Theory and appl cat on of quant tative p anning method- o og es for the des gn and operat on of water resources systems; class projects using computer, case stud es. Pre or corequisite CEE 542 or instructor approval.

544 Water Resources Systems II. (3) F '90
Advanced computer oriented workshop in the appl cation of quantitat ve planning techniques to the des gn and op eration of water resources systems. Prerequ site. CEE 543.

545 Foundations of Hydraulic Engineering. (2) S '91
Rev ew of incompress b e f u d dynamics. F ow in pipes and channe s unsteady and var ed flows wave mot on. Prerequ s te. CEE 341.

546 Free Surface Hydraulics. (2) F '91
Der vat on of one d mensiona equat ons used in open channe flow analysis; computat ons for un form and nonun form flows, unsteady f ow, f ood rout ng Mathe matica and physica mode s Prerequ s te CEE 341.

547 Principles of River Engineering. (2) S '92
Uses of r vers, study of watershed and channe proc esses Sed ment sources, y e d, and control hydrologic ana ys s. Case studies. Prerequ s te: CEE 341 or instruc- tor approval.

548 Sedimentation Engineering. (2) F '90
Introduct on to the transportat on of granu ar sed'mentary materia s by moving fluids. Degradation, aggregation and ocal scour in a uvia channe s. Mathematical and physi ca models Prerequisite. CEE 547 or instructor approva .

550 Soil Behavior. (3) S
Phys co-chem ca aspects of soi behav or, stab l zation of so s, eng neering properties of soils Prerequ s te: CEE 351

551 Advanced Soil Mechanics Laboratory. (3) F
Oedometer triax al (static and cyc c) back pressure satu rated and unsaturated samp es pore pressure measure ments resonant column, automat c data acqu s tion, in s tu test ng. Lecture, labs. Prerequ s te: CEE 351.

552 Geological Engineering. (3) S
Geolog cal investigat ons for eng neer ng purposes, case h stor es geologic structure, weathering, remote sens ng geophysics, air photo nterpretation for engineering s te locations Lecture, fie d trips requ red. Prerequis te CEE 351

553 Advanced Soil Mechanics. (3) S
Appl cation of theor es of elastic ty and p astic ty to soi s, theor es of consol dation, fa lure theor es response to static and dynamic load ng. Prerequ site: CEE 351.

554 Shear Strength and Slope Stability. 3) F
Shear strength of saturated and unsaturated so s strength deformat on relationships t me dependent strength parameters, effects of samp ing, advanced slope stab ty Prerequ s te CEE 351

555 Applied Soil Mechanics. (3 S
Deep foundat ons, braced excavations anchored bu k heads, re nforced earth underp nning, and dewater ng. Prerequ s te: CEE 452.

556 Seepage and Earth Dams. 3) F
Trans ent and steady state f u d flow through so , con f ned and unconf ned f ow, pore water pressures and ap p cat on to earth dams Prerequ site CEE 351

557 Topics in Geotechnical Engineering. (3) F S
New and deve op ng techno ogy n geotechn ca eng neer ng Prerequ s tes. graduate stand ng nstructor ap prova

558 Numerical Methods. (3) F '90
Constitut ve re at ons for so s, numerica techn ques ap p ed to geotechnica eng neering, nclud ng computer ap pl cat ons. Prerequ s tes. CEE 351; computer program m ng graduate standing

559 Earthquake Engineering. 3) F 91
Characterist cs of earthquake mot ons se ect on of des gn earthquakes, s te response ana yses, se sm c s ope sta b ty quefact on Prerequ sites· CEE 351 graduate stand ng.

561 Physical-Chemical Treatment of Water and Waste. 3) F
Theory and des gn of phys cal and chemica processes for the treatment of water and waste waters Prerequ s te CEE 361

562 Environmental Biochemistry and Waste Treatment. 3) S
Theory and des gn of b o og ca waste treatment systems Po ution and env ronmenta ass m lat on of wastes Pre requ site CEE 362

563 Environmental Chemistry Laboratory. (3) S
Ana ys s of water domest c and ndustr'a wastes abora tory procedures for po lut on evaluat on and the control of water and waste treatment processes Lecture lab Pre requ s te CEE 361 or 362

564 Industrial Hygiene. 3) N
Survey methods, egal and physio og ca aspects of occu pat ona hea th hazards. Methods of measurement and ana ys s and phys o ogica act ons of such contam nants as tox c gases, m neral dusts, meta s and their com pounds and ndustr a so vents

573 Computer Applications in Transportation. 3) F S
Use of ava ab e computer app cat on software to so ve traff c engineer ng, transportat on p ann ng and h ghway design prob ems. Prerequ s te graduate standing or n- structor approval.

574 Traffic Engineering. (3) F
Operator and veh c e characteristics, street capacity s g na s, s gns and mark ngs, etc Al phases of traff c eng neering as app ed to urban areas. Prerequisite CEE 372.

575 Traffic Engineering. (3 S
See CEE 574 Prerequisite CEE 372

576 Airport Engineering. (3) F
Planning and design of a rport fac l t es. Effect of a rcraft characteristics air traffic control procedures and a rcraft demand for runway and passenger hand ing faci t es on s te select on runway configuration and termina des gn. Prerequ site CEE 372

577 Urban Transportation Planning. 3) S
App cat on of and use parameters traff c generat on the ory traff c d str but on and ass gnment mode s trans t ana ysis and econom c factors to the so ution of the urban transportation problem. Prerequ s te: CEE 372.

578 Highway Engineering, Planning and Economics. (3) S
H ghway transportat on, nc ud ng des gn operat on, p an ning, environmenta mpact, econom c feas'b ity and f - nanc ng. H ghways as a reg ona system Prerequ site CEE 372.

Students enrolled in CEE 580, 590, 592, 599, 792 and 799 are required to attend graduate student seminars at the times shown in the Schedule of Classes *Each se mester, every graduate student enrolled for more than eight semester hours is to enroll for at least one semester hour of CEE 592, 599 792 or 799 Each civil engineer ing graduate student holding an appo ntment as a teach ing or research assistant or associate is to enroll for one semester hour of CEE 580· such credit does not apply toward graduation.*

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered.

Computer Science and Engineering

PROFESSORS:
BARNH LL (ECG 252), ASHCROFT, BLACKLEDGE, FINDLER, LEWIS, NIELSON, J. URBAN, WADGE, WOODFILL

ASSOCIATE PROFESSORS:
COLLOFELLO, FALTZ, FARIN, FAUSTINI, FOLEY, HUEY, LINDQUIST, MILLER, O'GRADY, PHEANIS

ASSISTANT PROFESSORS:
CALLISS, D ETRICH, ELGOT DRAPKIN, GOLSHAN , SEBAN, SEN, S. URBAN

INSTRUCTORS:
HOUSTON, TRANTINA

PROFESSOR EMERITUS:
ROBBINS

Computers have a significant impact on our daily lives, and this impact is likely to be even greater in the future as computer professionals continue to develop more powerful and less expensive computing systems. Computer science and com puter engineering deal with the study, design, development, construction, and application of modern computing machinery. Other important top ics include computing techniques and appropriate languages for general information processing, for scientific computation, for the recognition, stor age, 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 and Engineering prepare the student to be a participant in this rapidly changing area of technology by presenting in-depth treatments of the fundamentals of computer science and computer engineering. The department offers two undergraduate degrees: a B.S in Computer Science and a B.S.E. in Computer Systems Engineering.

Degree Requirements

Minimum Scholastic Requirements. In addition to cumulative GPA of 2.00 or higher, all computer science and computer engineering students must obtain a minimum grade of "C" in all CSC courses used for degree credit

Computer Science—B.S.

The Department of Computer Science and Engineering offers a B.S. degree that prepares the student for a career in computer science. A student pursuing a B.S. degree must complete the General Studies requirements described below, an English proficiency requirement, the computer science core courses, a senior-level breadth requirement in the major, and a set of technical electives.

		Semester Hour
English Proficiency		
ENG 101, 102	First Year Composition	6
	or ENG 105 Advanced First Year Composition (3) See page 287 for English exemption.)	

General Studies

Humanities and Fine Arts
*Social and Behavioral Sciences**
18 semester hours
These courses must include at least one upper division course, at least two courses from the same department and courses from at least two departments
Humanities and Fine Arts . . . 6–12
Social and Behavioral Sciences . . . 12–6

*Literacy and Critical Inquiry**
6 semester hours)
One course chosen from the university approved list. In general this course is sophomore level and includes a series of formal, graded, written or spoken assignments in composing critical discourse 3
ECE 400 Engineering Communications . . . 3

Numeracy
7 semester hours
CSC 355 Introduction to Theoretical Computer Science 3
MAT 270 Calculus with Analytic Geometry I 4
or MAT 290 Calculus I (5)

Natural Science
(14 semester hours)
PHY 121 University Physics I: Mechanics 3
PHY 122 University Physics Laboratory I 1
PHY 131 University Physics II: Electricity and Magnetism 3
PHY 132 University Physics Laboratory II 1
Any physics course requiring PHY 131 as a prerequisite or any laboratory science satisfying the S1 or S2 General Studies requirements (except PHY 101, 105, 111, 112) 6

Total General Studies 45

NOTE: One course in the area of global awareness* and one course in historical awareness* *must* appear in the final list of courses offered in the student's graduation program of study. These can be included in the humanities and fine arts social and behavioral sciences course selections.

* See pages 55 87 for the requirements and the approved list

		Semester Hours
Computer Science Core		
CSC 100	Introduction to Computer Science I	3
CSC 101	Introduction to Computer Science II	3
CSC 120	Digital Design Fundamentals	3
CSC 201	Application Languages Programming Laboratory	1 2
CSC 202	Functional Languages Programming Laboratory	2 1
CSC 225	Assembly Language Programming (Motorola)	3
	or CSC 226 Assembly Language Programming (Intel (3)	
CSC 310	Data Structures	3
CSC 325	System Design with Microprocessors (Motorola)	3
	or CSC 326 System Design with Microprocessors (Intel) (3)	
CSC 330	Computer Organization	3
CSC 340	Structure of Programming Languages	3
ECE 383	Probability and Statistics for Engineers	2
	or STP 326 Intermediate Probability 3)	
MAT 243	Discrete Mathematical Structures	3
MAT 271, 272	Calculus with Analytic Geometry II, III	8
	or MAT 291 Calculus II (5)	
MAT 342	Linear Algebra	3

Total Computer Science Core 43

Computer Science Breadth Requiren ent 18
Each student completes 18 hours of CSC 400 evel courses (CSC 483 excluded
Technical Electives 9
Each con puter science student must com p ete 14 hours of courses chosen from the computer science technical elective ist and approved by the student's advisor
Unrestricted Electives 7

Total Degree Requirements 128

Computer Science Program of Study
Typical Four-Year Sequence

Freshman Year

First Semester			Semester Hours
CSC	100	Introduction to Computer Science I.	3
ENG	101	First Year Composition	3
MAT	270	Ca cu us with Analytic Geometry I	4
General Studies E ective HU or SB)			3
Laboratory Science S1)			3
		Total	16

Second Semester			
CSC	101	Introduction to Con puter Science II	3
CSC	120	Digital Design Fundamenta s	3
ENG	102	First Year Composition	3
MAT	271	Calculus with Analytic Geometry II	4
Laboratory Science S2			3
		Total	16

Sophomore Year

First Semester			
CSC	201	App ication Languages Programming Laboratory	1
CSC	202	Funct ona Languages Programming Lab	3
MAT	243	D screte Mathematical Structures	3
MAT	272	Calculus with Analytic Geometry III	4
PHY	121	University Physics I· Mechanics	3
PHY	122	University Physics Laboratory I	1
General Studies E ective (HU or SB			3
		Total	16

Second Semester			
CSC	225	Assembly Language Programming (Motorola)	3
CSC	310	Data Structures	3
PHY	131	University Physics II Electricity and Magneti m	3
PHY	132	University Physics Laboratory II	1
General Studies Elective HL or SB [1]			3
Literacy and Critical Inquiry Elective			3
		Total	16

Junior Year

First Semester			
CSC	201	Application Languages Programming Laboratory	1
CSC	325	System Design with Microprocessors (Motorola	3
CSC	340	Structure of Programming Languages	3
MAT	342	Linear Algebra	3
General Studies Elective (HU or SB)[1]			3
Unrestricted Elective			3
		Total	16

Second Semester			
CSC	330	Computer Organization	3
CSC	355	Introduction to Theoretical Computer Science	3
ECE	383	Probability and Statistics for Engineers	2
General Studies Elective HU or SB)			3
Unrestricted Elective			2
Techn'cal Elective			3
		Total	16

Senior Year

First Semester			
CSC 400 level Computer Science Breadth Electives			6
ECE	400	Engineer ng Communications	3
General Studies Elect ve HU or SB [1]			3
Technical Elective			3
Unrestricted Elective			1
		Total	16

Second Semester			
CSC 400 level Computer Science Breadth Electives			12
Technical Elective			3
Unrestricted Elective			1
		Total	15

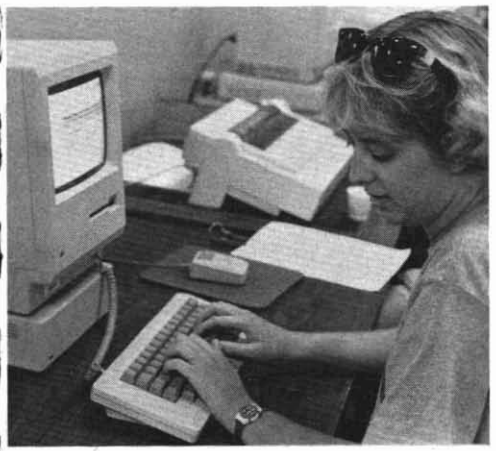
See pages 55 87 for the requ rements and the ap proved list

Computer Systems Engineering—B.S.E.

The Department of Computer Science and Engi neering offers a B.S.E. degree that prepares the student for a career in computer systems engi neering. This degree program provides training in both engineering and computer science. The degree requirements for the School of Engineer ng show the requirements for English profi ciency and General Studies for the B S.E. degree The following list specifies the remaining re quirements for the B S.E. degree.

Engineering Core			Semester Hours
CHM	114	(or CHM 116) General Chemistry for Engineers	4
CSC	225	Assembly Language Programming (Motorola) or CSC 226 Assembly Language Programming (Intel) (3)	3
ECE	105	Introduction to Languages of Engineering	3
ECE	210	Engineering Mechanics I: Statics	3
ECE	301	Electrical Networks I	4
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	333	Electrical Instrumentation	3
ECE	340	Thermodynamics	3
ECE	352	Properties of Electronic Materials	3
ECE	383	Probability and Statistics for Engineers	2
MAT	274	Elementary Differential Equations	3
MAT	291	Calculus II or MAT 271 and MAT 272 (4, 4)	5
MAT	342	Linear Algebra	3
PHY	361	Introductory Modern Physics (Basic Science Elective)	3
		Total	45

Computer Science Core			Semester Hours
CSC	120	Digital Design Fundamentals	3
CSC	200	Concepts of Computer Science	4
CSC	201	Application Languages Programming Laboratory	1
CSC	202	Functional Languages Programming Laboratory	1
CSC	325	System Design with Microprocessors (Motorola) or CSC 326, System Design with Microprocessors (Intel) (3)	3
CSC	330	Computer Organization	3
CSC	340	Structure of Programming Languages	3
CSC	355	Introduction to Theoretical Computer Science	3
CSC	421	Microprocessor System Design I	4
CSC	422	Microprocessor System Design II	4
CSC	423	Microcomputer System Hardware	3
MAT	243	Discrete Mathematical Structures	3
Area of Emphasis (Technical Electives)			13
		Total	51



The student selects technical electives from an approved list with approval of an advisor.

Computer Systems Engineering
Program of Study
Typical Four-Year Sequence

Freshman Year

First Semester			Semester Hours
CHM	114	General Chemistry for Engineers	4
CSC	120	Digital Design Fundamentals	3
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First-Year Composition	3
MAT	290	Calculus I	5
		Total	18

Second Semester			
CSC	200	Concepts of Computer Science	4
ECE	106	Introduction to Computer-Aided Engineering	3
ENG	102	First-Year Composition	3
MAT	243	Discrete Mathematical Structures	3
MAT	291	Calculus II	5
		Total	18

Sophomore Year

First Semester			
CSC	201	Application Languages Programming Laboratory	1
CSC	225	Assembly Language Programming (Motorola)	3
CSC	310	Data Structures	3
ECN	111	Macroeconomic Principles	3
MAT	274	Elementary Differential Equations	3
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Laboratory I	1
		Total	17

Second Semester			
CSC	202	Functional Languages Programming Laboratory	1
CSC	325	System Design with Microprocessors (Motorola)	3
ECE	210	Engineering Mechanics I: Statics	3
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Laboratory II	1
General Studies Elective (HU or SB)[1]			3
Literacy and Critical Inquiry Elective[2]			3
		Total	17

Junior Year

First Semester

CSC	330	Computer Organization	3
CSC	340	Structure of Programming Languages	3
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	383	Probability and Statistics for Engineers	2
PHY	361	Introductory Modern Physics	3
General Studies Elective (HU or SB)[1]			3
		Total	17

Second Semester

CSC	355	Introduction to Theoretical Computer Science	3
CSC	471	Microprocessor System Design I	4
ECE	301	Electrical Networks	4
MAT	342	Linear Algebra	3
General Studies Elective (HU or SB)			3
		Total	17

Senior Year

First Semester

CSC	422	Microprocessor System Design II	4
ECE	333	Electrical Instrumentation	3
ECE	340	Thermodynamics	3
General Studies Elective (HU or SB)			3
Technical Elective			4
		Total	17

Second Semester

CSC	423	Microcomputer System Hardware	3
ECE	352	Properties of Electronic Materials	3
ECE	400	Engineering Communications	3
Technical Electives			9
		Total	18

See pages 50–80 for the requirements and the approved list

See page 314 for special requirements and selection of an LI elective

COMPUTER SCIENCE

CSC 100 Introduction to Computer Science I. 3 F, S
Concepts of problem solving, algorithms, structured programming, fundamental algorithms and techniques, computer systems concepts. Prerequisite: MAT 118

101 Introduction to Computer Science II. (3 F, S
Advanced programming techniques; file processing; implementation of arrays, stacks, queues, linked lists, binary search trees, large program development, team programming. Prerequisite: CSC 100 *[Satisfies General Studies Requirement. N3]*

120 Digital Design Fundamentals. (3 F, S, SS
Number systems, conversions, methods, binary and complement arithmetic, Boolean and switching algebra, circuit minimization, ROMs, PLAs, flip-flops, synchronous sequential circuits, register transfer design. Lecture, Lab. Cross listed with EEE 120. Prerequisite: CSC 100 or ECE 105

180 Computer Literacy. 3 F, S
Introduction to general problem solving approaches using widely available software tools such as database packages, word processors, spreadsheets and report generators. Nonmajors only. *[Satisfies General Studies Requirement N3]*

181 Applied Problem Solving with BASIC. 3) F, S
Introduction to systematic definition of problems, solution formulation, method validation. Computer solution using BASIC required for projects. Lecture, lab. Nonmajors only. Prerequisite: MAT 117 *[Satisfies General Studies Requirement N3]*

183 Applied Problem Solving with FORTRAN. 3 F, S
Algorithmic, or ented, systems approach to problem definition, solution formulation and solution using FORTRAN. Computer solution required for projects. Nonmajors only. Prerequisite: MAT 118 *[Satisfies General Studies Requirement N3]*

200 Concepts of Computer Science. 4 A
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. Prerequisite. ECE 105 or equivalent *[Satisfies General Studies Requirement N3]*

201 Application Languages Programming Laboratory. 1 F, S, SS
Each module introduces a programming language such as C, FORTRAN, PL/1, or COBOL. Includes programming exercises. May be repeated for different languages. Prerequisite: CSC 101 or 200

202 Functional Languages Programming Laboratory. 1 F, S, SS
Each module introduces a programming language such as APL, Lisp, or PROLOG. Includes programming exercises. May be repeated for different languages. Prerequisite: CSC 101 or 200

225 Assembly Language Programming (Motorola). 3 F, S, SS
Assembly language programming, register level computer organization, data structures and addressing modes, assemblers, linkers. Motorola based assignments. Cross listed with EEE 225. Prerequisite: CSC EEE 120

226 Assembly Language Programming (Intel). 3 F, S, SS
Assembly language programming, register level computer organization, data structures and addressing modes, assemblers, linkers. Intel based assignments. Cross listed with EEE 226. Prerequisites: CSC EEE 120

304 Introduction to Cobol. 3 F
Fundamental concepts of the Cobol programming language. Emphasis on structured programming. Prerequisite: CSC 100 or 200

305 Introduction to PL/I. 3 S
Basic concepts of the programming language PL/I. Prerequisite: CSC 100 or 200

310 Data Structures. 3 F, S
Data representation; advanced treatment of arrays, stacks, queues, lists, dynamic storage allocation, binary trees, strings, graphs, AVL trees, data abstraction. Prerequisites: CSC 101 or 200, MAT 243

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. Lecture, lab. Prerequisites: CSC 225 or 226, MAT 243

321 Computer Systems Arch tecture. 4 F S
I tegrat on of DMA O a d other process g e ements into a s ng e system arch tecture Memory h erarchy and subsystems Processor context memory management Lecture ab Prerequ s te CSC 320 or 325 or 326

325 System Design with M'croprocessors (Motorola) 3 F S SS
CPU Memory management per phera dev ce nterfaces and programm ng. M crocontro ers, standard system buses ser a and pa a e I O d rect memo y access de v ces commun cat ons Lecture, lab Cross sted as EEE 325 Prerequ s te· CSC EEE 225

326 System Design with Microprocessors (Intel). 3 F S SS
CPU Memory ma agement peripheral dev ce nterfaces and programm ng M crocontrol ers standard system buses, ser al and para e O d rect memory access de v ces f oatmg po nt pro essors Lecture ab Cross sted as EEE 326. Prerequ s te CSC EEE 226

330 Computer Organization. (3 F S SS
nstruct on set des gn m crocontro p pe n ng, memory med a organ zat'on and management networks and commun cat ons Prerequ te CSC EEE 225 or CSC EEE 226

340 Structure of Programming Languages. 3 F S
Forma spec f cat on for anguage syntax and dynam c runt me env ronments, ntroduct on to language transla t on Prerequ s tes CSC 201 or 202, 225 or 226 and 310

355 Introduction to Theoretical Computer Science. 3) F S
The theory of computat on ntroduction to forma an guages recurs ve funct ons comp ex ty Prerequ s te CSC 310

383 Applied FORTRAN Programming. 3 F S
Advanced FORTRAN character hand ng, mach ne de pendency, sort ng and merg ng, p ott ng tapes, d sks t me shar ng term nals brary programs Lecture lab Nonma ors only Prerequ s te CSC 183

408 Introduction to Scene Analysis. 3 A
mage ana ys s and format on ow eve process ng ob ject segmentat n textu e ana ys s stereo v s on, mot on· h gher evel nterpretat on act ve sens ng Prerequ s te CSC 310 or nstructor approva

410 Information Process ng. 3 A
Pr mary, secondary f e access organ zations Mu t attr bute ndex ng F le process ng ntroduct on to database management and document retrieva Prerequis te CSC 310.

412 Database Management. 3 S
Introduct on to DBMS concepts Data mode s and an guages Relat ona database theory Database securnty n tegr ty and concurrency Prerequ site CSC 310

420 Comparison of Computer Architectures. (3 A
Evo ut on of ma n ne architectures, instruct on sets, ad dress ng modes control structures Characterizat on of computer arch tectures Performance evaluat on Pre requ s te CSC 321 or 330 or 423

421 Microprocessor System Design I. 4 F, S
Hardware software and assembly anguage program m ng of a m crocomputer system are used as veh c es to teach fundamenta s of dig tal system des gn Lecture, ab. Prerequ s te: CSC 320

422 Microprocessor System Design II. 4 F S
Des gn f m rocomputer system us ng co temporary og c and m crocomputer system components Requ res assemb y anguage programm ng Prerequ s te CSC 421

423 Microcomputer System Hardware. 3) S
Informat on and te hn que presented n CSC 422 are used to deve op the hardware des gn of a mu t processor mu t programm ng m croprocessor ba ed system. Pre requ s te CSC 422

428 Computer-Aided Processes. 3 A
Hardware and software cons derat ons for computer zed manufacturing systems Spec f c concentrat on on auto mat c nspect on, numer ca control robotics, ntegrated manufactur ng systems. Prerequ s te CSC 321 or 330

430 Elementary Concepts of Operating Systems. 3) F, S
Des gn and mp ementat on of superv sory system compo nents nput/output methods process management mu t programm ng and mult process ng systems, storage man agement, f le systems Prerequisites CSC 321 or 330, 340.

438 Systems Programming. 3 A
Des gn and mp ementat on of systems programs. text ed tors, f e ut t es, mon tors assemb ers re ocat ng ink ng oaders O hand ers s hedu ers etc Prerequis te CSC 421 or nstructor approva

440 Compiler Construction I. 3 F
Introduct on to programm ng anguage mp ementat on Implementat on strateg es comp at on, nterpretat on trans at'on Major comp at on phases lex ca ana ysis semant c ana ys s opt mizat on code generat on Pre requis te CSC 340

450 Analysis of Algorithms. 3 F
Des gn and ana ys s of omputer a gor thms us ng ana yt ca and emp r a methods, comp ex ty measures des gn methodo og es survey of mportant a gor thms Prerequ s te. CSC 310

451 Switching Theory 3 N
Comb nat ona og c fun tiona decompos t on, NAND NOR c rcu t ana ys s and synthes s og c arrays terative networks fau t d agnos s, sequent a c rcu t representa ti n, memory dev ces. Prerequis te CSC 320 or 325 or 326.

457 Theory of Formal Languages. 3 A
Theory of grammar, methods of syntact c analys s and spec f cat on types of art f c a anguages re at onsh p be tween forma anguages and automata Cross sted as MAT 401 Prerequ s te CSC 355

459 Logic for Computing Scientists I. 3 F
Propos tiona og c, symbol c process ng princ p es of og c programming; reso ution pattern match ng, Pro og; various applicat ons of predicate og c n computer sc ence· extensions to pred cate og c Prerequ s te: CSC 355.

460 Software Project Management and Development I. 3 F, S
Software l fe cyc e ana ys s programm ng teams, project documentation and m estones, requ rements and specif' cat ons des gn test ng and ma ntenance too s and tech n ques Prerequ s te· sen or stand ng

470 Computer Graphics. 3) S
D sp ay devices, data structures, transformations interac tive graph cs, 3 d mensiona graph cs, h dden ine prob- em. Prerequisites CSC 310 MAT 342.

ENGINEERING

471 Survey of Artificial Intelligence. (3) F, S
Introduct on to heurist c search, games know edge repre sentation techn ques formal and fuzzy logics, natura an guage understand ng expert systems, computer v s on. Prerequ sites CSC 310; know edge of LISP and PROLOG.

473 Nonprocedural Programming Languages. (3) S
Functiona and og c programm ng us ng anguages ike Luc d and Pro og (Typical app cations wou d be a Screen Editor and an Expert System.) Prerequisite: CSC 355.

474 Modeling for Computer Simulation. (3) A
Mathematical descr pt on of general dynam c systems (discrete event, discrete time, continuous) n forms su t able for computer mp ementation Prerequis tes CSC 310; ECE 383

475 Simulation Theory and Languages. (3) A
Statistica background for s mu at on Mode construct on and va dation, ana ys s of resu ts. Languages that support simulation Prerequ s te: CSC 474.

476 Introduction to Natural Language Processing. (3) F
Pr nc p es of computationa ingu st cs formal syntax se mantics, as app ed to the design of software w th natural (human) language I O Prerequ s te: CSC 310 or nstructor approval

477 Introduction to Computer-Aided Geometric Design. (3) S
Introduct on to parametric curves and surfaces, Bez er and B-spline nterpolation and approximat on techn ques. Prerequ s tes. CSC 101 or 200 MAT 342

508 Digital Image Processing I. (3) F
Digital mage fundamenta s mage transforms, image en hancement and restorat on techn ques mage encod ng and segmentat on methods Prerequis te EEE 303 or instructor approval.

509 Digital Image Processing II. (3) S
Advanced analyt ca techniques appl ed to d gital mage processing, computer v s on app cat ons nc uding robot cs Prerequ s te: CSC 508

512 Database Systems Design. (3) F
Mu t eve , genera zed DBMS arch tectures and design. D stributed databases: transparent funct ona t es query processing, update synchron zation, concurrency control. Prerequis tes: CSC 410 412

513 Database Machines. (3) N
Nonnumer c process ng. Von-Neumann bottlenecks Para e and associat ve processors. Database mach nes: survey, theory, software, performance Advanced topics in database architectures Prerequ s tes: CSC 321 or 330; 410 or 412

515 Information Storage and Retrieval. (3) N
Concepts of nformat on storage and retr eval theory, appl cat ons, case stud es Prerequ s te: CSC 410.

516 Digital Testing and Reliability. (3) A
Fau t model ng test generation and simulat on for comb nat ona and sequent al c rcu ts; memory testing, se f checking logic, fault to erant og c, re ab ty ana ysis. Prerequisites: CSC 321 or 330 or 423 355 or 451

517 Digital Design Automation. (3) N
Typ ca computer aided design system S mulat on tech n ques, test generat on, microprogrammed contro design aids, spec fcat on sheet ana ys s. App icat ons Prerequ site CSC 520 or 524

518 Hardware Design Languages. (3) N
ntroduction to hardware design languages (HDL s) HDL descr ption of ntegrated c rcuit components and systems. HDL descr ption of computer organizat ons Prerequ s te: CSC 321 or 330

520 Computer Architecture II. 3) A
Theoret cal structure of computer and computations, per formance trade offs, contro un ts memory hierarchies, nput/output nterconnect on networks operat ng system support. Prerequisite CSC 430

521 Microprocessor Applications. (4) S
Microprocessor techno ogy and ts appl cat on to the de s gn of pract ca dig tal systems Hardware assembly lan guage programm ng, nterfacing of m croprocessor based systems Lecture, ab. Prerequ site CSC 421.

522 Microprogramming. (3) A
Theory, pract ce and app icat on of m croprogramm ng Prerequisite: CSC 321 or 330

523 Microcomputer Systems Software. (3) F
Deve op ng system software for a mu t processor, mu tiprogramm ng m croprocessor based system us ng nformation and techniques presented n CSC 421 422. Pre requ s te CSC 422.

524 Multiprogramming Architectures. (3) N
Main-line computer arch tectures multiprogramming, timeshar ng, mu t process ng, hardware software tradeoffs, memory h erarch es, input/output structures, commu n cat ons. Prerequis te CSC 321 or 330 or 423

526 Parallel Processing. (3) N
Rea and apparent concurrency Hardware organ zat on of mu tiprocessors, mu tip e computer systems, sc entific at tached processors and other para e systems Prerequ s te: CSC 321 or 330 or 423.

527 High-Level-Language Machines. (3) N
Advantages and disadvantages of h gh eve anguage machines. Languages su tab ity Microprogramm ng and nterpretive execut on I O operat ons. Examples. Pre requ s te: CSC 520 or 524.

529 RISC Design Methodology. (4) N
Opt mal computer architecture des gn methodology based on the symbiotic re at onship of hardware and software d sc p ines. Pre or corequ s te CSC 440 (prerequ s te), 520 (corequ s te)

530 Operating System Case Study. (3) F
Study of the design and mp ementat on of a t meshared mu t programm ng operat ng system w th emphas s on the UNIX operat ng system. Prerequ s tes CSC 430; know edge of C anguage.

531 Distributed Operating Systems. (3) N
Interprocess commun cat ons concurrency control, file system, language constructs, architecture and network cons derations in d str buted operat ng and mult processor systems. Case stud es. Prerequ site CSC 530 or nstructor approva .

532 Security in Computing Systems. (3) A
In depth development of the concepts of computer secu r ty mpact on computer hardware and software and on user. Prerequ s te CSC 430.

534 Computer Networks. (3) N
Computer network protoco s, hardware elements, and software algor thms Error hand ng, routing, flow contro , host to host communicat on local area networks. Pre requ s te CSC 320 or 325 or 326.

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.

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.

556 Expert Systems. (3) S
Knowledge acquisition and representation, rule-based systems, frame-based systems, validation of knowledge bases, inexact reasoning, expert database systems.

560 Software Project Management and Development II. (3) F, S
Software project management, cost estimation, configuration management, quality assurance. Advanced software engineering life cycle topics. Prerequisite: CSC 460.

563 Software Requirements and Specification. (3) F
Examination of the definitional stage of software development; analysis of specification representations and techniques emphasizing important application issues. Prerequisite: CSC 460.

564 Software Design. (3) S
Examination of software design issues and techniques. Includes a survey of design representations and a comparison of design methods. Prerequisite: CSC 460.

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

566 Software Maintenance. (3) S
Survey of software maintenance problems, tools, metrics, management approaches. Implications of software maintenance on software development. Prerequisite: CSC 460.

570 Advanced Computer Graphics I. (3) A
Hidden surface algorithms, lighting models and shading techniques. User interface design. Animation techniques. Fractals and stochastic models. Raster algorithms. Prerequisite: CSC 470.

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: ECE 383 or STP 326.

573 Advanced Computer Graphics II. (3) A
Computer-aided geometric design. Interactive and surface representation and design. Scattered data techniques. CAD/CAM. Constructive solid geometry and modelling. Prerequisite: CSC 470.

576 Topics in Natural Language Processing. (3) S
Comparative parsing strategies, scoping and reference problems, non-first-order logical semantic representations, and discourse structure. Prerequisite: CSC 476 or instructor approval.

577 Advanced Computer-Aided Geometric Design I. (3) F
General interpolation; review of curve interpolation and approximation; spline curves; visual smoothness of curves; parameterization of curves; introduction to surface interpolation and approximation. Prerequisites: CSC 470, 477; or instructor approval.

578 Advanced Computer-Aided Geometric Design II. (3) S
Coons patches and Bezier patches; triangular patches; arbitrarily located data methods; geometry processing of surfaces; higher dimensional surfaces. Prerequisites: CSC 470, 477; or instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

Electrical Engineering

REGENTS' PROFESSOR:
FERRY (ECG 127)
PROFESSORS:
AKERS, BACKUS, BAJAJ, BALANIS, BOSE, CROUCH, DeMASSA, HADEN, HIGGINS, KARADY, KAUFMAN, KELLY, McKLVEEN, PALAIS, ROEDEL, RUSSELL, SCHRODER, SIRKIS, WANG
ASSOCIATE PROFESSORS:
COCHRAN, DAV S, GREENEICH, GRONDIN, MARACAS, SHEN, SKROMME, TYLAVSKY
ASSISTANT PROFESSORS:
ABERLE, EL-GHAZALY, EL-SHARAWY, GORUR, HASHEMI-YEGANEH, HOLBERT, KOZICKI, MORRELL, SPANIAS, TSAKALIS
PROFESSORS EMERITI:
AX, BARKSON, DONNELLY, SCHWUTTKE, STEINMANN, THOMPSON, TICE, WELCH, ZIMMER

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 net works and switching systems, computer systems, and electric power generation and distribution. 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 minuscule semiconductor integrated circuits that contain many thousands of elementary devices. They design systems for automatically controlling mechanical devices and a variety of processes. They are re sponsible for the design of satellite communica tion links as well as patient monitoring systems for hospitals. The development of the microprocessor has expanded the opportunities for electri cal engineers to improve the design of familiar products since these devices are now incorpo rated in automobiles, consumer and office products, entertainment systems, and a vast variety of test and measurement instruments and machine tools.

Students who earn a B.S.E. degree majoring in Electrical Engineering will be involved in a variety of electrical and electronic problems in the course of their careers. To ensure the necessary breadth of knowledge, the Electrical Engineering curriculum includes basic (core) engineering courses and courses in networks and electronic circuits, electromagnetic fields and waves, microprocessors, communication and control systems, solid state electronics, electrical power systems, and other specialty courses.

Electrical Engineering—B.S.E.

The curriculum in Electrical Engineering builds upon the base provided by the engineering core. Beyond the engineering core, the curriculum in cludes a number of required electrical engineer ing and technical elective courses. Approved technical elective courses serve to provide students with an opportunity either to broaden their background in electrical 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 engineering or to pursue advanced education in graduate school.

Degree Requirements

Electrical Engineering Core

Students in Electrical Engineering fulfill the requirements of the engineering core by taking ECE 334 and 352 and EEE 225 or 226. No credit is given for ECE 333. Students may replace ECE 210 and 312 with PHY 321 and 322. Only ECE 313 may be deleted. The mathematics and basic science electives are met by taking the following courses:

			Semester Hours
MAT	342	Linear Algebra	3
MAT	362	Advanced Mathematics for Engineers and Scientists I	3
PHY	361	Introductory Modern Physics	3

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

			Semester Hours
EEE	120	Digital Design Fundamentals	3
EEE	302	Electrical Networks II	3
EEE	303	Signals and Filters	3
EEE	325	System Design with Microprocessors (Motorola)	3
		or EEE 326 System Design with Microprocessors (Intel) (3)	
EEE	340	Electromagnetic Engineering I	3
EEE	341	Electromagnetic Engineering II	4
EEE	360	Energy Conversion and Transport	4
EEE	396	Professional Seminar	0
EEE	490	Senior Design Laboratory	3
		Total	26

Technical Electives in Electrical Engineering

The program in Electrical Engineering requires a total of 23 hours of technical electives. To ensure breadth of knowledge, students *must* select from the courses indicated not less than three of the following five areas:

Area	Course
Communications	EEE 455
Control	EEE 480
Electronics Circuits	EEE 405 or 425 or 433
Power Systems	EEE 470 or 471 or 473
Solid State Electronics	EEE 436

Of the remaining technical electives, at least half must be electrical engineering (EEE) 400 level courses. With approval of the faculty advisor, computer science (CSC) 400-level courses may be used as an alternative to meet this requirement.

With faculty advisor approval, qualified students may choose technical electives from other courses in engineering, mathematics, and the sciences at or above the 300 level, including graduate courses. Students must have a GPA of not less than 3.00 and approval of the instructor to enroll in EEE graduate level courses. In addition, up to six semester hours of technical electives may be chosen from the approved list of courses from the College of Business.

Electrical Engineering Program of Study
Typical Four-Year Sequence

Freshman Year

First Semester			*Semester Hours*
CHM	114	General Chemistry for Engineers or CHM 116 General Chemistry (4)	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First Year Composition	3
MAT	290	Calculus I	5
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
		Total	19

Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
EEE	120	Digital Design Fundamentals	3
ENG	102	First-Year Composition	3
MAT	291	Calculus II	5
PHY	131	University Physics II. Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
		Total	18

Sophomore Year

First Semester			
ECE	210	Engineering Mechanics I: Statics	3
ECE	301	Electrical Networks I	4
EEE	225/226	Assembly Language Programming	3
MAT	274	Elementary Differential Equations	3
MAT	342	Linear Algebra	3
		Total	16

Second Semester			
ECE	312	Engineering Mechanics II Dynamics	3
EEE	302	Electrical Networks II	3
EEE	325/326	System Design with Microprocessors	3
MAT	362	Advanced Mathematics for Engineers and Scientists I	3
PHY	361	Introductory Modern Physics	3
General Studies Elective (HU or SB)			3
		Total	18

Junior Year

First Semester			
ECE	334	Electronic Devices and Instrumentation	4
ECE	352	Properties of Electronic Materials	3
ECN	111	Macroeconomics	3
EEE	303	Signals and Filters	3
EEE	340	Electromagnetic Engineering I	3
EEE	396	Professional Seminar	0
Literacy and Critical Inquiry Elective[2]			3
		Total	19

Second Semester			
ECE	340	Thermodynamics	3
EEE	341	Electromagnetic Engineering II	4
EEE	360	Energy Conversion and Transport	4
General Studies Elective (HU or SB)			6
		Total	17

Senior Year

First Semester			
EEE	490	Senior Design Laboratory	3
General Studies Elective (HU or SB)			3
Technical Electives			11
		Total	17

Second Semester			
ECE	400	Engineering Communications	3
Technical Electives			12
		Total	15

[1] See pages 55 87 for the requirements and the approved list.

[2] See page 288 for special requirements and selection of an L1 elective.

Graduation Requirements

The attention of the student is directed to the re tention and graduation requirements of the university and the School of Engineering. In addi tion to those requirements, a student must earn a grade of "C" or better in the mathematics and physics courses listed in the program of study. The student must also have an overall GPA 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 elec tives.

Special Program

For those students interested in microelectronics manufacturing engineering, an option in this area of emphasis is available under the Engineering Special Programs. See page 379 for details and course requirements.

ELECTRICAL ENGINEERING

EEE 120 Digital Design Fundamentals. (3) F S, SS
Number systems convers on methods b nary and com plement arithmet c, boo ean and sw tch ng algebra, c rcu t m nimization ROMs PLAs, f pf ops synchronous se quent al circuits, reg ster transfer des gn Lecture, ab. Cross l sted as CSC 120. Prerequisite CSC 100 or ECE 105

225 Assembly Language Programming (Motorola). (3) F S, SS
Assembly anguage programm ng, reg ster evel computer organ zation, data structure and addressing modes, as semblers nkers Motoro a-based assignments. Cross listed as CSC 225 Prerequ s te. CSC EEE 120

226 Assembly Language Programming (Intel). 3) F S, SS
Assemb y language programm ng reg ster eve computer organizat on, data structure and address ng modes assemb ers linkers nte based ass gnments. Cross- sted as CSC 226 Prerequ site CSC 100 or ECE 105, CSC EEE 120

302 Electrical Networks II. (3 F, S, SS
Analysis of near and nonl near networks. Ana yt ca and numerical methods Prerequ site. ECE 301.

303 Signals and Filters. (3) F S, SS
F lter ng and spectra ana ys s n cont nuous and d screte systems Prerequ site EEE 302.

325 System Design with Microprocessors (Motorola). (3) F S, SS
CPU Memory management/per pheral dev ce interfaces and programming M crocontrol ers, standard system buses, ser a and para el I O d rect memory access de v ces commun cat ons Lecture, ab Cross- sted as CSC 325 Prerequ s te: CSC EEE 225.

326 System Design with Microprocessors (Intel). (3 F S, SS
CPU Memory management/periphera device nterfaces and programm ng. Microcontro lers, standard system buses, ser a and paralle O direct memory access de v ces, commun cat ons Lecture lab Cross isted as CSC 326 Prerequ site CSC EEE 226.

340 Electromagnetic Engineering I. (3) F S SS
Stat c and time vary ng vector fie ds, boundary value prob ems; die ectr c and magnetic mater als. Maxwe 's equat ons, boundary cond t ons, uniform p ane waves Prerequ s tes. MAT 362, PHY 131.

341 Electromagnetic Engineering II. 4) F, S
Coax a and wavegu de transm ss on nes matching tech n ques, p ane waves in ossy med a, polar zation; ref ec t on and refract on, e ectromagnet c system concepts, ra d at on Lecture ab. Prerequ s tes ECE 105 301 EEE 340 or equiva ents.

360 Energy Conversion and Transport. (4) F S
Three phase c rcuits. Energy supp y systems Magnet c circu t analysis, synchronous generators, transformers, nduct on mach nes, dc c rcu ts. Load flow and short cir cu t calcu at ons. Lecture, lab Prerequ s te· ECE 301.

396 Professional Seminar. 0 F, S
Top cs of interest to upper-d v s on e ectr ca eng neers. One ecture. Prerequisite jun or stand ng

405 Filter Design. 3) F
Pr nc p es of act ve and pass ve f lter des gn. T me and frequency doma n approx mat ons Prerequ s te· EEE 303 or equivalent

406 Computer-Aided Design. 3) S
Principles and appl cation of modern CAD techn ques to so ve engineering prob ems; nc udes independent proj ect Prerequ s te EEE 303 or equ va ent.

407 Signal Processing I. (4) F
T me and frequency doma n character zat on of determ n stic time ser es L near operators, Four er and z trans forms dig ta fi ter synthes s system mode ng Lecture ab. Prerequ s te EEE 303

425 Digital Systems and Circuits. (4) F
Digital og c gate ana ys s, propagation de ay t mes f g ures of mer t noise marg ns App cat on of MOS and b po ar log c fam l es, nc ud ng NMOS CMOS standard and advanced TTL and ECL regenerat ve og c c rcu ts, memor es, VLSI c rcu ts; computer simu at ons us ng PSPICE. Lecture ab Prerequisite· ECE 334

433 Analog Integrated Circuits. 3 S
Analysis des gn and appl cat ons of modern analog c r cu ts us ng integrated b po ar and f eld effect transistor techno og es. Prerequ s te· ECE 334

434 Quantum Mechanics for Engineers. (3 F
Probab ity, Schroed nger equat on, eigenfunctions har mon c osc ator, periodic potent a , superpos t on angu ar momentum, scatter ng tunnel ng perturbat on theory. Prerequ s te: EEE 340

435 Microelectronics. (3) S
Pract ce of so d state device fabricat on techniques in c ud ng th n film and ntegrated c rcu t fabr cation pr n c p es. Lecture, ab Prerequ s te: EEE 436 or equ va ent

436 Fundamentals of Solid State Devices. 3) F, S
Metal sem conductor contacts, P N junct ons, l ght nter act ng dev ces Schottky d odes b po ar and f eld effect transistors, p anar and thin f lm integrated c rcu t C de v ces Prerequis te ECE 352

439 Semiconductor Facilities and Cleanroom Practices. (3) F
Microcontam nat on c eanroom concepts, operationa cons derat ons, u trapure water process materia s safety pract ces, introduct on to ndustr a hyg ene emergency response. Mandatory for users of CEAS cleanroom

443 Antennas. (3) S
Fundamenta parameters eng neer ng pr nc p es, radia tion ntegra s inear w re antennas oops arrays; numer ca computations measurements. Prerequ s te EEE 341 or equ valent.

445 Microwaves. 4 F
Wavegu des, circu t theory for wavegu d ng systems m crowave dev ces, systems and energy sources str pl nes and m crostr ps, mpedance matching transformers measurements Lecture, lab Prerequis te. EEE 341 or equ va ent.

448 Fiber Optics. (4) F
Pr nc p es of f ber opt c commun cat ons. Lectures ab Prerequisites: EEE 303 340

451 Error-Correcting Codes. 3) N
App cation of modern algebra to the ana ys s and synthe sis of random error detect ng and error correcting b ock codes Prerequ s te. CSC EEE 120

454 Random Signal Theory I. (3) F S
App ıcat on of stat stica techn ques to the representation and analys s of e ectr ca s gna s and to commun cat ons systems ana ys s Prerequisite EEE 303.

455 Communication Systems. (4) F S
S gna analysis L near exponent al and pulse modu a tion Comparat ve ana ys s of c rcu ts and systems. Lec ture ab Prerequisite EEE 303.

459 Data Communication Systems. (3) S
System character st cs Commun cat ons med a Commu- n cation codes Data va id ty checking. L ne protoco s ter minals, system conf gurat ons. Examples. Prerequ sites EEE 303 322

460 Nuclear Concepts for the 21st Century. (3) S
The wor d energy s tuation and the ro e of nuclear power. Nuc ear fission and fus on theory. The nuclear fue cyc e. Ultrasafe reactor des gns. Rad ation damage to e ectron ics nc ud ng soft errors and space rad at on Current and future app cations n nuc ear med c ne radio ogy, and food preservation Cross sted as NUC 460

461 Health Physics Principles and Radiation Measurements. (3) S
Sources, character st cs dos metry shie ding and meas- urement techn ques for cosmogen'c terrestr al and an thropogenic rad at on Ion z ng and non on z ng rad at on theory ALARA concept. Emphas s on nstrumentat'on detectors and env ronmenta monitor ng Lecture, ab Cross- sted as BME 461 and NUC 461 Prerequis te. ECE 301

462 Reactor Safety Analysis. 3) N
Power reactor safety and l censing methodo og es Reac tor transient and acc dent ana ys s. T me dependent so u tion to neutron d ffus on equat on Use of ndustry codes to assess f ssion product bu d up, emergency core cool- ng behavior, react v ty off site re eases and dose ca cu a t ons. Cross sted as NUC 462 Prerequ s te. EEE or NUC 460.

463 Electrical Power Plant. (3 F
Nuclear, foss l and so ar energy sources Ana ys s and design of steam supp y systems e ectrical generat ng systems and aux ary systems. Power p ant effic ency operat on and costs and ana yses. Cross sted as NUC 463 Prerequ s tes ECE 301 340

464 Nuclear Engineering Experiments. (3 F
Theory and app ed concepts in reactor des gn nstru mentation e ectron cs, and sh e d ng. Expenmental meas urements of nuc ear parameters using subcr t ca reactors and fus on neutron generator Fast and thermal activat on ana ys s. Pr mary coolant analys s Mossbauer spec trometry Lectures, ab. Cross listed as NUC 464. Core quisite EEE/NUC 460.

465 Radiation Dosimetry and Instrumentation (3) F 90
Rad ation dos metry and nstrumentation used at nuc ear power plants. Ca culat on of external and nterna rad a t on doses. Radiat on Bio ogy Sh eld ng ca culat ons. Cross- isted as NUC 465 Prerequ s te. BME EEE NUC 461

470 Electric Power Devices. 3) F
Ana ysis of dev ces used for short circu t protect on nc ud ng c rcu t breakers, relays, current and voltage transduc ers etc Protect on aga nst sw tching and i ghtn ng over voltages Insulat on coord nat on Lectures. Prerequisite EEE 360

471 Power System Analysis. (3) S
Rev ew of transm ss on l ne parameter calculation. Zero sequence mpedance, symmetr ca components for fau t ana ysis, short circu t ca culat on, review of power flow ana ys s, power system stabi ity, power system control concepts. D str bution system analys's, feeder design voltage drop capac tor placement, substat on ocat on Prerequ s te· EEE 360

473 Electrical Machinery. (3 S
Ana ys s and des gn of transformers and rotat ng ma ch nes dc, induct on and synchronous mach nes. Prin c ples of motor dr ves; thyristor microprocessor contro . Prerequ s te: EEE 360.

480 Feedback Systems. 4) F S
Analysis and design of near feedback systems Fre quency response and root ocus techn ques, ser es com pensation, and state var ab e feedback. Lecture, ab Pre requ s te EEE 303

482 Introduction to State Space Methods. (3) S
Discrete and cont nuous systems n state space form in ear systems and A R.M A models. E ements of real za tion, observer and stab zat on theory. Non l near sys tems, stabi ty phase plane and Liapunav methods App i cations to d g tal (computer s mu ation

490 Senior Design Laboratory. (3) F, S
Project oriented laboratory Each student w ll comp ete severa des gn projects during the semester. Lecture, lab Prerequ s tes: ECE 334; EEE 303, sen or status or in structor approva

506 Signal Processing of Time Series II. (3) S
Study of random time ser es autocorre at on sequence power spectra density opt mum f ters spectral ana ys s, rational model ng of stat onary time ser es Prerequ site EEE 407

525 VLSI Design. (3) S
Analys s and des gn of Very Large Scale ntegrated VLS C rcuits. Physics of sma devices fabr cation, regular structures, and system timing Open on y to graduate students.

531 Semiconductor Device Theory I. (3) F
Transport and recomb nation theory pn and Schottky bar r er diodes, b po ar and junct on f e d effect transistors MOS capac tors and trans stors. Prerequ site EEE 436 or equ va ent.

532 Semiconductor Device Theory II. (3) S
Advanced MOSFETs, charge-coupled dev ces, solar ce s photodetectors l ght em tting diodes m crowave dev ces, modu at on doped structures. Prerequ site. EEE 531.

533 MOS Integrated Circuit Engineering. (3) F
MOS device phys cs 'ntegrated c rcuit fabricat on, CMOS, ana og and d g ta c rcuit des gn s mu at on and ayout y e d and re iab l ty models Prerequ site EEE 436 or equ va ent

534 Semiconductor Transport. 3) N
Carrier transport n sem conductors Hal effect h gh e ectric f e d Boltzmann equat on, corre ation funct ons carr er-carr er interact ons Prerequ s te EEE 436 or equ valent

535 Solar Cells. 3) F
Photovo ta c dev ces nc ud ng homojunctions and heterojunctions Photogenerat on of carr ers, spectra re sponse, electr ca character st cs, eff c ency Prerequis te: EEE 436 or equ va ent

536 Semiconductor Characterization. 3) N
Measurement techniques for sem conductor mater a s and dev ces. E ectrical optical phys ca and chemical character zat on methods Prerequ s te EEE 436 or equivalent

537 Semiconductor Optoelectronics I. (3) N
E ectron c states n sem conductors, quantum theory of rad at on, absorpt on processes rad ative processes, nonradiat ve processes photoluminescence photonic de v ces Prerequis te EEE 434

538 Semiconductor Optoelectronics II. 3) N
Mater al and device phys cs of sem conductor asers, l ght emitt ng d odes, photodetector, etc Emerg ng mate r a and dev ce techno ogy in II V sem conductors Pre requisite EEE 537.

539 Introduction to Solid State Electronics. (3 S
Crystal attices reciproca att ces, quantum stat st cs, at tice dynamics, equ l br um and nonequ brium processes n sem conductors Prerequ site· EEE 434

541 Electromagnetic Fields and Guided Waves. (3) F
Po ar zat on and magnet zation d elect r c conducting anisotropic and sem conduct ng media, dua ty, un que ness and mage theory, p ane wave functions wavegu des resonators and surface gu ded waves Pre requ s te: EEE 341 or equ va ent

542 Selected Microwave Devices. (3) S
Use of ferrite, sem conductor and piezoelectr c mater als n m crowave systems Prerequ s tes. ECE 352 and EEE 445, or equ va ents

543 Antenna Analysis and Design. 3) F
Impedances, broadband antennas, frequency ndepend ent antennas, min atur zation aperture antennas, horns, ref ectors, lens antennas, cont nuous sources design techn ques Prerequ s te. EEE 443 or equ va ent

544 High Resolution Radar. (3) F
Fundamentals wideband coherent des gn, waveforms and process ng, stepped frequency, synthet c aperture radar SAR) nverse synthet c aperture radar SAR m ag ng Prerequisites EEE 303, 340· or equ va ents.

545 Microwave Circuit Design. (3 N
Analys s and des gn of m crowave attenuators, n phase and quadrature phase power d v ders, mag c tee's, direc t ona coup ers phase shifters, DC b ocks, equa zers, etc Prerequ s te· EEE 445 or nstructor approva .

546 Advanced Fiber Optics. (3 N
Theory of propagat on in fibers, frequency modu at on of l ght f ber opt c heterodyne rece vers f ber optic sensors b refringence n f bers. Prerequ s te EEE 448 or instructor approva

547 Microwave Solid State Circuit Design I. (3) N
Appl cat on of sem conductor characterist cs to practical design of m crowave m xers, detectors im ters sw tches, attenuators, multip ers phase sh fters and amp f ers. Prerequisite EEE 545 or nstructor approva

548 Coherent Optics. (3) N
D ffraction enses, opt ca process ng ho ography, e ec tro optics asers. Prerequ s te EEE 341

549 Lasers. (3 N
Theory and design of gas so id, and sem conductor la sers Prerequ s te· EEE 448 or instructor approval

550 Transform Theory and Applications. (3) F
Appl cat ons of comp ex variab es to Four er Lap ace and z transforms. Oriented to applicat ons n control, network, commun cation, and l near system theory Prerequ s te: EEE 303

551 Information and Coding Theory. (3) N
Fundamenta theorems of nformation theory for sources and channe s convo ut onal and burst codes Prerequi s tes: EEE 451 454

552 Coherent Communications. (3) N
Systems ana ysis and design of telecommun cation sys tems using phase ocked oops Prerequ s te EEE 454

555 Random Signal Theory II. (3) S
Processing of s gna s n the presence of no se. Random s gna s correlat on, frequency spectra estimat on, f ter ng, no se, pred ction trans ents Prerequ s te EEE 454

556 Detection and Estimation Theory. 3) N
Combinat on of the c ass ca techn ques of stat stical nfer ence and the random process characterizat on of commu n cat on, radar and other modern data processing sys tems. Prerequisites EEE 454, 455.

558 Modulation Theory. (3) N
No se performance of analog and dig tal modu ation sys tems Emphas s on modern d'gita techn ques n terrestria and sate l te commun cat ons systems. Prerequ s tes· EEE 454, 455

559 Computer Communication Networks. (3) N
ntroduct on to computer networks. Hardware e ements. Data nk protocols. Packet and message switch ng soft ware elements. Network contro Examp es Prerequ s te· EEE 459.

566 Medical Imaging Instrumentation. (3) N
Des gn and analys s of mag ng systems and nuclear de v ces for med ca d agnosis, therapy and research. Labo ratory exper ments us ng d agnost c rad o ogy, f uoros copy ultrasound and CAT scann ng Lecture lab. Cross-listed as BME 566 and NUC 566 Prerequ site: BME 465 or EEE/NUC 465 or nstructor approva

567 Radiation Shielding and Transport. (3) F
Shie d ng for rad at on therapy d agnost c radio ogy, cyclotrons and nuc ear reactors Monte Car o and emp r cal computat'onal methods, regu at ons design prob ems Cross sted as BME 567 and NUC 567 Prerequ site. BME 465 or EEE/NUC 465.

568 Medical Tomography. (3) S
CT, SPECT, PET, MRI Three d mens ona *in vivo* meas urements nstrument des gn, phys o og ca mode ng, c n ca protocols reconstruct on a gor thms, quant tat on ssues Cross sted as BME 568 and NUC 568 Pre requ s te BME 465 or EEE/NUC 465

569 Radiochemistry and Radiopharmaceutical Production. (3) N
Advanced principles of cyclotron design, targetry, operation, and utilization. Novel syntheses, tracer preparation, quality control, biodistribution studies. Cross-listed as BME 569 and NUC 569. Prerequisite: BME 465 or EEE/NUC 465.

571 Power System Transients. (3) N
Analysis of transient currents and voltages generated by disturbances in power networks. EMTP method. Travelling waves. Transients in transformers and generators. Protection against transients. Prerequisite: EEE 471.

572 Power Electronics. (3) N
Analysis of device operation: thyristors, gate-turn-off thyristors, transistors. Design of rectifier and inverter circuits. Applications: variable speed drives, HVDC, motor control, uninterruptable power supplies. Prerequisite: EEE 471.

573 Power System Control. (3) N
Concepts of economic and secure operation of power systems; load frequency control, economic dispatch, unit commitment, state estimation, contingency analysis. Prerequisite: EEE 471.

574 Computer Solution of Power Systems. (3) N
Algorithms for digital computation for power flow, fault, and stability analysis. Sparse matrix and vector programming methods, optimization, stochastic methods. Prerequisite: EEE 471.

577 Power System Planning. (3) F
Power flow and transient stability analysis, load forecasting methods, reliability concepts. Transmission planning, loss of load probability and production cost analysis, optimal network and generation expansion. Prerequisite: EEE 470.

579 Power Transmission and Distribution. (3) S
High voltage transmission line design: conductors, corona, RI and TV noise dc transmission. Distribution system analysis: load characteristics, feeder voltage drop, capacitor applications. Prerequisite: EEE 471.

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 454, 550, 582.

582 Linear System Theory. (3) F
Controllability, observability, and realization theory for multivariable continuous time systems. Stabilization and asymptotic state estimation. Disturbance decoupling, noninteracting control and banded input/banded output stability. Prerequisite: EEE 482.

585 Digital Control Systems. (3) N
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.

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.

631 Heterojunctions and Superlattices. (3) N
Principles of heterojunctions and quantum well structures, band line-ups, optical and electrical properties. Introduction to heterojunction devices.

641 Advanced Electromagnetic Field Theory. (3) N
Cylindrical wave functions, waveguides and resonators; spherical wave functions and resonators; integral equations; scattering and radiation; perturbational and variational methods. Prerequisite: EEE 541 or equivalent.

643 Advanced Topics in Electromagnetic Radiation. (3) N
High-frequency asymptotic techniques, geometrical, and physical theories of diffraction (GTD and PTD), moment method (MM), radar cross section (RCS) prediction, Fourier transforms in radiation, synthesis methods. Prerequisite: EEE 543.

645 Microwave Filter Design. (3) N
Analysis and design of microwave low-pass, high-pass, band-pass and band-stop filters and microwave diplexers/multiplexers. Prerequisite: EEE 545 or instructor approval.

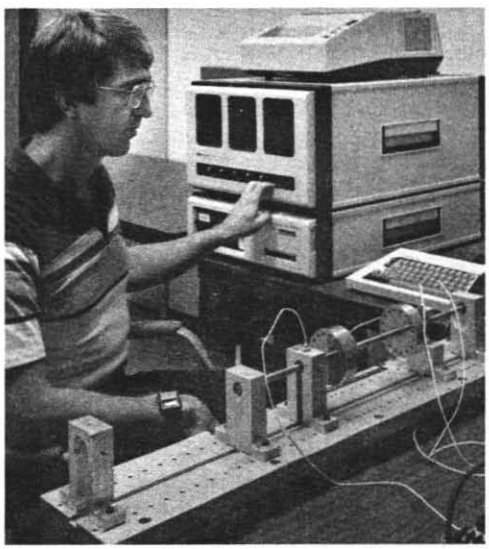
647 Microwave Solid State Circuit Design II. (3) N
Practical design of microwave free-running and voltage-controlled oscillators using Gunn and Impatt diodes and transistors; analysis of noise characteristics of the oscillator. Prerequisites: EEE 545, 547.

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) F
Critical examination of new bipolar device and circuit technologies. Performance trade-offs, 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 577, 579 or equivalents; instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.



Industrial and Management Systems Engineering

PROFESSORS:
WOLFE (ECG 303), BAILEY, BEDWORTH, MONTGOMERY, SM TH
ASSOCIATE PROFESSORS:
ANDERSON, COCHRAN, DEAN, KEATS, KNIGHT, MACKULAK, MOOR, ROLLIER, SHUNK
ASSISTANT PROFESSORS:
BEAUMARIAGE, HUBELE, NUÑO, ROBERTS, RUCKER
PROFESSORS EMERITI:
HOYT, YOUNG

The industrial engineer (IE) provides leadership for American organizations in productivity im provement and in reestablishing competitiveness in the domestic and international marketplaces. This gives IE's a wide range of interests and responsibilities. In a manufacturing enterprise, for example, the common goal of American industry (and the IE) is both to modernize and migrate the organization toward the concept of the factory of the-future (FOF).

Information technologies are of major interest to the industrial engineer. Information technol ogy makes it possible to integrate people, mate rial, machines, money, and other resources into productive enterprises Information systems including networks, database models, and computer hardware and software that tie people and resources together symbolize the essence of "in tegration" from a systems perspective

Technology integration includes the integration of mechanical, electrical, chemical, structural, and biological systems to create synergistic higher level systems and subsystems. Other dis ciplines tend to take vertical cuts deep into their areas of specialty while IE's take horizontal cuts across multiple areas of technology.

A distinguishing feature of industrial engineering is the emphasis on people. In fact, industrial engineering is often referred to as the "people oriented profession." It is a primary function of the IE to integrate people and technology ori ented systems. IE's are active in the fields of human factors and ergonomics. With the devel opment of the field of artificial intelligence and expert systems, the IE is being called upon to lead the movement from muscle-based work to knowledge based work. Industrial engineering is the only engineering discipline offering course work in quality assurance, so critical in today's competitive environment.

The IE is not only the developer of people and technology-integrated systems but also a prime candidate for all levels of management, espe cially those in high tech organizations, because of the IE's background in technology integration, organizational theory, management practice, and engineering economics. This is evidenced by the fact that more than half of all practicing IE's are in some level of management.

The demand for IE's is growing in direct pro portion to the exponential increase in integration, modernization, and automation activities. It has been predicted that the demand growth rate for industrial engineers will be considerably higher than average for the foreseeable future.

Industrial Engineering—B.S.E.

Degree Requirements

The following courses are required as a part of the engineering core mathematics requirement and the microcomputer elective (only ECE 313 Introduction to Deformable Solids may be de leted from the engineering core):

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

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

			Semester Hours
ASE	485	Engineering Statistics	3
IEE	300	Economic Analysis for Engineers	2
IEE	330	Microcomputer Applications in Industrial Engineering	3
IEE	367	Methods Engineering and Facilities Design	4
IEE	374	Quality Control	3
IEE	422	Information Systems Design	3
IEE	431	Engineering Administration	3
IEE	461	Integrated Production Control	3
IEE	475	Introduction to Simulation	3
IEE	476	Operations Research Techniques/ Applications	4
IEE	488	Industrial Engineering Analysis	3
IEE	490	Project in Design and Development	3
MET	343	Material Processes	4
Area of Emphasis (technical electives)			11
		Total	52

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. A maximum of two courses are allowed outside the School of Engineering. The graduate courses listed under these areas may, with departmental approval, be taken for undergraduate credit provided the student has a GPA greater than or equal to 3.00.

Production systems. IEE 464, 561, 570; OPM 331, 435, 470, 475.

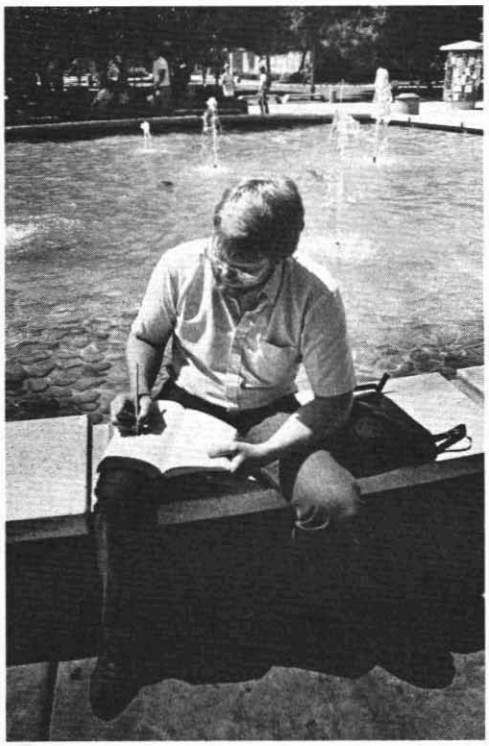
Computer-aided manufacturing. CHE 461; IEE 464; MET 346, 443, 451, 452, 453.

Engineering management. BLW 306; FIN 300; IEE 411, 510, 531.

Information systems. CSC 304, 305, 410, 412; IEE 464, 577.

Quality control/reliability. AET 409; IEE 569, 570, 571, 573; MAE 441, 442.

With departmental approval, 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
CHM	114	General Chemistry for Engineers[1]	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First-Year Composition	3
MAT	270	Calculus with Analytic Geometry I	4
General Studies Elective (HU or SB)[2]			3
		Total	17

Second Semester			
ECE	106	Introduction to Computer-Aided Engineering	3
ENG	102	First-Year Composition	3
MAT	271	Calculus with Analytic Geometry II	4
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
Literacy and Critical Inquiry Elective[3]			3
		Total	17

Sophomore Year

First Semester			
ECN	111	Macroeconomic Principles or ECN 112 Microeconomic Principles (3)	3
IEE	300	Economic Analysis for Engineers	2
MAT	242	Elementary Linear Algebra	2
MAT	272	Calculus with Analytic Geometry III	4
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
		Total	15

Second Semester			
ECE	210	Engineering Mechanics I: Statics	3
ECE	383	Probability and Statistics for Engineers	2
IEE	330	Microcomputer Applications in Industrial Engineering	3
MAT	274	Elementary Differential Equations	3
Basic Science Elective[4]			3
General Studies Elective (HU or SB)[2]			3
		Total	17

Junior Year

First Semester			
ASE	485	Engineering Statistics	3
ECE	301	Electrical Networks I	4
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	340	Thermodynamics	3
Technical Elective			3
General Studies Elective (HU or SB)[2]			3
		Total	19

Second Semester

ECE	333	Electrical Instrumentation	3
ECE	350	Structure and Properties of Materials	3
IEE	367	Methods Engineering and Facilities Design	4
MET	343	Material Processes	4
Technical Elective			2
General Studies Elective (HU or SB [2]			3
		Total	19

Senior Year

First Semester

IEE	374	Quality Control	3
IEE	422	Information Systems Design	3
IEE	431	Engineering Administration	3
IEE	461	Integrated Production Control	3
IEE	463	Computer Aided Manufacturing and Control	3
IEE	475	Introduction to Simulation	3
		Total	18

Second Semester

ECE	400	Engineering Communications	3
IEE	476	Operations Research Techniques Applications	4
IEE	488	Industrial Engineering Analysis	3
IEE	490	Project in Design and Development	3
Technical Electives			6
		Total	19

Graduation requirements: 133 semester hours minimum (excluding English requirement)

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

[2] See pages 55-87 for the requirements and the approved list

[3] See page 288 for special requirements and selection of an L1 elective.

[4] Must be an earth science or life science course; if physics or chemistry, the course must be of a more advanced level than PHY 131

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 man, machines, material, and money. Modern manufacturing engineering is concerned with the application of technology, including computers, robots, graphics, mathematical and digital models, information and database systems, microtechnology, and systems theory

Emphasis is placed on management and economics as well as technology. Graduates of the program are 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 engineering core mathematics requirement and the microcomputer elective (only ECE 333 Electrical Instrumentation may be deleted from 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 and Control	3

The basic science elective may be selected from BIO 181, CHM 331, GLG 100, PHY 361, or ZOL 201.

In addition, the following courses are required:

			Semester Hours
IEE	300	Economic Analysis for Engineers	2
IEE	330	Microcomputer Applications in Industrial Engineering	3
IEE	374	Quality Control	3
IEE	422	Information Systems Design	3
IEE	431	Engineering Administration	3
IEE	464	Computer Integrated Design	3
IEE	490	Project in Design and Development	3
MAE	317	Dynamic Systems and Control	3
MAE	318	Dynamic Systems and Control Lab	1
MET	331	Design for Manufacturing I	3
MET	343	Material Processes	4
MET	438	Design for Manufacturing II	4
MET	443	N/C Computer Programming	3
MET	451	Introduction to Robotics	3
Technical Electives (one course of engineering science content required			11
		Total	52

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 Prerequisite: MAT 270

330 Microcomputer Applications in Industrial Engineering. 3 F, S
Concepts related to development of operational capability in the use of microcomputer hardware software and networking as related to industrial engineering applications Prerequisite: ECE 105 *[Satisfies General Studies Requirement: N3]*

367 Methods Engineering and Facilities Design. (4) F, S
Analysis and design of work systems; productivity; motion and time study techniques; human factors. Analysis and design of facilities for automated and manmachine systems, emphasis on process design, material handling layout design and facilities location Lecture, ab Prerequisites: EE 300; EE 330 or equivalent

374 Quality Control. (3) F
n depth analysis of control chart and other stat stical process contro techn ques Organ zation and managerial aspects of qua ty assurance. Attr bute and variab e ac ceptance samp ing plans Prerequ s te. ECE 383

411 Engineering Economy. (3) S
Equ pment rep acement analysis, treatment of inflation in cash f ow stud es, and consideration of risk and uncer ta nty Prerequisite IEE 300

422 Information Systems Design. (3) F SS
Emphas s on the app ication of system ana ysis and de- s gn to information systems. M croprocessor MIS project requ red. Prerequisite IEE 330 or equivalent

431 Engineering Administration. (3) F, SS
Eng neering organ zation and admin strat on, introduct on to decis on mak ng, quantitative and qual tat ve ap- proaches to management, and eng neer ng admin stra- t on

437 Human Factors Engineering. (3) F
Study of people at work des gning for human perform- ance effect veness, and product v ty. Cons derat ons of human physio og cal and psycho og ca factors Prerequ site IEE 367

461 Integrated Production Control. (3 F, S
Product on contro techn ques for the plann ng, analys s, control and eva uat on of operating systems Time ser es *forecasting, network plann ng, scheduling, and contro* . Prerequ s tes ECE 383 IEE 330 or equivalent

463 Computer-Aided Manufacturing and Control. (3) F S
Emphas s on computer control n manufactur ng; rea t me concepts C M NC group techno ogy and process plan n ng robot cs. Prerequisite· IEE 330 or equ valent *[Sat isfies General Studies Requirement N3]*

464 Computer-Integrated Design. (3) F, S
Use of CAD tools to create geometr c objects and layout des gns Des gn nterfac ng through database structure w th manufac ur ng p anning control funct ons. ncludes open shop design laboratory assignments in add tion to c assroom work Prerequisites: ECE 106, IEE 330 or equ valent *[Satisfies General Studies Requirement N3]*

475 Introduction to Simulation. (3) F, S
Use of s mu ation in the analys s and des gn of network and d screte systems Methods for using a s mulat on an guage ntroduction to stat st ca aspects to s mulation. Prerequ s tes· ECE 383; EE 330 or equ va ent. *[Satisfies General Studies Requirement N3]*

476 Operations Research Techniques/Applications. (4) F, S
Top cs nclude near programm ng, network optim zat on dynamic programm ng, Markov processes and queueing mode s Emphas s on the des gn and development of mode s for solving decis on prob ems n ndustr al sys tems Prerequ s tes. ECE 383 MAT 242 *[Satisfies Gen eral Studies Requirement: N2]*

488 Industrial Engineering Analysis. (3) S
Labor mater a and overhead cost analys s parametr c cost est mat ng, risk analys s invo v ng budget im tations, assurance of est mates, qua ity cost systems fe cyc e cost ana ys s ncluding effects on engineer ng des gn, re liab ty, mainta nab lity serviceability, testab ty, and avai ab ty Prerequ s tes ECE 383, IEE 300

490 Project in Design and Development. (3) F, S
nd v dua project n creative design and synthes s Pre- requ s te: senior standing.

501 Foundations of Industrial Engineering I. (3) F
Techniques for the ana ysis and des gn of man machine systems Emphasis on work planning, methods, measure ments, materia hand ing and facil ty des gn. Not ava - able for E graduate credit

502 Foundations of Industrial Engineering II. (3) S
Introduct on to quantitat ve product on contro techn ques p ann ng forecast ng, nventory control and MRP, sched u ng. Influence of CAD CAM and automation on produc tion contro process. Not ava ab e for .E. graduate cred t Prerequ site· ECE 383 or 500

503 Economic Analysis for Engineers. (2) F, S
Econom c eva uat on of a ternatives for eng neering deci sions, emphas z ng the t me value of money Not avai *ab e for I.E graduate credit Prerequisite. MAT 270*

510 Measurement of Productivity. (3) F
The eng neer ng economic aud t and its use with applica t ons to break even analys s var able budget control cost analysis and product pr c ng Prerequ s tes ECE 383 or 500, EE 330 or equ va ent

511 Analysis of Decision Processes. (3) F
Methods of mak ng dec s ons n complex env ronments stat stica dec sion theory; effects of r sk, uncerta nty and strategy on eng neering and manager a decis ons. Pre requ s te· ECE 383 or 500.

520 Ergonomics Design. (3) S
Human phys o og cal and psycholog cal factors in the de- s gn of work env ronments and in the employment of peop e n man machine systems. Open shop lab ass gn ments in addition to c ass work. Prerequ s te IEE 437 or 547.

531 Topics in Engineering Administration. (3) S
Cons derat on given to ph osoph cal, psychological, pol t cal and soc al imp ications of adm nistrative decis ons. Prerequ site· IEE 431 or 541

533 Scheduling and Network Analysis Models. (3) S
App cat on of schedul ng and sequencing a gor thms de- term n stic and stochast c network ana ysis, and f ow algo- rithms. Prerequ s tes: ECE 383 or 500, IEE 476 or 546

540 Engineering Economy. (3) S
Equipment rep acement ana ys s, treatment of nflation in cash flow stud es and considerat on of r sk and uncer tainty Open on y to students w thout prev ous cred t for EE 411 Prerequ s te EE 300 or 503

541 Engineering Administration. (3) F, SS
Eng neer ng organ zat on and adm n stration; ntroduct on to dec s on making quant tat ve and qua itative ap proaches to management and engineer ng administrat on. Open only to students w thout prev ous cred t for EE 431.

542 Information System Design. (3) F, SS
Emphasis on the app cat on of system ana ys s and de s gn to nformation systems Microprocessor MIS project requ red. Open on y to students w thout prev ous cred t for EE 422 Prerequ s te IEE 330 or equ va ent.

543 Computer-Aided Manufacturing and Control. (3) F, S
Emphasis on computer control in manufacturing rea time concepts. CIM, NC, group technology and process p an n ng robot cs Open on y to students w thout previous cred t for EE 463 Prerequ s te. IEE 330 or equ valent

544 Computer-Integrated Design. (3) F S
Use of CAD too s to create geometric objects and layout designs Design nterfac ng through database structure *with manufacturing p ann ng contro functions* ncludes open shop des gn lab assignments n addit on to c ass room work Open on y to students w thout previous cred t for IEE 464. Prerequ sites. ECE 106, IEE 330 or equ va ent

ENGINEERING

545 Introduction to Simulation. (3) F, S
Use of simu ation in the ana ys s and des gn of network and discrete systems Methods for us ng a simu at on lan guage. Introduct on to stat st cal aspects of simu at on Open only to students w thout previous cred t for EE 475 Prerequisites: ECE 383 or 500 EE 330 or equivalent

546 Operations Research Techniques Applications. (4) F, S
Top cs nclude l near programm ng network opt m'zat on dynamic programm ng Markov processes and queueing mode s Emphas s on the design and deve opment of mode s for solving dec sion problems n ndustr al systems Open only to students without prev ous credit for EE 476. Prerequisites: ECE 383 or 500 MAT 242

547 Human Factors Engineering. (3) F
Study of people at work design ng for human perform ance effectiveness and productiv ty. Considerat ons of human phys o og ca and psycho ogical factors Open on y to students without prev ous cred t for IEE 437. Prerequ s te: IEE 367 or equ va ent.

548 Industrial Engineering Analysis. (3) S
Labor mater a and overhead cost ana ys s, parametr c cost est mat ng r sk analys s nvolving budget im tations, assurance of est mates, qua ty cost systems, l fe cyc e analysis inc ud ng effects on eng neer ng des gn, re ab l ity ma ntainab ty, serviceab l ty testabi ty and avai ab ity. Open on y to students w thout previous credit for IEE 488 Prerequ s tes ECE 383 or 500; IEE 300 or 503.

560 Database Concepts for Industrial Management Systems. (3) F
Appl cat on of data base concepts to ndustria systems problems. Topics include conceptua modeling, data structures, database software, and perspect'ves from ex pert and know edge base systems Prerequ s tes ECE 383 or 500, EE 422 or 542

561 Production Control Information Systems. (3) F
Development of information system des gns for produc- t on contro Top cs inc ude MRP I, MRP I schedu ng sequenc ng and nventory contro On- ne des gn con cepts are covered Prerequis tes ASE 485 or 500 IEE 461; MAT 242.

563 Systems Analysis for Distributed Systems. (3) S
Ana ysis and des gn of d str buted systems for computer ntegrated manufactur ng and nformation process ng Concepts of host dr ven microprocessors to col ect, store and commun cate data Prerequ s tes· ECE 383 or 500, EE 422 or 542

564 Planning for Computer-Integrated Manufacturing. (3 F
Theory and use of IDEF methodology n planning for f ex- b e manufacturing robot cs and rea -t me contro S mu a t on concepts app ed to computer integrated manufactur ng p ann ng. Prerequ s te: EE 463 or 543.

565 Computer-Integrated Manufacturing Research. (3) S
Determ nat on and eva uation of research areas n com puter ntegrated manufactur ng nc uding rea time soft ware manufactur ng nformat on systems, flexib e and n tegrated manufacturing systems robot cs, computer graph cs Prerequis te IEE 564

566 Simulation in Computer-Integrated Manufacturing Planning. (3) S
Use of s mu at on n the p ann ng of computer ntegrated manufactur'ng p ann ng re ated to robot cs f exible and ntegrated manufactur ng systems Use of computer graph cs comb ned w'th s mu at on ana ys s for CIM dec sion support. Prerequ s te: EE 475 or 545.

567 System Simulation. (3) S
Use of simu ation in the ana ys s and des gn of systems nvo v ng cont nuous and d screte processes; s'mu ation anguages; stat stica aspects of s mulat on Prerequ s te IEE 475 or 545

569 Advanced Statistical Methods. (3) S
Appl cation of stat stical 'nference procedures, based on ranks, to eng neering problems Eff c ent alternatives to c assica statist cal nference constra ned by normal ty as sumptions Prerequ s te· ASE 485 or 500

570 Advanced Quality Control. (3) F
Economic based acceptance sampl ng multiattr bute ac ceptance samp ng, narrow mit gaug ng n nspector error and attr butes acceptance sampl ng, pr nc ples of qua ty management, se ected topics from current l terature. Pre requ s tes ASE 485 or 500; EE 374.

571 Quality Management. (3) S
Tota quality concepts qual ty strateg es, qua ity and com- pet t ve posit on qua ty costs, vendor re ations, the qual ty manual, qual ty in the serv ces Prerequ s te· IEE 431 or 541

572 Design of Engineering Experiments. (3) F
Analys s of variance and exper menta des gn Top cs n c ude genera des gn methodo ogy ncomplete blocks, confounding, fract ona rep cat on, response surface methodo ogy Prerequ s te· ASE 485 or 500.

573 Reliability Engineering. (3) S
Top cs nc ude the nature of re ab ity, t me to fai ure den s ties, espec a y the exponent a and We bu , ser es par allel standby systems, complex system re iabil ty, Baye s an re ab ity ana ys s and sequent al rel ab' ty tests. Pre requ s te: ECE 383 or 500.

574 Applied Deterministic Operations Research Models. (3) F
Formu ation so ution ana ysis and app ication of deter m n stic models n operat'ons research, inc ud ng those of l near programm'ng, nteger programm ng, and non near programm ng. Prerequisite· IEE 476 or 546.

575 Applied Stochastic Operations Research Models. (3) S
App cat on of stochastic mode s inc ud ng nventory the ory, queue ng theory, Markov processes, stochastic pro gramm ng, and renewal theory. Prerequ sites: ASE 485 or 500 EE 476 or 546

576 Applications of Operations Research. (3) F
Case stud es of appl cat on of near and non inear mode s and general types of search techn ques. Prerequisite IEE 574 or instructor approva .

577 Decision and Expert Systems Methodology. (3) S
Systems approach to the ana ys's design and mplemen tat on of dec s on support systems Emphasis on devel opment of databases mode bases d a ogs, and systems arch tecture as we as systems effectiveness. Introduc- t on to expert systems as dec sion a d included Term project requ red Prerequ site IEE 422 or 542

579 Time Series Analysis and Forecasting. (3) F
Forecast ng t me ser es by the Box Jenk ns and exponen tial smooth'ng techn ques exist ng d g ta computer pro grams are uti zed to augment the theory Prerequ s tes. ASE 485 or 500· EE 461

678 Advanced Decision Theory. (3) S
Advanced decision theory techn ques for ndustria sys tems. Top cs nclude conjugate fami es of d stributions, va ue theory decis ons w th mu tip e object ves, and goa programming. Prerequ site IEE 511

681 Reliability, Availability and Serviceability. (3) F Includes organizing for RAS, hardware and software RAS, integrity and fault-tolerant design, maintenance design and maintenance strategy, Markov models for RAS, fault-free analysis and military standards for RAS. Prerequisite: ECE 383 or 500.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

Mechanical and Aerospace Engineering

PROFESSORS:
BOYER (ECG 346C), BEAKLEY, BICKFORD, CHEN, DAVIDSON, EVANS, FLORSCHUETZ, HIRLEMAN, JACOBSON, JANKOWSKI, KRAJCINOVIC, LOGAN, METZGER, NEITZEL, NELSON, ROY, SARIC, SCHMIDT, SO, WALLACE, WOOD, YAO

ASSOCIATE PROFESSORS:
FERNANDO, LAANANEN, LIU, PECK, RANKIN, REED, SHAH, TONG, WIE

ASSISTANT PROFESSORS:
BILIMORIA, BLECHSCHMIDT, CASTELAZO, HENDERSON, KOURIS, KUO, MAJUMDAR, McNEILL, MIGNOLET, NATSIAVAS, WELLS

PROFESSORS EMERITI:
ALLEN, AVERY, DITSWORTH, FRY, KAUFMAN, PRICE, RICE, SHAW, THOMPSON, TURNBOW, WILCOX, WOOLDRIDGE

The Department of Mechanical and Aerospace Engineering is the administrative home for two undergraduate majors:

Aerospace Engineering
Mechanical Engineering

Both 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 students an education in technological areas critical to the design and development of aerospace vehicles and systems. Aerospace Engineering graduates are typically employed at government laboratories (i.e., NASA) and in a wide range of aerospace industries. The *Mechanical Engineering* major is perhaps one of the most broadly applicable programs in engineering, providing education for a wide variety of employment opportunities.

The two majors, discussed in more detail below, can serve as entry points to immediate professional employment or to graduate study. The emphasis in all fields is on development of fundamental knowledge that 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 or special programs that emphasize primarily current applications or specific industries.

Degree Requirements

All degree programs in the department require that students attain a minimum GPA of 2.00 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 331 as part of the engineering core requirements, students in the Department of Mechanical and Aerospace Engineering are required to select the following:

			Semester Hours
ECE	210	Engineering Mechanics I: Statics	3
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics	3
ECE	350	Structure and Properties of Materials	3

The microcomputer/microprocessor course, when required by a degree requirement, must be:

			Semester Hours
MAE	405	Microcomputer-Aided Processes for MAE	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

First Semester			*Semester Hours*
CHM	114	General Chemistry for Engineers or CHM 116 General Chemistry (4)	4
ECE	105	Introduction to Languages of Engineering	3

ENG	101	First Year Composition	3
MAT	290	Calculus I	5
General Studies Elective (HU or SB)			3
		Total	18

Second Semester

ECE	106	Introduction to Computer Aided Engineering	3
ENG	102	First-Year Composition	3
MAT	291	Calculus II	5
PHY	121	University Physics I. Mechanics	3
PHY	122	University Physics Lab I	1
General Studies Elective (HU or SB)[1]			3
		Total	18

Sophomore Year

First Semester

ECE	210	Engineering Mechanics I· Statics	3
MAT	242	Elementary Linear Algebra	2
MAT	274	Elementary Differential Equations	3
PHY	131	University Physics II Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
Literacy and Critical Inquiry Elective[2]			3
General Studies Elective (HU or SB)[1]			3
		Total	18

Second Semester

ECE	301	Electrical Networks I	4
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics	3
ECE	350	Structure and Properties of Materials	3
ECE	386	Partial Differential Equations for Engineers	2
		Total	18

[1] See pages 55 87 for the specific requirements and the approved list.

[2] See page 288 for special requirements and selection of an LI elective.

Aerospace Engineering—B.S.E.

The primary concern of aerospace engineers is the design and development of a wide variety of aircraft and space vehicles and systems. 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 medicines, and the design of solar power satellites.

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

Aerospace Engineering Major

Aerospace Engineering students are required to select the following courses in the engineering core:

			Semester Hours
ECE	333	Electrical Instrumentation or MAE 405 Microcomputer Aided Processes for MAE (3)	3
ECE	386	Partial Differential Equations for Engineers	2
MAT	242	Elementary Linear Algebra	2
PHY	361	Introductory Modern Physics	3

The Aerospace Engineering major consists of:

			Semester Hours
MAE	317	Dynamic Systems and Control	3
MAE	361	Aerodynamics I	3
MAE	413	Spacecraft Dynamics and Control	3
MAE	416	Aerospace Vibrations	4
MAE	425	Aerospace Structures I	3
MAE	426	Aerospace Structures II	4
MAE	441	Design Theory and Techniques	3
MAE	460	Gas Dynamics	3
MAE	461	Aerodynamics II	3
MAE	462	Dynamics of Flight	3
MAE	463	Propulsion	3
MAE	464	Aerospace Laboratory	2
MAE	467	Aircraft Performance	3
MAE	468	Aerospace Systems Design	3
Area of Emphasis Technical Electives			8 or 9
		Total	51 or 52

Aerospace Engineering Areas of Emphasis

Technical electives may be selected from among any of the courses listed below or from courses listed under the Mechanical Engineering areas of emphasis. The courses are grouped so that the student may select an elective package of closely related courses. A student may, with prior approval of the advisor and department, select a general area and a corresponding set of courses not listed below that would support a career objective not covered by the following categories.

Aerodynamics. MAE 434, 466, 471, 490; MAT 466.

Aerospace materials. ECE 383; MSE 355, 420, 440, 441, 450, 470.

Aerospace structures ECE 383; MAE 404, 490; MSE 470.

Computer methods. ASE 485; CSC 310, 320, 422, 428, ECE 383; IEE 463, 464, 475; MAE 403, 404, 405, 406, 471, 541; MAT 464, 465, 466.

Design MAE 341, 403, 404, 406, 435, 442, 446, 466, 490; MSE 440, 441, 470.

Engineering Mechanics. MAE 341, 402, 404, 442, 471; MAT 464, 466.

Mechanical Engineering. Any courses listed under Mechanical Engineering areas of emphasis.

Propulsion MAE 382, 434, 436, 465, 489, 490.

System dynamics and control. CSC 428; ECE 383; EEE 480, 482; MAE 417, 447, 490

Aerospace Engineering
Program of Study
Typical Last Two-Year Sequence

Junior Year

First Semester			*Semester Hours*
ECE	333	Electrical Instrumentation or MAE 405 Microcomputer Aided Processes for MAE 3)	3
MAE	317	Dynamic Systems and Control	3
MAE	361	Aerodynamics I	3
MAE	413	Spacecraft Dynamics and Control	3
MAE	425	Aerospace Structures I	3
PHY	361	Introductory Modern Physics	3
		Total	18
Second Semester			
MAE	426	Aerospace Structures II	4
MAE	441	Design Theory and Techniques	3
MAE	460	Gas Dynamics	3
MAE	467	Aircraft Performance	3
General Studies Elective (HU or SB)			3
		Total	16

Senior Year

First Semester			
MAE	416	Aerospace Vibrations	4
MAE	461	Aerodynamics II	3
MAE	462	Dynamics of Flight	3
MAE	463	Propulsion	3
General Studies Elective (HU or SB)[1]			3
		Total	16
Second Semester			
ECE	400	Engineering Communications	3
MAE	464	Aerospace Laboratory	2
MAE	468	Aerospace Systems Design	3
Technical Electives			9
		Total	17

See pages 55 87 for the requirements and the approved list.

Energy Systems Engineering—B.S.E.

The Energy Systems Engineering program is currently under review by the faculty senate for possible elimination. For information about this major, contact the Department of Mechanical and Aerospace Engineering, ECG 346, 602 965 3201.

Mechanical Engineering—B.S.E.

Mechanical engineering is a creative discipline that draws upon a number of basic sciences to design the devices, machines, processes, and systems that 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 power plants; 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 products 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 society. 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: the principles governing the use of energy; the 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 select the following in the engineering core:

			Semester Hours
ECE	333	Electrical Instrumentation	3
ECE	386	Partial Differential Equations for Engineers	2
MAE	405	Microcomputer-Aided Processes for MAE	3
MAT	242	Elementary Linear Algebra	2
PHY	361	Introductory Modern Physics	3

The Mechanical Engineering major consists of:

			Semester Hours
ECE	384	Numerical Analysis for Engineers I	2
MAE	317	Dynamic Systems and Control	3
MAE	318	Dynamic Systems and Control Laboratory	1
MAE	371	Fluid Mechanics	3
MAE	372	Fluid Mechanics	4
MAE	382	Thermodynamics	3
MAE	415	Vibration Analysis	4
MAE	422	Mechanics of Materials	4
MAE	441	Design Theory and Techniques	3
MAE	442	Mechanical Systems Design or MAE 446 Thermal Systems Design (3)	3
MAE	443	Engineering Design	3
MAE	488	Heat Transfer	3
MAE	491	Experimental Mechanical Engineering	3
MAE	490	Projects in Design and Development	2
Area of Emphasis (Technical) Electives			7–8
Total			48–49

Mechanical Engineering Areas of Emphasis

Technical electives may be selected from among any of the courses listed below or from courses listed under the Aerospace Engineering areas of emphasis. The courses are grouped so that the student may select an elective package of closely related courses A student may, with prior approval of the advisor and department, select a general area and a corresponding set of courses not listed below that would support a career objective not covered by the following categories.

Aerospace. Any courses listed under Aerospace Engineering areas of emphasis.

Biomechanical. BME 411, 412, 416, 419, 517 (recommended), EEE 302, 434.

Computer methods ASE 485; CSC 310, 320, 422, 428; ECE 383; IEE 463, 464, 475; MAE 403, 404, 405, 406, 471, 541; MAT 464, 465, 466.

Control and dynamic systems. CSC 428; ECE 383; EEE 360; IEE 463; MAE 413, 416, 417, 447, 462, 467.

Design MAE 341, 351, 403, 404, 406, 417, 434, 435, 438, 442, 446, 447.

Energy systems EEE 360; MAE 430, 434, 435, 436, 437, 438, 446.

Engineering mechanics MAE 341, 402, 404, 413, 426, 442, 460, 461, 471; MAT 464, 466.

Manufacturing CSC 428; IEE 300, 374, 411, 461, 463; MAE 341, 351, 403, 404, 442, 447; MSE 355, 420, 431, 440.

Stress analysis, failure prevention and materials. ECE 383; MAE 341, 404, 426, 447; MSE 355, 420, 431, 440, 450.

Thermosciences. MAE 336, 402, 430, 434, 435, 436, 437, 446, 460, 463, 471.

Mechanical Engineering Program of Study Typical Last Two-Year Sequence

Junior Year

First Semester

			Semester Hours
ECE	333	Electrical Instrumentation	3
ECE	384	Numerical Analysis for Engineers I	2
MAE	371	Fluid Mechanics	3
MAE	382	Thermodynamics	3
MAE	422	Mechanics of Materials	4
PHY	361	Introductory Modern Physics	3
Total			18

Second Semester

MAE	317	Dynamic Systems and Control	3
MAE	318	Dynamic Systems and Control Laboratory	1
MAE	372	Fluid Mechanics	4
MAE	441	Design Theory and Techniques	3
MAE	488	Heat Transfer	3
Microcomputer Elective			3
Total			17

Senior Year

First Semester

MAE	415	Vibration Analysis	4
MAE	442	Mechanical Systems Design or MAE 446 Thermal Systems Design (3)	3
MAE	491	Experimental Mechanical Engineering	3
Technical Electives			4
General Studies Elective (HU or SB)[1]			3
Total			17

Second Semester

ECE	400	Engineering Communications	3
MAE	443	Engineering Design	3
MAE	490	Projects in Design and Development	2
Technical Electives			4
General Studies Elective (HU or SB)[1]			3
Total			15

[1] See pages 55 87 for the requirements and the approved list.

Special Programs

An engineering mechanics option is available under the Engineering Special Programs. See pages 377 378 for details and course requirements.

MECHANICAL AND AEROSPACE ENGINEERING

MAE 317 Dynamic Systems and Control. (3) 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 Prerequisites: ECE 301, 312 Corequisite (except Aerospace Engineering majors) MAE 318

318 Dynamic Systems and Control Laboratory. (1) F S
Corequisite: MAE 317 or instructor approval

336 Air Conditioning and Refrigeration. (3) F
Refrigeration cycles, refrigerant properties, heating, cooling loads; psychrometry, purification; temperature and humidity control. Prerequisite MAE 382 or MET 432 or instructor approval.

341 Mechanism Analysis and Design. (3) F
Positions, velocities and accelerations of machine parts, cams, gears, flexible connectors rolling contact introduction to synthesis. Prerequisite: ECE 312

351 Manufacturing Processes Survey. (3) F S
Production techniques and equipment. Casting and molding, pressure forming, material removal joining and assembly processes, automation and material handling. Lecture, recitation Prerequisite: ECE 350

361 Aerodynamics I. (3) F S
Fluid statics, conservation principles stream function velocity potential, vorticity inviscid flow, Kutta Joukowski thin airfoil theory, panel methods Prerequisites ECE 312, 340.

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, demonstrations. Prerequisites ECE 384, 386; MAE 371

382 Thermodynamics. (3) F, S
Applied thermodynamics gas mixtures psychometrics property relationships, power and refrigeration cycles, and reactive systems. 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 313 MAE 361 or 371 MAT 242

403 CAD Systems Development. 3) S
Design, implementation of CAD System, user interface design computer graphics, data structures, extensive code development Prerequisites ECE 105 or equivalent, junior standing in program

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: ECE 313; MAT 242.

405 Microcomputer-Aided Processes for MAE. (3) F S
Microcomputer and microprocessor fundamentals Overview of programming languages, input/output, interfacing and analog/digital conversion data acquisition, control applications. Prerequisite CSC 100 or ECE 106 *[Satisfies General Studies Requirement. N3]*

406 CAD CAM Applications in MAE. (3) F
Solution of engineering problems with the aid of state-of the art software tools in solid modeling, engineering analysis and manufacturing; sensitivity of modeling parameters, reliability tests on software. Prerequisite instructor approval.

413 Spacecraft Dynamics and Control. (3) F S
Kinematics of particles and rigid bodies Euler's moment equations satellite orbits and maneuvers, spacecraft attitude dynamics and control. Prerequisites ECE 312 MAT 242

415 Vibration Analysis. (4 F, S
Free vibration and forced response of single and multiple degree of freedom systems continuous systems numerical methods Lecture, lab Prerequisites: ECE 312 MAE 422

416 Aerospace Vibrations. (4) F, S
Finite degree of freedom systems, self excited systems· one dimensional continuous system vibrations; two dimensional flutter theory flutter analyses using normal modes Prerequisites MAE 361, 425

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

422 Mechanics of Materials. (4) F S
Failure theories energy methods finite element methods, plates, torsion of noncircular members unsymmetrical bending shear center, beam column Lecture, lab Prerequisites ECE 313 MAT 242

425 Aerospace Structures I. (3 F, S
Stability, energy methods torsion, curved bars finite elements circular plates unsymmetrical bending Prerequisites ECE 313 MAT 242

426 Aerospace Structures II. 4 F, S
Flight vehicle loads, semimonocoque structures, buckling fatigue, aerospace materials, composites joints finite element applications. Lecture lab. Prerequisite MAE 425.

430 Introduction to Nuclear Engineering. (3) F
Neutron interact ons with matter. Pr nc ples of neutron cha n reacting systems Neutron d ffus on and modera t on Heat remova from nuc ear reactors Point reactor k - net cs. Prerequ s te PHY 361

434 Internal Combustion Engines. (3) S
Performance characterist cs combust on, carburet on and fuel injection coo ng and control of nternal combust on eng nes Computer model ng Lab demonstrat ons Pre requ site MAE 382

435 Turbomachinery. (3) S
Des gn and performance of turbomach nes nclud ng steam gas and hydraul c turb nes, centrifuga pumps compressors, fans, and b owers. Corequisite. MAE 372 or 461

436 Combustion. 3) N
Thermochem ca and react on rate processes combust on of gaseous and condensed phase fuels. Appl cations to propuls on and heat ng systems. Po lutant format on Prerequis te· MAE 382

437 Direct Energy Conversion. (3 N
Unconvent ona methods of energy convers on, fue cel s, thermoe ectr cs, therm on cs, photovo ta cs and magne tohydrodynamics Prerequisites: ECE 340 350

438 Solar Energy. (3) S
So ar rad at on and instrumentat on des gn and test ng of co ectors performance ana yses of systems, therma storage, photovo ta cs mater als and econom c ana ysis. Prerequis tes MAE 382, 488.

441 Design Theory and Techniques. 3 F S
The des gn process problem defin t on, conceptua de s gn form and funct on, dec s on mak ng materia se ec t on manufacturab ty modes of fa ure fatigue, profes s ona sm, and eth cs Prerequ sites ECE 106, 350 MAE 422 or 425

442 Mechanical Systems Design. (3 F, S
Appl cat on of design pr nc p es and techn ques to the synthesis, mode ng and opt mizat on of mechan ca e ec tromechan cal, and hydrau c systems Prerequ s te· MAE 441.

443 Engineering Design. (3) F S
Group projects to des gn engineer ng components and systems. Problem defin tion deation model ng and ana ysis dec sion making and documentat on activit es emphas zed 6 hours ab Prerequ s te· MAE 442 or 446

446 Thermal Systems Design. (3 F
App cat on of eng neering pr ncip es and techn ques to the mode ing and analys s of therma systems and com ponents Opt mization techn ques are presented and their use demonstrated Prerequ s te MAE 441

447 Robotics and Its Influence on Design. (3 S
Robot app cat ons conf gurat ons, s ngu ar posit ons, and work space modes of contro vis on, programm ng exer c ses design of parts for assemb y Prerequisite MAE 317.

460 Gas Dynamics. 3) F S
Compress ble f ow at subson c and supersonic speeds· duct f ow, norma and ob que shocks perturbation theory, w nd tunnel des gn. Prerequ s te· MAE 361 or 371

461 Aerodynamics II. (3) F S
Transon c hyperson c f ows w ng theory, Nav er Stokes, am nar turbu ent shear flows pressure drop n tubes, separation drag v scous nvisc d interact on wing des gn. Prerequ s te MAE 460.

462 Dynamics of Flight. (3 F,S
Aerodynam c forces and moments, static stab l ty and contro equations of motion, stab l ty der vatives, latera and ong tud na mot on and control. Prerequis tes· MAE 413 467

463 Propulsion. (3) F S
App cat on of gas dynam cs and thermodynamics to air-breath ng eng nes and rockets emphasis on turbojet, tur-bofan and turboprop eng nes Corequ s te· MAE 460

464 Aerospace Laboratory. 2 F S
Measurements of aerodynam c parameters n both sub son c and superson c f ows· f ow over airfo s and bod es of revo ut on Flow v sual zat on Computer aided data acqu s t on and process ng Lecture lab. Prerequisite MAE 460 Pre or corequ s te MAE 461

465 Rocket Propulsion. (3 S
Rocket f ight performance, nozz e des gn; combustion of l qu d and so d prope lants component des gn; advanced propu s on systems nterp anetary m ssions test ng Pre requ s te MAE 460.

466 Rotary Wing Aerodynamics and Performance. 3) F S
ntroduct on to he copter and prope er ana ys s tech-n ques Momentum, b ade e ement, vortex methods Hover and forward f ight Ground effect autorotation, compress bi ity effects. Prerequis tes ECE 386 MAE 361 or instructor approva

467 Aircraft Performance. 3 F S
Techn ca aspects of f ght, ntegrat ng aerodynamic pr n-c ples re ating to ft drag and thrust w th power operat ng character st cs performance of an a rp ane ana yzed as a system Prerequ s te. MAE 361. Pre or corequ s te MAE 441.

468 Aerospace Systems Design. (3) F S
Group projects re ated to aerospace veh cle design, work ng from m ss on defin tion and cont nu ng through prelim nary design; dec s on mak ng and commun cation act v ties emphas zed Prerequ s tes. MAE 426, 441 462

471 Computational Fluid Dynamics. 3) F
Numer ca so utions for se ected prob ems n f uid me chan cs. Prerequ s te: MAE 372 or 461

488 Heat Transfer. 3 F, S
Steady and unsteady heat conduct on nc ud ng numerical solut ons therma boundary layer concepts and app ica t ons to free and forced convect on Therma rad ation concepts. Lab exper mentat on, demonstrat ons. Pre requ s te· MAE 371

489 Thermophysics. (3 F
Bas c pr nc p es of heat transfer and their app cat on to aerospace systems, propu sion dev ces, spacecraft ther ma contro and waste heat reject on systems Prerequi s te· ECE 340

490 Projects in Design and Development. 2) F, S
Capstone projects n fundamental or app ed aspects of eng neering Prerequ sites Mechan ca Eng neering and Energy Systems Eng neer ng ma ors MAE 441, 491, En g neer ng Spec a Programs eng neering mechan cs ma jors· MAE 422

491 Experimental Mechanical Engineering. (3) F, S
Exper menta and analyt ca studies of phenomena and performance of f u d f ow heat transfer thermodynam cs refr gerat on, and mechan cal power systems. 6 hours ab Prerequ s tes ECE 333 or microcomputer elective MAE 372, 382, 488.

498 Pro-Seminar. (1 3 N
Special top cs for advanced students. Appl cat on of the eng neering disc p nes to des gn and ana ysis of modern techn cal dev ces and systems Prerequ s te instructor approval.

504 Laser Diagnostics. (3) S
Fundamentals of opt cs and the 'nteract on of with matter Laser sources aser spectroscopy ve oc metry, partic e s z ng, and surface characterization

505 Perturbation Methods in Mechanics. 3) N
Non near osci ations, stra ned coord nates, renormal za t on, mu tiple sca es, boundary ayers matched asymp tot c expans ons turn ng po nt prob ems, WKBJ method

506 Advanced System Modeling, Dynamics and Control. (3) S
Lumped parameter modeling of phys ca systems w th examples. State variab e representat ons and dynam c response ntroduct on to modern contro Prerequ site. ASE 582 or MAT 442.

507 Optimal Control Theory and Application. (3) F
Opt ma contro of physical systems Ca cu us of vari at ons, Pontryagin s pr nc p e m n mum t me fue prob ems, l near quadrat c regu ator and numerica methods Prerequis te: MAE 506

510 Dynamics and Vibrations. (3) F
Lagrange s and Ham lton s equat ons r gid body dynam cs, gyroscop c mot on smal osc ation theory

511 Acoustics. 3) F
Princ ples under ying the generat on, transmiss on and re cept on of acoustic waves Appl cations to no se contro arch tectura acoust cs random v brations acoust c fa tigue

512 Random Vibrations. *(3 S*
Rev ew of probab ty theory random processes, station arity, power spectrum wh te noise process, random re sponse of s ng e and mu t p e DOF systems Markov proc esses simu at on Prerequ s tes MAE 510 or nstructor approva

515 Structural Dynamics. (3) S
Free vibrat on and forced response of discrete and con t nuous systems, exact and approx mate methods of so u tion fin te e ement model ng, computat ona techniques Prerequ s te. MAE 510 or instructor approval.

517 Nonlinear Oscillations. 3) F
Ex stence, stab l ty and b furcation of solut ons of non n ear dynam cal systems Methods of analysis of regu ar and chaot c responses. Prerequ s te MAE 510 or nstruc tor approval

518 Dynamics of Rotor-Bearing Systems. (3) S
Natural whirl frequency cr t ca speed and response ana ys s of r g d and f ex ble rotor systems Bear ng nf u ence and representat on Stabi ty ana ysis Methods of ba anc ng

520 Solid Mechanics. (3) F
ntroduction to tensors k nematics k net cs, and const tu t ve assumpt ons lead ng to e astic, p astic, and v scoelas- tic behavior. Applications

522 Variational Principles of Mechanics. (3 S
V rtua work, stat onary and comp ementary potent a en erg es Ham ton's princ p e App cation of these and d rect methods to vibrat ons elasticity and stab ty. Pre requ s te MAE 520 or equ va ent.

523 Theory of Plates and Shells. (3) F
L near and non near theor es of plates Membrane and bend ng theories of shel s She s of revo ution Prerequ - site MAE 520

524 Theory of Elasticity. (3) S
Formu ation and so ution of two- and three dimensional boundary va ue prob ems Prerequ s te. MAE 520

527 Finite Element Methods in Engineering Science. (3) F
Discret zation 'nterpo ation e ementa matrices, assem b y computer implementat on Application to so id and f uid mechan cs, heat transfer, t me dependent prob ems. Prerequisite. ASE 582

529 Theory of Elastic Stability. (3) S
Stab ity of discrete and cont'nuous mechan cal systems Stabil ty of conservat ve and nonconservat ve systems Dynam c instab l ty Prerequ s te: MAE 523.

536 Combustion. (3) N
Thermodynam cs chem ca kinet cs of combust on Ex *plos on and gn t on theories React've gas dynam cs* Structure, propagation and stability of flames; Exper menta methods Prerequ site. MAE 436 or nstructor ap provai.

537 Direct Energy Conversion. (3) N
Advanced se ected top cs in d rect energy convers on, theory, des gn, and applicat ons Cross listed as MSE 533 Prerequisite. MAE 581

541 CAD Tools for Engineers. (3) F
E ements of computer techn ques required to deve op CAD software Data structures inc uding sts trees, and graphs. Computer graph cs nc ud ng 2 D and 3-D a go rithms and user nterface techn ques

542 Geometric Modeling in CAD CAM. (3) S
Geometr c and sol d mode ng, curve and surface design, CAD database arch tectures, ntegrat on of so d mode ng into eng neer ng processes Prerequ site MAE 541 or instructor approva

544 Mechanical Design and Failure Prevention. 3 F
Modes of mechan ca fa lure; appl cat on of principles of e ast c ty and p astic ty n mu t ax a state of stress to de s gn synthes s, fai ure theor es fatigue creep; impact. Prerequ s te MAE 443

546 CAD CAM Applications in MAE. 3 F
So ut on of eng neer ng prob ems w th the a d of state of the art software tools n solid mode ing, eng neer ng ana ys s and manufactur ng; se ection of model ng para meters, rel ab ty tests on software Open only to stu dents w thout prev ous cred t for MAE 406 or with nstruc- tor approval

547 Mechanical Design and Control of Robots. (3) N
Homogeneous transformations, three d mens onal k ne mat cs geometry of mot on, forward and inverse k nemat ics, workspace and mot on trajectories dynamics contro stat c forces

548 Mechanism Synthesis and Analysis. (3) S
A gebraic and graphica methods for exact and approxi mate synthesis of cam, gear and nkage mechan sms; design optim zation methods of planar motion ana ys s; character st cs of plane mot on, spat al kinematics

557 Mechanics of Composite Materials. 3) S
Ana ys s of compos te mater a s and app cations Mi cromechan ca and macromechanica behav or Classical *aminat on theory developed w th nvest gat on of bend ng* extension coupl ng

560 Propulsion Systems. (3) N
Design of a r breath ng gas turb ne engines for aircraft propu s on m ss on ana ys s cycle ana ysis, engine s z ng; component design

ENGINEERING

561 Computational Aerodynamics. 3) S
Fin te d'fference and f n te vo ume techn ques for so v ng the subson c transon c and superson c f ow equat ons. The method of character st cs Numer ca gr d generat on techn ques Prerequis te. MAE 571 or instructor approva

562 Transonic Flow. (3) F
Transonic flow, nonl near sma d sturbance equat ons m xed f ow w th shock waves Ana yt ca and numer ca treatments for a rfo s App cat ons to w ngs bod es, and turbomach nery. Prerequ s te MAE 460 or 461

563 Unsteady Aerodynamics. (3 S
Unsteady ncompress b e and compress ble f ow Wings and bod es n osc latory and transient mot ons Kernel funct on approach and pane methods. Aeroe ast c app i cations Prerequ s tes· MAE 460 or 461 562.

564 Advanced Aerodynamics. (3) F
Perturbat on method L nearized subson c and super son c f ows Th n w ng s ender body theor es L ft ng sur face theory Pane method computat on Prerequ s te MAE 460 or 461

565 Turbomachinery. (3 N
Design and performance of turbomachines, nc ud ng tur bines, compressors pumps, fans and b owers

571 Fluid Mechanics. 3 F
Bas'c k nemat c dynam c and thermodynamic equat ons of the f u d continuum and the r app icat on to basic f u d mode s.

572 Inviscid Fluid Flow. 3 S
Mechan cs of f uids for f ows in wh ch the effects of v s cos ty may be gnored Potent a f ow theory waves, inv s cid compress b e f ows Prerequ s te MAE 571

573 Viscous Fluid Flow. 3 F
Mechan cs of f u ds for f ows n wh ch the effects of vis cosity are sign ficant Exact and approx mate so ut ons of the Nav er Stokes system aminar f ow at ow and h gh Reyno ds number Prerequ s te MAE 571

574 Viscous, Compressible Fluid Flow. (3) N
Mechan cs of f u ds for f ows n wh ch the effects of com pressibi ity and v scos ty are s gnif cant Compress b e boundary ayers free shear ayers shock waves interna flows. Prerequ s te· MAE 572.

575 Turbulent Shear Flows. 3 F
Homogeneous and isotrop c turbu ence wa turbu ence Exper menta resu ts. Introduct on to turbu ent f ow ca cu ations Prerequ s te MAE 571

577 Turbulent Flow Modeling. (3) S
Reyno ds equations and the r c osure Mode ng of simp e and complex turbu ent f ows calcu at ons of nterna and externa f ows and app cat on to engineer ng problems Prerequis te MAE 571

581 Thermodynamics. 3 F
Bas c concepts and laws of c ass cal equ br um thermo dynam cs App cat ons to eng neering systems

582 Statistical Thermodynamics. 3 N
K net c and quantum theory Stat st cal mechan cs; en semb e theory Structure and thermodynam cs of non n teract ng and nteract ng part cles Bo tzmann ntegro d f ferent a equat on Cross sted as MSE 531 Prerequ s te· MAE 581

585 Conduction Heat Transfer. 3 F
Basic equat ons and concepts of conduct on heat transfer Mathemat ca formu at on and so ut on ana yt cal and numer ca of steady and unsteady, one and mu t d men s ona heat conduct on and phase change prob ems Pre requ s tes. ECE 386; MAE 488

586 Convection Heat Transfer. 3 S
Bas c concepts and govern ng equat ons Ana ys s of am nar and turbu ent heat transfer for nternal and exter na f ows Natura and m xed convect on Prerequ s te MAE 488

587 Rad ation Heat Transfer. 3 F
Advanced concepts and so ut on methodo og es for rad a t on heat transfer nc ud ng exchange of therma rad at on between surfaces rad at on n absorb ng, em tt ng and scatter ng med a and rad at on comb ned w th conduct on and convect on Prerequ s te. MAE 488.

588 Two-Phase Flows and Boiling Heat Transfer. 3 S
Poo and f ow bo g heat transfer condensat on heat transfer var ous mode s of vapor qu d m xture flows, gas so d m xture f ows exper menta measurement tech n ques

589 Heat Transfer. 3 F
Bas c concepts phys ca and mathemat ca models for heat transfer. App cat ons to conduct ve, convect ve ra d at ve, and comb ned mode heat transfer Prerequis te MAE 488

594 Graduate Research Conference. 1 F S
Top cs in contemporary research. Requ red every semes ter of a l departmenta graduate students reg stered for 9 or more semester hours Not for degree cred t

598 Special Topics. 1 3 F S
Spec a top cs courses, nc ud ng the fo ow ng, wh ch are regular y offered are open to qua f ed students
a Dynam cs and Control
b Two Phase F ow
c Hydrodynam c Stab ty
d Combust on D agnost cs
e CAD CAM Too s
f) Aeroe ast c ty
g Aerospace Veh c e Gu dance and Contro

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered

Programs in Engineering Special and Interdisciplinary Studies

George C. Beakley Jr., Ph.D., Director

The following degree programs are administered by the Office of the Dean of the College of Engi neering and Applied Sciences:

B S E Engineering Spec al Programs
- Engineer ng Mechanics (see pages 377 378
- Engineer ng Syne gy see pages 378 379
- Manufactur ng Engineering (see page 366
- Microelectronics Manufacturing Engineering see page 379
- Nuclear Sciences see pages 379 380)
- Pre medical Engineering (see pages 381 383

Systems Engineering (see pages 382 383)

B.S. Engineering Interdisciplinary Programs
Engineering Business and Prelaw (see pages 383 384)
Geological Engineering (see page 384)

Descriptions of these majors and options, with their respective program requirements, can be found on the pages indicated.

Purpose

The majors of Engineering Special Programs and of Engineering Interdisciplinary Programs 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 is brought to bear on problems of a large scope. The necessary breadth that these students seek often is not obtainable in traditional engineering fields. Rather, specially 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 (B.S.E.) degree with a major in Engineering Special Programs; and (2) the Bachelor of Science (B S) degree with a major in Engineering Interdisciplinary Programs.

The B.S.E. in Engineering Special Programs is designed primarily for students intending to pursue engineering careers at a professional level in industry or graduate studies. The B.S. in Engineering Interdisciplinary Programs accommodates those students who desire the integrity of an engineering education but who 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 B.S.E. and the B.S have been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Engineering Special Programs—B.S.E.

Engineering Mechanics. The curriculum of the engineering mechanics option is intended for individuals who are interested in pursuing a more basic and theoretical education than is provided by typical curricula in aerospace, civil, or mechanical engineering. This curriculum is particularly suited for individuals whose goals are an increased depth of understanding in the fundamentals of mechanics and the pursuit of an advanced engineering degree, with the ultimate career goal of an academic or research position. Thus, it is strongly recommended that a GPA of at least 3.00 be maintained by all engineering mechanics students.

The engineering mechanics option is based on increased course work in mathematics and the broad field of engineering mechanics, the latter of which includes three interrelated areas: dynamics, fluid mechanics, and solid mechanics. Each of these areas is related to a variety of important and challenging technological problems. Examples include vibration control in space vehicles at launch, optimal design of composite structures, crystal growing in a microgravity environment, fluid transition to turbulence on swept wings, and computer aided modeling of structures ranging from surgical implants to space satellites. The fundamental emphasis of the engineering mechanics program provides the flexibility and understanding that is required to cope with rapidly occurring changes in technology and the needs of society.

This option is administered by the Department of Mechanical and Aerospace Engineering

Engineering mechanics students are required to select the following in the engineering core:

			Semester Hours
ECE	333	Electrical Instrumentation	3
		or ECE 334 Electronic Devices and Instrumentation (4)	
ECE	384	Numerical Analysis for Engineers I	2
ECE	386	Partial Differential Equations for Engineers	2
MAE	405	Microcomputer-Aided Processes for MAE	3
PHY	361	Introductory Modern Physics[1]	3

In addition, the following courses are required:

			Semester Hours
MAE	371	Fluid Mechanics	3
MAE	372	Fluid Mechanics	4
MAE	402	Introduction to Continuum Mechanics	3
MAE	404	Finite Elements in Engineering	3
MAE	413	Spacecraft Dynamics and Control	3
MAE	415	Vibration Analysis	4
MAE	422	Mechanics of Materials	4
MAE	441	Design Theory and Techniques	3
MAE	488	Heat Transfer	3
MAE	490	Projects in Design and Development	2
MAT	342	Linear Algebra	3
MAT	371	Advanced Calculus I	3
		or MAT 460 Applied Real Analysis 3)	
MSE	440	Mechanical Properties of Solids	3
Area of Emphasis (Technical) Electives[2]			6–8
Total			47–49

[1] Basic science elective.

[2] Must include one course of engineering design type

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

Biomechanics. BME 411, 412, 416, 419; EEE 434; MAE 341.

Dynamics MAE 317, 318, 417, 462, 506, 510, 515.

Engineering mathematics. ASE 485, 582, 586; ECE 383, 385; MAT 371, 460, 461, 462; STP 421.

Fluid mechanics. MAE 435, 460, 463, 471, 571.

Solid mechanics. MAE 426, 520, 522, 523, 524, 529.

Engineering Mechanics Program of Study
Typical Last Two-Year Sequence

Junior Year

First Semester			Semester Hours
ECE	333	Electrical Instrumentation	3
		or ECE 334 Electronic Devices and Instrumentation (4)	
MAE	371	Fluid Mechanics	3
MAT	371	Advanced Calculus I	3
		or MAT 460 Applied Real Analysis (3)	
MSE	440	Mechanical Properties of Solids	3
PHY	361	Introductory Modern Physics	3
General Studies Elective (HU or SB)[1]			3
Total			18

Second Semester

ECE	384	Numerical Analysis for Engineers I	2
MAE	372	Fluid Mechanics	4
MAE	404	Finite Elements in Engineering	3
MAE	413	Spacecraft Dynamics and Control	3
MAE	422	Mechanics of Materials	4
Total			16

Senior Year

First Semester

MAE	402	Introduction to Continuum Mechanics	3
MAE	405	Microcomputer Aided Processes for MAE	3
MAE	415	Vibration Analysis	4
MAE	441	Design Theory and Techniques	3
MAE	488	Heat Transfer	3
Total			16

Second Semester

ECE	400	Engineering Communications	3
MAE	490	Projects in Design and Development	2
General Studies Elective (HU or SB)[1]			3
Technical Electives			8
Total			16

[1] See pages 55 87 for the requirements and the approved list

Engineering Synergy. Engineering synergy is the concept of bringing together diverse disciplines, some outside engineering, that interact in an enhanced fashion. This program accommodates those students with broad interests who wish to pursue an individualized engineering degree program that is interdisciplinary in its design and yet provides the proper prerequisites for graduate study in a chosen major. Students may apply for admission to the professional program if they are admitted to the University Honors College or have completed at least 45 semester hours at Arizona State University with a GPA of 3.25 or higher The application for admission to the program must be accompanied by an essay describing the student's reasons for pursuing a synergistic degree program. The program requirements include those of General Studies, the engineering core, and the individualized major, as described under the School of Engineering on pages 330 331. The major requirements are determined and approved by an advisory committee consisting of three faculty appointed by the director of Engineering Special and Interdisciplinary Studies. The student is expected to demonstrate progression in the selected course work. The courses chosen must contain at least 12 hours of

engineering science and 14 hours of engineering design content. The total program of 133 semester hours (excluding university English requirements) must also include at least 50 upper-division hours.

Manufacturing Engineering. This program is administered by the Department of Industrial and Management Systems Engineering (see page 366).

Microelectronics Manufacturing Engineering. This engineering special programs option has been established to prepare a student for a challenging and rewarding career as a microelectronics manufacturing engineer. It is administered by the Department of Electrical Engineering.

The successful demonstration of the first integrated electronic circuit in 1958 led to the creation of a new industry to manufacture these remarkable electronic devices. Today, microelectronic circuits are essential components in products that range from inexpensive, mass produced consumer goods to extremely sophisticated limited production electronic systems.

Microelectronics manufacturing engineers are vitally important participants in every project to develop commercially viable microelectronic products from design prototypes. Their professional participation begins with the design of the production product and continues through all phases of the manufacturing process until the completed product is delivered to the purchaser. Typical responsibilities include device design and evaluation, process design and characterization, equipment procurement and acceptance, quality control, production schedules, resource allocation, and engineering support of production personnel in the manufacturing facility.

Because the responsibilities of a microelectronics manufacturing engineer are so diverse, an interdisciplinary undergraduate program that provides concurrent education in several engineering disciplines, mathematics, and the physical sciences is essential to prepare a student for a career in microelectronics manufacturing engineering. This engineering special programs option provides the desirable concurrent education within the context of a curriculum that meets all ABET accreditation criteria.

The following courses are required as part of the engineering core and mathematics electives:

			Semester Hours
CHM	441	General Physical Chemistry	3
ECE	334	Electronic Devices and Instrumentation	4
ECE	352	Properties of Electronic Materials	3
ECE	383	Probability and Statistics for Engineers	2
EEE/CSC	225	Assembly Language Programming(Motorola) or EEE CSC 226 Assembly Language Programming (Intel) (3)	3
MAT	242	Elementary Linear Algebra	2

Only ECE 313 Introduction to Deformable Solids may be deleted from the engineering core.

In addition, the following courses are required:

			Semester Hours
CHE	461	Process Control	3
CHM	331	General Organic Chemistry or PHY 361 Introductory Modern Physics (3)	3
EEE/CSC	120	Digital Design Fundamentals	3
EEE	302	Electrical Networks II	3
EEE CSC	325	System Design with Microprocessor (Motorola or EEE/CSC 326 System Design with Microprocessor Intel) (3)	3
EEE	435	Microelectronics or UET 418 Hybrid Integrated Circuit Technology (4)	3
EEE	436	Fundamentals of Solid State Devices	3
EEE	439	Semiconductor Facilities and Cleanroom Practices	3
IEE	300	Economic Analysis for Engineers	2
IEE	374	Quality Control or MET 401 Statistical Process Control (3	3
IEE	463	Computer Aided Manufacturing and Control or MET 416 Applied Computer Integrated Manufacturing (3)	3
UET	432	Semiconductor Packaging and Heat Transfer	3
UET	437	Integrated Circuit Testing	3
One of the following Senior Design Projects			3
ASE	490	Project in Design and Development (3)	
CHE	490	Chemical Engineering Projects (3)	
EEE	490	Senior Design Laboratory (3)	
IEE	490	Project in Design and Development (3)	
MSE	490	Capstone Design Project (3)	
UET	415	Electronic Manufacturing Engineering Principles (3)	
Technical Electives			10–11
Total			49 50

Nuclear Sciences. The curriculum of the nuclear sciences option encourages an individualized program based on the student's own career interests and objectives. The program provides a

strong foundation in basic engineering, nuclear, and radiation health physics 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 (1) the discovery, development, or utilization of energy or (2) the materials or products that use, release, or may be affected by radiation

Individual elective programs may also be aligned with a traditional discipline such as chemical, civil, electrical, and 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, radiation damage to electronics, computer-aided operation and accident analysis at power generation facilities, and designing better man machine interfaces. Finally, there are opportunities to pursue selected areas such as waste disposal, radiation effects on electronics in space, biomedical applications, nuclear applications in forensics, low-level radiation measurements of our natural radiation environment, and anomalies from trace amounts of natural radioactivity in computer microprocessing circuits.

Motivated students who have demonstrated scholastic excellence are encouraged to participate in summer research programs at national laboratories or with an industry or in the ASU Nuclear Sciences summer exchange programs at national laboratories or at overseas facilities in Australia, Austria, Israel, Japan, or Switzerland. 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 (only ECE 313 Introduction to Deformable Solids may be deleted):

			Semester Hours
ECE	210	Engineering Mechanics I. Statics	3
ECE	312	Engineering MechanicsII: Dynamics	3
ECE	350	Structure and Properties of Materials or ECE 352 Properties of Electronic Materials (3)	3
EEE/CSC	225	Assembly Language Programming (Motorola) or EEE CSC 226 Assembly Language Programming Intel)(3 or MAE 405 Microcomputer Aided Processes for MAE (3)	3
PHY	361	Introductory Modern Physics (Basic Science Elective)	3

In addition, the following courses are required:

			Semester Hours
EEE/NUC	460	Nuclear Concepts for the 21st Century or MAE 430 Introduction to Nuclear Engineering (3)	3
EEE/NUC	461	Health Physics Principles and Radiation Measurements	3
EEE/NUC	462	Reactor Safety Analysis	3
EEE/NUC	463	Electrical Power Plant	3
EEE/NUC	464	Nuclear Engineering Experiments	3
EEE/NUC	465	Radiation Dosimetry and Instrumentation	3
MAE	371	Fluid Mechanics or EEE 302 Electrical Networks II (3)	3
MAE	382	Thermodynamics or EEE 303 Signals and Filters (3) or EEE 322 Microprocessor Applications (4)	3
MAE	415	Vibration Analysis or EEE 480 Feedback Systems (4)	4
MAE	422	Mechanics of Materials	4
Technical Electives			20
Total			52

NUCLEAR ENGINEERING

NUC 460 Nuclear Concepts for the 21st Century. (3) S
The world energy s tuat on and the ro e of nuc ear power. Nuc ear fiss on and fus on theory The nuclear fue cycle. Ultrasafe reactor designs Rad ation damage to e ectron- cs, nc uding soft errors and space rad at on Current and future app cat ons n nuc ear medic ne, rad o ogy, and food preservat on Cross sted as EEE 460

461 Health Physics Principles and Radiation Measurements. (3) S
Sources characterist cs dos metry, sh e d ng and meas urement techniques for cosmogen c terrestria and an thropogenic rad ation. Ioniz ng and non oniz ng rad at on theory ALARA concept Emphas s on instrumentat on, detectors, and environmental monitoring Lecture lab. Cross sted as EEE 461 and BME 461. Prerequis te ECE 301.

462 Reactor Safety Analysis. (3) S
Power reactor safety and cens'ng methodolog es Reac tor trans ent and accident analysis. T'me dependent so u tion to neutron diffus on equation Use of ndustry codes to assess f ss on product bui d up emergency core cool ng behav or reactiv'ty, off s te releases and dose ca cu at ons Cross l sted as EEE 462. Prerequ s te EEE or NUC 460

463 Electrical Power Plant. (3) F
Nuclear, fossi , and so ar energy sources Ana ysis and des gn of steam supp y systems, electr ca generat ng systems and aux ary systems Power p ant eff c ency, operat on and costs, and ana yses Cross isted as EEE 463. Prerequis tes: ECE 301, 340.

464 Nuclear Engineering Experiments. (3 F
Theory and app ed concepts in reactor design nstru mentat on, electron cs, and sh e d ng. Experimenta meas urements of nuclear parameters us ng subcnt ca reactors and fusion neutron generator Fast and therma act vat on ana ysis. Primary coo ant analysis. Mossbauer spec trometry Lecture, lab. Cross isted as EEE 464 Core qu s te: EEE/NUC 460

465 Radiation Dosimetry and Instrumentation (3) F
Rad at on dos metry and nstrumentat on used at nuc ear power p ants. Calcu at on of externa and nterna rad a t on doses Rad at on b o ogy. Sh eld ng calcu at ons. Cross l sted as EEE 465. Prerequisite. BME EEE NUC 461

566 Medical Imaging Instrumentation. (3) N
Design and analysis of imag ng systems and nuc ear de v ces for medica diagnos s, therapy and research Labo ratory exper ments us ng d agnost c rad o ogy f uoros copy, u trasound and CAT scanning Lecture, ab Cross sted as BME 566 and EEE 566 Prerequ s te. BME 465 or EEE 465 or NUC 465 or nstructor approva .

567 Radiation Shielding and Transport. (3) F
Sh e d ng for rad at on therapy, diagnost c rad o ogy, cyc otrons and nuc ear reactors Monte Carlo and em pir ca computational methods, regulat ons, des gn prob lems. Cross isted as BME 567 and EEE 567 Prerequ s te· BME 465 or EEE/NUC 465

568 Medical Tomography. (3) S
CT SPECT, PET, MR . Three d mensiona *in vivo* meas urements. Instrument des gn, phys'o ogical modeling cl nica protoco s reconstruction a gorithms quantitation issues Cross sted as BME 568 and EEE 568 Pre requ s te BME 465 or EEE/NUC 465

569 Radiochemistry and Radiopharmaceutical Production. (3) N
Advanced pr nc ples of cyclotron des gn targetry opera t on and ut l zat on Nove syntheses, tracer preparat on qual ty contro , b od str but on stud es Cross sted as BME 569 and EEE 569. Prerequ s te. BME 465 or EEE NUC 465.

Omnibus Courses: See pages 48 49 for omn bus courses that may be offered.

Pre-medical Engineering. 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 in volved 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 technol ogy, transport phenomena, biomechanics, bio electric phenomena, operations research and cy bernetics. This option is of special interest to students desiring entry into a medical college and whose medical interests lie in research, aerospace and undersea medicine, artificial organs, prosthe ses, biomedical engineering, or biophysics. Since both engineering and medicine have as their goal the well being of humans, this program is compatible with any field of medical endeavor.

Academic Requirements. In addition to the General Studies requirement, CHM 116 General Chemistry and BIO 181 General Biology (basic science elective) must be selected in the engineering core. Other engineering core requirements are outlined in the area of emphasis descriptions. The following courses required in the pre medical engineering program and have been selected to meet all university and ABET accreditation requirements:

			Semester Hours
BIO	182	General Biology	4
BME	331	Transport Phenomena I: Fluids	3
BME	334	Heat and Mass Transfer	3
BME	411	Biomedical Engineering I	3
BME	412	Biomedical Engineering II	3
BME	413	Physiological Instrumentation	3
BME	417	Biomedical Engineering Design	3
BME	423	Physiological Instrumentation Lab	1
BME/AGB	435	Animal Physiology I	4
BME	490	Biomedical Engineering Projects	2
BME	496	Professional Seminar[1]	0
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
Engineering Technical Electives (to be selected from an area of emphasis)			9 10
Total			50–51

Students must register for BME 496 each semester.

Students interested in pre medical engineering may elect to emphasize either general bioengineering or computer science:

General bioengineering This emphasis is designed to strengthen the student's knowledge of bioengineering. It emphasizes biomedical research. The following courses are required in the engineering core: ECE 333, 340, and 350 and MAE 405. ECE 312 is not required in the engineering core. The 10 hours of technical electives may be selected from engineering, biology, or chemistry upper division courses, but these courses must include adequate engineering science and design content.

Computer science. This emphasis is designed for students interested in the application of modern computer technology for medical information

processing and medical scientific computation and for the recognition, storage, retrieval, and processing of medical data. The following courses are required in the engineering core: CSC/EEE 225 or CSC/EEE 226, ECE 334, 340, and 352 and MAT 242 ECE 312 is not required in the engineering core. Technical electives must include CSC 310, one advanced computer programming course selected from CSC 383, or 470 and upper division engineering courses of engineering science and design content.

Pre-medical Engineering Program of Study
Typical Four-Year Sequence

First Year

First Semester			*Semester Hours*
BME	496	Professional Seminar	0
CHM	113	General Chemistry	4
ECE	105	Introduction to Languages of Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	290	Calculus I	5
		Total	18

Second Semester			
BME	496	Professional Seminar	0
CHM	116	General Chemistry	4
ECE	106	Introduction to Computer-Aided Engineering	3
MAT	291	Calculus II	5
PHY	121	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
		Total	16

Second Year

First Semester			
BIO	181	General Biology	4
BME	496	Professional Seminar	0
ENG	102	First Year Composition	3
MAT	274	Elementary Differential Equations	3
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
General Studies Elective HU or SB)[1]			3
		Total	17

Second Semester			
BIO	182	General Biology	4
BME	496	Professional Seminar	0
CHM	331	General Organic Chemistry	3
CHM	335	General Organic Chemistry Lab	1
ECE	210	Engineering Mechanics I Statics	3
ECE	301	Electrical Networks I	4
Literacy and Critical Inquiry Elective[1]			3
		Total	18

Third Year

First Semester			
BME	331	Transport Phenomena I: Fluids	3
BME	435	Animal Physiology I	4
BME	496	Professional Seminar	0
CHM	332	General Organic Chemistry	3
ECE	312	Engineering Mechanics II. Dynamics or Technical Elective	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics or CHM 441 General Physical Chemistry (3)	3
		Total	19

Second Semester			
BME	334	Heat and Mass Transfer	3
BME	496	Professional Seminar	0
CHM	336	General Organic Chemistry Laboratory	1
ECE	333	Electrical Instrumentation or ECE 334 Electronic Devices and Instrumentation (4)	3
ECE	350	Structure and Properties of Materials or ECE 351 Engineering Materials (3) or ECE 352 Properties of Electronic Materials (3) or CHM 442 General Physical Chemistry (3)	3
ECE	384	Numerical Analysis for Engineers I or ECE 386 Partial Differential Equations for Engineers (2) or MAT 242 Elementary Linear Algebra (2)	2
General Studies Elective (HU or SB)[1]			3
Technical Elective			3
		Total	18

Fourth Year

First Semester			
BME	411	Biomedical Engineering I	3
BME	413	Physiological Instrumentation	3
BME	423	Physiological Instrumentation Lab	1
BME	496	Professional Seminar	0
BME	490	Biomedical Engineering Projects	2
MAE	405	Microcomputer Aided Processes for MAE or CHE 461 Process Control 3) or CSC/EEE 225 Assembly Language Programming (Motorola) (3 or CSC/EEE 226 Assembly Language Programming (Intel) (3 or IEE 463 Computer A ded Manufacturing and Control (3)	3
General Studies Elective (HU or SB [1]			3
Technical Elective			3
		Total	18

Second Semester

BME	412	Biomedical Engineering II	3
BME	417	Biomedical Engineering Design	3
BME	496	Professional Seminar	0
ECE	383	Probability and Statistics for Engineers	2
ECE	400	Engineering Communications	3
General Studies Elective (HU or SB)[1]			3
Technical Elective			1
Total			15

Graduation requirements 133 semester hours plus English proficiency

[1] See pages 55 87 for the requirements and the approved list of courses

Systems Engineering. Systems engineering deals with the integration of diverse components into a functioning whole. The curriculum of this option 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 set of courses that 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 engineering core and mathematics electives:

			Semester Hours
CSC/EEE	225	Assembly Language Programming (Motorola) or CSC/EEE 226 Assembly Language Programming (Intel) (3)	3
ECE	210	Engineering Mechanics I: Statics	3
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	334	Electronic Devices and Instrumentation	4
ECE	352	Properties of Electronic Materials or ECE 350 Structure and Properties of Materials (3)	3
ECE	383	Probability and Statistics for Engineers	2
MAT	242	Elementary Linear Algebra	2
PHY	361	Introductory Modern Physics (Basic Science Elective)	3

Only ECE 313 Introduction to Deformable Solids may be deleted from the engineering core.

In addition, the following courses are required:

			Semester Hours
ASE	490	Project in Design and Development	3
CSC	120	Digital Design Fundamentals	3
CSC/EEE	325	System Design with Microprocessors (Motorola) or CSC/EEE 326 System Design with Microprocessors (Intel) (3)	3
CSC	330	Computer Organization	3
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	Operations Research Techniques/ Applications	4
Technical Electives			13
Total			51

Engineering Interdisciplinary Programs—B.S.

Engineering Business and Pre-law. This option accommodates especially those engineering students whose primary intent is to earn a Juris Doctor (J.D.) or a Master of 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.

In addition to ECN 111, the following course is required as a part of the social and behavioral sciences requirement:

			Semester Hours
ECN	112	Microeconomic Principles	3

The following courses are required as a part of the engineering core and mathematics electives:

			Semester Hours
ECE	383	Probability and Statistics for Engineers	2
IEE	463	Computer Aided Manufacturing and Control	3
MAT	242	Elementary Linear Algebra	2

The course to be deleted from the engineering core depends on the student's chosen engineering electives (area of emphasis) and is subject to approval of the advisor.

In addition, the following courses are required:

			Semester Hours
ACC	211	Introductory Financial Accounting	3
ACC	212	Introductory Managerial Accounting	3
ASE	485	Engineering Statistics	3
BLW	305	Legal Environment of Business	3
FIN	300	Fundamentals of Finance	3
IEE	300	Economic Analysis for Engineers	2
IEE	367	Methods Engineering and Facilities Design	4
		or IEE 422 Information Systems Design (3)	
IEE	461	Integrated Production Control	3
IEE	476	Operations Research Techniques/ Applications	4
IEE	490	Project in Design and Development	3
MGT	301	Management and Organization Behavior	3
MKT	300	Principles of Marketing	3
Engineering Technical Electives (Including three courses of engineering science and one of engineering design type content)			15
Total			52

Geological Engineering. This option 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 that 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 development of water, petroleum, and mineral deposits are encompassed within the program.

The following courses are required as a part of the engineering core (only ECE 333 Electronic Instrumentation may be deleted):

			Semester Hours
CEE	400	Microcomputer Applications in Civil Engineering	3
ECE	210	Engineering Mechanics I: Statics	3
ECE	312	Engineering Mechanics II: Dynamics	3
ECE	351	Engineering Materials	3
GLG	101	Introduction to Geology (Physical)[1]	3

In addition, the following courses are required:

			Semester Hours
ASE	490	Project in Design and Development	3
CEE	351	Soil Mechanics	4
CEE	452	Foundations	3
CEE	552	Geological Engineering	3
GLG	103	Introduction to Geology I Lab	1
GLG	310	Structural Geology	3
GLG	321	Mineralogy	3
GLG	322	Mineralogy Lab	2
GLG	362	Geomorphology	3
GLG	424	Petrology-Petrography	4
MAE	371	Fluid Mechanics	3
Engineering Technical Electives[2]			20
Total			52

[1] Basic science elective.

[2] Includes two courses of engineering science and two courses of engineering design type content. An approved summer engineering-geology field course is also highly recommended.

College of Fine Arts

Seymour L. Rosen, B.A.
Dean

Purpose

The College of Fine Arts provides for preprofessional and professional education in the several arts disciplines and also an opportunity for nonmajors 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 myriad concerts, art exhibitions, music and dance concerts, dramatic productions, opera, lectures, and seminars.

Organization

The college is one of 12 schools and colleges on campus. It houses the School of Art, the Department of Dance, the School of Music, the Department of Theatre, and the University Art Museum. An average of 2,000 students per semester enroll as majors in various degree programs offered through these units

Admission

Students meeting basic admission standards of Arizona State University may 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 may be accepted up to a maximum of 64 semester hours. A community college student planning to transfer at the end of his or her first or second year should plan his or her community college courses to meet the requirements of the ASU curriculum selected. Students attending Arizona community colleges are permitted to follow the degree requirements specified in the ASU *General Catalog* in effect at the time they begin their community college work, providing their college attendance has been continuous.

Courses transferred from community colleges are not 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 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 are 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 students 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.

Advisement

Advisement is handled as a decentralized activity within the college. To offer personalized attention, each academic unit establishes its own graduation advisement procedures. Students are encouraged to make appointments through the central office of their major disciplines.

Degrees

MAJOR FIELD	DEGREE	DEPARTMENT/SCHOOL
Baccalaureate Degrees		
Art Emphases: art history, photographic studies, studio art	B.A.	School of Art
Art Concentrations: art education, ceramics, drawing, fibers, graphic design, intermedia, metals, painting, photography, printmaking, sculpture, wood	B.F.A.	School of Art
Choral–General Music	B.M.	School of Music
Dance	B.A.	Dance
Dance Concentrations: dance education, performance and choreography	B.F.A.	Dance
Instrumental Music Concentrations: instrumental, string	B.M.	School of Music
Music	B.A.	School of Music
Music Therapy	B.M.	School of Music
Performance Concentrations: guitar, jazz, keyboard, music theatre, orchestral instrument, piano, accompanying, voice	B.M.	School of Music
Theatre	B.A.	Theatre
Theatre Concentrations: performance/production (acting, design/technology), theatre education	B.F.A.	Theatre
Theory and Composition Concentrations: composition, theory	B.M.	School of Music

Degrees

MAJOR FIELD	DEGREE	DEPARTMENT
Graduate Degrees		
Art Concentrations: art education, art history	M.A.	School of Art
Art Concentrations: ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, sculpture, wood	M.F.A.	School of Art
Choral Music Concentrations: choral music, general music	M.M.	School of Music
Choral Music	D.M.A.	School of Music
Dance Concentration: performance and choreography	M.F.A.	Dance
Instrumental Music	M.M., D.M.A.	School of Music
Music History and Literature	M.A.	School of Music
Performance Concentrations: music theatre musical direction, music theatre performance, performance pedagogy, piano accompanying, solo performance (instrumental, keyboard, voice)	M.M.	School of Music
Secondary Education* Concentrations: art education, choral music, general music or instrumental music, music education, theatre education	Ph.D., Ed.D.	
Solo Performance	D.M.A.	School of Music
Theatre	M.A.	Theatre
Theatre Concentrations: scenography, theatre for youth	M.F.A.	Theatre
Theory and Composition Concentrations: composition, theory	M.M.	School of Music

* The Ed.D. degree is administered through the College of Education

Baccalaureate Degrees

The three baccalaureate degrees differ in curric ula with respect to the amount of specialization permitted in the major field. The Bachelor of Arts degree provides a broad, scholarly, humanis tic program, while the other two programs place greater emphasis upon the major field. General Studies play an integral role within the educa tional mission of the university and as such con stitute an important component of all undergradu ate degrees in the College of Fine Arts. See pages 388 389 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, ful fill the requirements for the appropriate area of specialization under the Bachelor of Fine Arts or Bachelor of Music degrees. In addition, a student wishing to be admitted to the Professional Teacher Preparation Program (PTPP) in the College of Education (leading to teaching certification) must obtain an advisor from the Office of Student Affairs in the College of Education before making application for the PTPP. Students must have completed 56 hours with a minimum GPA of 2.50 and also have passed the three Pre Professional Skills Tests in order to be eligible for the program. Further detail on admission re quirements and procedures for the PTPP can be found on pages 260–264 under the College of Education.

Graduate Degrees

Master's programs range from 30–60 semester hours, depending upon the degree chosen. Doc toral programs vary in scope and curricula. See the *Graduate Catalog* for specific requirements for the M.A., M.F.A., M.M., D.M.A., Ph.D., and Ed.D. degrees.

Degree Requirements

In addition to the general information given be low, 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 for the major. Depending on the major, 18–24 hours must be selected from upper-division courses (300 or 400 level). The semester-hour require-ments in the major are distributed between a field of specialization (30–45 hours) and one or more related fields (an additional 15 hours). The exact content of the major is selected by a student in consultation with his or her advisor under rules and regulations of the department or school con cerned.

Bachelor of Fine Arts Degree (B.F.A.) The Bachelor of Fine Arts degree requires 65 85 se mester hours for the major. At least 30 of these hours, depending 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. Audi tions and/or interviews are required for admission to the B.F.A. program in Dance or Theatre. Con sult these departments for specific information.

Bachelor of Music Degree (B.M.) The Bachelor of Music degree requires 84 semester hours for the major. The required number of upper division courses (300 or 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 accompanying, theory–composition, instrumental music, and choral general music. An entering undergraduate Music major, regardless of the area of spe cialization, must perform an entrance audition in his or her primary performing medium (voice or instrument).

General Studies Requirements

To meet the General Studies requirement, a mini mum of 35 semester hours must be completed in the General Studies areas. Six semester hours must also be completed in the awareness areas. A course may concurrently satisfy a core area requirement and an awareness area requirement. Neither courses in the major nor related field area courses may be cross-listed in fulfillment of both major and General Studies core or awareness requirements with the exception of concurrent listings in the numeracy (computer applications) and literacy (upper division) areas, as specified by the University General Studies guidelines.

Core Areas:	*Semester Hours*
Literacy and Critical Inquiry	6
Numeracy	6
* Humanities and Fine Art	6 or 9
(Fine arts majors must take at least six semester hours of fine arts course work in areas outside of the major school or department. These may be courses in art, dance, music, or theatre. A student may	

concurrently fulfill this requirement and the humanities and fine arts General Studies requirement by selecting approved courses as indicated in the *Schedule of Classes* This requirement may also be met by taking *any* College of Fine Arts course outside of the student's major and listing it under General Studies electives.)

* Social and Behavioral Sciences ....6 or 9
Natural Sciences 8

Awareness Areas:

Global Awareness 3
Historical Awareness 3

* 15 hours total

Refer to pages 55 59 of this *Catalog* for a description of the University General Studies requirements. General Studies courses are regularly reviewed. To determine whether a course meets one or more General Studies course credit requirements, see the listing of courses, pages 60–87. General Studies courses are also identified following course descriptions according to the following key:

Key to General Studies Credit Abbreviations

L1	Literacy and Critical Inquiry Core Courses (Intermediate level)
L2	Literacy and Critical Inquiry Core Courses (Upper division)
N1	Numeracy Core Courses (Mathematics)
N2	Numeracy Core Courses (Statistics and Quantitative Reasoning)
N3	Numeracy Core Courses (Computer Applications)
HU	Humanities and Fine Arts Core Courses
SB	Social and Behavioral Science Core Courses
S1	Natural Science Core Courses (Introductory)
S2	Natural Science Core Courses (Additional Courses)
G	Global Awareness Courses
H	Historical Awareness Courses

Graduation Requirements

Several programs require additional General Studies electives that may be selected from anthropology, architecture, biology, botany, chemistry, communication, economics, English (except ENG 101, 102, 105, 107, and 108), foreign languages, geography, geology, history, humanities, interdisciplinary studies in liberal arts (LIA), journalism and telecommunication, philosophy, physical education (except activity courses), physical science, physics, political science, psychology, religious studies, sociology, zoology, and any College of Fine Arts course outside the student's major to meet the minimum number required for a particular degree program. Additional electives to complete the total of 126 semester hours may be taken in any area of the university.

In addition, the student must meet the university English proficiency requirement: ENG 101 and 102 (six hours) or ENG 105 (three hours). Foreign students may satisfy this requirement by taking ENG 107 and 108. These courses may not be used to meet General Studies elective requirements.

All Bachelor of Arts degrees require the equivalent of 16 semester hours in one foreign language. (Exception: the Bachelor of Arts degrees in Dance, Theatre, and Art with an emphasis in studio art strongly recommend but do 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 are placed in language study at the level above completed work. Candidates for the Bachelor of Music degree in voice performance and piano accompanying have specific foreign language requirements. These are stated in each of the degree requirements (pages 405–406). There is no foreign language requirement for other areas of specialization of the Bachelor of Fine Arts or Bachelor of Music degrees.

The minimum graduation requirement is the completion of 126 semester hours with a minimum cumulative scholarship index of 2.00. Of these 126 semester hours, at least 50 must be selected from upper division courses, number 300 to 400. Many professional programs within the College of Fine Arts require additional semester hours for graduation and a higher cumulative scholarship index of their majors. To be acceptable as graduation credit, all course work in the major discipline must show an earned grade of "C" (2.00) or higher.

Academic Standards

The terms of disqualification, reinstatement, and appeals are consistent with those set forth by the university on page 55 of this *Catalog*, except for Theatre. For the B.F.A. in Theatre, a student must have a minimum GPA of 3.00 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 rein statement for two semesters.

Special Programs

Together with faculty, visiting scholars, and art ists-in residence, students in all fields of the Col lege of Fine Arts participate in dynamic, innova tive programs. The creative energy that infuses the visual and performing arts finds expression in research and study.

The Visual Arts Research Studios, in the School of Art, conducts research in historical and contemporary technologies in the visual arts. VARS is the only studio of its kind in this coun try. It brings together artists, master printers, and photographers to encourage collaboration and re search. Students are appointed to assist VARS personnel in the planning and production of proj ects in the Print Research facility, the Photogra phy Collaborative facility, and the Pyracantha Press.

The School of Art also offers opportunities to explore and refine a new artistic medium: com puter graphics. Students may work with software for "painting," solid modeling, animated solid modeling, and live video mapping. While com puter graphics makes use of the latest technology, other areas preserve and revitalize established media. The newly established neon studio con tributes to the revival of interest in neon as an ar tistic medium and trains students in this difficult craft. Students in the emerging field of photo graphic studies are trained in photographic his tory, criticism, and exhibition management. The School of Art publishes *The History of Photogra phy Monograph Series*, which receives interna tional acclaim The Northlight Gallery, operated entirely by students, has also become known internationally for photographic exhibitions.

Recognized as one of the top programs in the country, the Department of Dance emphasizes the choreography, performance, and theory of mod ern dance. The artist in residence program brings major figures and companies to campus each year. The department was selected as one of five in the United States to participate for three years in the Curriculum Development Project of the Dance Notation Bureau in important research on labanotation. Students work closely with vis iting artists, artists in-residence, a curator of- dance and researchers investigating labanotation as well as the possibilities of video and computer technology in dance and dance music composi tion. At the American College Dance festivals for the past several years, graduate students have taken top honors at both the regional and national levels.

An ambitious performance program offers to the public several concerts each year, some with works created and performed by graduate and undergraduate students and others featuring works by faculty and visiting artists. Dance Ari zona Repertory Theatre (DART) gives graduate and undergraduate students the opportunity to perform and tour in the metropolitan area, the re gion and the state.

Faculty in the School of Music include a wide range of performers, teachers, conductors, com posers, and scholars who are recognized both na tionally and internationally. Students have the opportunity to participate in comprehensive de gree programs that provide for wide and diver gent opportunities in performance and course work. Student performing organizations are rec ognized as being some of the finest in the nation, and ASU students regularly compete successfully in national competitions. The broad scope of de gree options allows students excellent choices in gaining depth and breadth in the musical field.

The Department of Theatre takes special pride in its scenography and theatre for youth pro grams. The theatre for youth program enjoys an international reputation, provides comprehensive training, and attracts students, scholars, and visi tors from around the world. Students are chal lenged to excel in every aspect of theatrical train ing. They have opportunities to act in and direct mainstage and touring shows, to conduct re search, and to teach on and off campus. The pro gram has developed Hayden Library's Child Drama Special Collection, which includes rare books, plays, and personal and national associa tion archives It is the most complete and exten sive collection in the English speaking world. Students in the scenography program are actively involved in all aspects of design and technology for mainstage and studio productions and receive regional and national awards for their work on a regular basis. A multi ethnic theatre program provides opportunities for students to view and work with professional and semi professional multi ethnic productions on campus. And the experimental theatre program allows students to work with resident and professional actors while providing a venue for original and exciting per formance pieces.

A playwright in residence works with both undergraduate and graduate students, creating

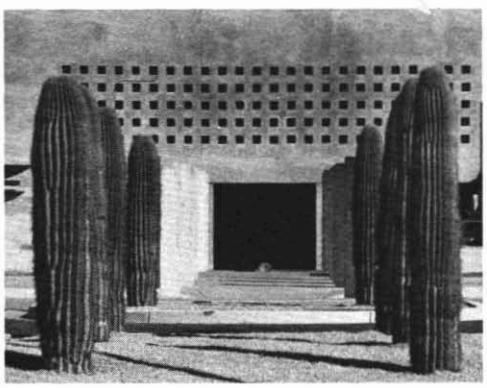
and showcasing original scripts from students and faculty. An interdisciplinary M.F.A. in Creative Writing encourages graduate students to work closely with writers of drama, fiction, and poetry and with directors and producers from the Departments of English and Theatre. Faculty in the Departments of Theatre and English offer students a unique opportunity to tailor a course of study to fit individual needs, talents, and goals.

General Information

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 average 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.

Performer's Certificate. The Performer's Certificate, awarded by the College of Fine Arts upon recommendation of the faculty of the Department of Dance, gives special recognition to excellence in interpretation and technical proficiency in dance performance. Specific information may be obtained by contacting the Department of Dance. The Performer's Certificate parallels the Certificate of Merit in intent and may or may not be awarded every year.

Preprofessional 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.



School of Art

PROFESSORS:
LEHRER (ART 102), BRECKENRIDGE, CHOU, GASOWSKI, GILLINGWATER, JAY, LINDERMAN, MAGENTA, MEISSINGER, PILE, PIMENTEL, STULER, SWEENEY, J.R. TAYLOR, WOODS

ASSOCIATE PROFESSORS:
ALQUIST, BRITTON, COCKE, DeMATTIES, DETRIE, ECKERT, FAHLMAN, FRONSKE, GULLY, HAJICEK, JENKINS, KAIDA, KRONENGOLD, PITTSLEY, RABINER, RISSEEUW, ROWLEY, SCHMIDT, SHARER, UMBERGER, WEISER, WHITE, B. YOUNG, J. YOUNG

ASSISTANT PROFESSORS:
HULICK, MAXWELL, SCHLEIF, SCHUTTE, SERWINT, SHIPP, VERSTEGEN

PROFESSORS EMERITI:
BROADLEY, FARNESS, FINK, GOO, GRIGSBY, HAHN, HALE, HELLER, JACOBSON, KELLY, SCHAUMBURG, J.J. TAYLOR, WAGNER WATSON, WOOD

Major Requirements

For advisement purposes, all students registering in an Art degree program 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. Check sheets are available in the School of Art office.

Bachelor of Arts Degree Curriculum

The School of Art offers three emphases at the Bachelor of Arts level: studio art, photographic studies, 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. This emphasis consists of a minimum of 45 semester hours as approved by the student's advisor. It requires 30 semester hours in studio, including ART 111, 112, 113, 115, and 15 hours in a related field(s) including ARS 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 with a "C" or better. The foreign language requirement of the B.A. degree is optional but strongly recommended.

Art History. This emphasis consists of a minimum of 45 semester hours as approved by the student's advisor. It requires 33 semester 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 ARS 480, Research Methods, is required before the senior year. Other requirements are ARS 101, 102, lower-division ARS (non-western course), one ARS 498 Pro-Seminar; ARE 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 the Department of Foreign Languages section.

Photographic Studies. This emphasis consists of a minimum of 48 semester hours as approved by the student's advisor. Required courses include ARS 450, 451, and 454, ART 409, one upper-division ARS course in modern art, and one in criticism. Knowledge in at least one foreign language is required, equivalent to the level obtained through the completion of two years of study at the college level. For specific courses, see the Department of Foreign Languages section.

Bachelor of Fine Arts Degree Curriculum

Art. This major consists of 75 semester hours, 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, metals, painting, photography, printmaking, sculpture, and wood.

All students in this degree program follow the same pattern of courses in art for the first two semesters: ARS 101 and 102; ART 111, 112, 113, and 115.

At least 30 upper-division semester hours must be earned within the major, with a minimum of 12 semester hours within the concentration.

All course work counted in the major must be with a "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 check sheets.

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 student's program of study.

Graphic Design. This concentration 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. This concentration consists of 75 semester hours in Art, including ART 111, 112, 113, 115, 201, 223, one three-dimensional course (either ART 231, 261, 272, 274, 276); ARS 101, 102, and two ARS upper-division electives (including one in 20th-century art). The following art education courses are required: ARE 350, 450, 470, 480, 486, 494 (Special Topics), and 496. 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, metals, wood, fibers, or art history. Teaching experience is provided in the children's art workshop, which is an on-campus art history-based studio program for children ages five to 15. Participation in the workshop is part of the requirements for ARE 486.

A student with a GPA of 2.50 or better pursuing a B.F.A. in Art with a concentration in art education may also choose to become certified for teaching art K–12. If certification is elected while pursuing the art education undergraduate degree, additional hours are required of specified course work in the College of Education. Students must be accepted into the College of Education professional program, and students must meet the U.S. and Arizona constitution requirement. Certification may also be pursued after receiving an undergraduate degree through the postbaccalaureate program in the College of Education. The postbaccalaureate program requires acceptance into the College of Education professional program. Admission of postbaccalaureate

students into art education certification courses requires a minimum of 27 semester hours of studio art and 12 semester hours of art history, including ARS 101 and 102. Art education courses for certification are ARE 450, 480, 486, and 496. These courses are to be taken in the sequence of ARE 450 and 480 in the spring semester, ARE 486 in the following fall semester, and ARE 496 in the next spring semester. ARE 486 meets the requirements for the secondary methods class in the subject area. See an art education advisor regarding these and other requirements.

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 an emphasis in ceramics, drawing, fibers, intermedia, metals, painting, photography, printmaking, sculpture, or wood. In cooperation with the College of Education, the degrees of Master of Arts in Education, Doctor of Education, and Doctor of Philosophy are offered with a concentration in art education. Consult the *Graduate Catalog* for requirements for all graduate degrees.

STUDIO CORE CURRICULUM

ART 111 Drawing I. (3) F, S, SS
Fundamental, technical and perceptual skills using common drawing media and their application to pictorial organization. 6 hours a week.

112 Two-dimensional Design. (3) F, S, SS
Fundamentals of pictorial design. 6 hours a week.

113 Color. (3) F, S, SS
Principles of color theory as related to the visual arts. 6 hours a week. Prerequisites: ART 111, 112.

115 Three-dimensional Design. (3) F, S, SS
Fundamentals of three dimensional form. 6 hours a week. Prerequisites: ART 111, 112.

DRAWING

ART 211 Drawing II. (3) F, S, SS
Continued development of technical and perceptual skills. Emphasis on materials and pictorial content. 6 hours a week. Prerequisites: ART 113, 115.

214 Life Drawing I. (3) F, S, SS
Development of skill and expressiveness in drawing the basic form, construction and gesture from the human figure. 6 hours a week. Prerequisites: ART 113, 115.

311 Drawing III. (3) F, S
Emphasis on composition, exploration of drawing media. 6 hours a week. Prerequisites: ART 211, 214; instructor approval.

314 Life Drawing II. (3) F, S
Drawing from the model with greater reference to structural, graphic and compositional concerns. 6 hours a week. Prerequisite: ART 214 or instructor approval.

315 Life Drawing III. (3) F, S
The human figure as the subject for drawing. Emphasis on conceptual alternatives and management of materials. 6 hours a week. Prerequisite: ART 314 or instructor approval.

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. 6 hours a week. Prerequisites: ART 311; instructor approval.

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. 6 hours a week. Prerequisite: ART 315 or instructor approval.

415 Art Anatomy. (4) N
Study of human anatomical structures as applied to the practice of figure oriented art. 3 hours lecture, 5 hours studio a week. Prerequisite: ART 214.

PAINTING

ART 223 Painting I. (3) F, S, SS
Fundamental concepts and materials of traditional and experimental painting media. Emphasis on preparation of painting supports, composition and color. 6 hours a week. Prerequisites: ART 113, 115.

227 Watercolor I. (3) F, S
Fundamental concepts, materials and techniques of watercolor. Emphasis on problem solving, basic skills, composition and color. 6 hours a week. Prerequisites: ART 113, 115.

323 Painting II. (3) F, S
Development of competency in skills and expression. Assigned problems involve light, space, color, form and content. 6 hours a week. Prerequisite: ART 223 or instructor approval.

324 Painting III. (3) F, S
Continuation of ART 323. 6 hours a week. Prerequisite: ART 323 or instructor approval.

325 Figure Painting. (3) F, S
The human figure clothed and nude as the subject for painting in selected media. 6 hours a week. Prerequisites: ART 314, 323.

327 Watercolor II. (3) A
Explorations of personal expression in watercolor. Continued development of watercolor skills using traditional and experimental materials and techniques. 6 hours a week. Prerequisite: ART 227.

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. 6 hours a week. Prerequisite: instructor approval.

423 Advanced Painting. 3 F, S
Continuation of ART 324. May be repeated for credit. 6 hours a week. Prerequisite: ART 324.

425 Advanced Figure Painting. (3) F, S
Continuation of ART 325. May be repeated for credit. 6 hours a week. Prerequisites: ART 315, 324, 325.

427 Advanced Watercolor. (3) F, S
Continuation of ART 327. May be repeated for credit. 6 hours a week. Prerequisite: ART 327.

INTERMEDIA

ART 340 Intermedia. (3) F, S
Experimental conceptua and interdiscip nary stud o art with emphasis on new med'a and techno og es. 6 hours a week May be repeated once for cred t Prerequis tes ART 113, 115, 6 hours additiona studio requ rements or instructor approva

341 Mixed Media. (3) A
Explor ng v sua effects by comb ning tradit onal and non traditiona methods techn ques and concepts. May be re peated once for cred t 6 hours a week. Prerequ sites. ART 113, 115 6 hours addit ona studio requ rements; or instructor approval

440 New Media Concepts. (3) F S
Cont nued experiments with new media and interdisc p i nary concerns n art May be repeated for credit. 6 hours a week Prerequ s te: ART 340

441 Video Art. (1 F, S
Ut iz ng v deo and aud o equipment essent al to the pro duction of broadcast qua ty video art May be repeated for credit. 2 hours a week Corequ sites ART 340, 341 or 440 nstructor approva

PHOTOGRAPHY

ART 201 Photography I. (3) F, S
Development of sk s and techn ques of b ack and wh te photography Emphas s on camera work and darkroom procedures. 2 ectures, 3 hours ab.

301 Photography II. (3) F, S
Photography as an art med um w th add t ona exploration nto persona photograph c aesthet cs 6 hours a week. Prerequisites. ART 113 115, 201; or instructor approva .

304 Advanced Photography. (3) F, S
Interpretat on and man pulation of ght as a too n the performance of express ve photography 6 hours a week Prerequ s te· ART 301 or nstructor approva

305 Color Photography I. (3) F, S
App ication of co or transparenc es and prints to photo graph c art 6 hours a week. Prerequ site ART 304 or in structor approva

306 Photo Techniques. (3) F S
Exp orat on of camera and darkroom techn ques w th em phas s on creative contro for the well crafted b ack and wh te pr nt 6 hours a week. Prerequis te: ART 301 or in structor approval

401 Nonsilver Photography. (3) F, S
Recognition of the nherent character st cs of nons lver processes and the use of these processes n the commu n cation of deas. May be repeated for cred t. 6 hours a week. Prerequ site ART 306 or nstructor approva

403 Black and White Photography. (3) F S
Advanced exp orat on of exper mental, interpret ve and straight photography. May be repeated for cred t. 6 hours a week Prerequ s te ART 304 or instructor approva

404 Portraiture Photography. (3) F, S
Photograph ng peop e Cr tica d scuss ons and sl de ec tures on ssues in portra ture. May be repeated for credit. 6 hours a week Prerequ s tes ART 304, 306, or instruc tor approval.

405 Advanced Color Photography. (3) F, S
ntensive use of subtract ve color process in photographic printing. May be repeated for credit 6 hours a week Pre requisite ART 305 or nstructor approva

409 Photographic Exhibition. (3) A
Care of photographic prints, print presentat on and exh b t on. Practica experience in ga ery operations. May be repeated for cred t. 6 hours a week Prerequ s te: ART 304 or nstructor approval.

PRINTMAKING

ART 252 Lithography I. (3) F, S
B ack and white p anograph c printmaking ut iz ng stone and aluminum p ate processes. 6 hours a week. Prerequi s tes· ART 113 115.

351 Intaglio I. (3) F, S
Introduction to contemporary and traditional developmental techn ques for b ack and white prints. 6 hours a week Prerequ s te: nstructor approval.

352 Lithography II. (3 F, S
Cont nuation of ART 252 ntroduct on to color techn ques and advanced mage-format on processes 6 hours a week. Prerequis te: ART 252 or nstructor approva .

354 Screen Printing I. (3) A
Var ous methods and applications includ ng the photo graph c stenc and transfer techniques 6 hours a week. Prerequ s te· nstructor approval.

355 Photo Process for Printmaking I. (3) A
Introduct on to photographic princip es and ski ls for photo-mechanical printmak ng processes, inc uding photo si kscreen, photo- itho and photo-etch ng 6 hours a week Prerequis te: instructor approva

451 Advanced Intaglio. (3) F, S
Var ous contemporary and traditiona methods of print ng to achieve co or pr nts May be repeated for cred t. 6 hours a week Prerequ s te nstructor approva .

452 Advanced Lithography. (3) F, S
Continuat on of ART 352 May be repeated for credit. 6 hours a week. Prerequisite nstructor approva

454 Advanced Screen Printing. (3) A
Cont nuat on of ART 354 May be repeated for cred t. 6 hours a week Prerequ s te: instructor approval

455 Advanced Photo Processes for Printmaking. (3) A
A cont nued study of photomechanical techniques and applicat ons to printmak ng or photograph c processes Prerequisite ART 355 or instructor approva

456 Fine Printing and Bookmaking I. (3) A
Letterpress print ng and typography as fine art. Study of h story, a phabets mechanics of hand typesetting, press work and var ous forms of pr nted matter. Prerequ s te: n structor approva

457 Fine Printing and Bookmaking II. (3) A
Continuation of ART 456 Bookb nd ng book des gn and pr nting, advanced typography, theory and presswork. May be repeated for cred t Prerequis tes ART 456, n structor approval

458 Papermaking. (3) F, S
History theory demonstrat ons, sheet form ng, collage treatments and 3 dimens onal approaches May be re peated for cred t 6 hours a week Prerequ site. instructor approva

459 Monoprinting. (3) F S
The nonmu t ple printed image us ng a variety of technical approaches. May be repeated for cred t. 6 hours a week. Prerequ s tes. ART 311 323 or any 300 level printmaking c ass, nstructor approval

SCULPTURE

ART 231 Sculpture I. (3) F, S, SS
Exp orat on and express on of scu ptura form through 'deas and concepts re ated to bas c mater als, stud o safety. 6 hours a week Prerequ s tes ART 113, 115.

331 Sculpture II. (3) F, S
Continuat on of ART 231 6 hours a week Prerequ s te ART 231.

332 Advanced Sculpture. (3) F, S
Scu ptura prob ems re ated to arch tecture and man's en v ronment. Exploration n al med a. Color re ationsh ps as app ied to scu pture 6 hours a week. Prerequ s te. ART 331

333 Experimental Sculpture. (3) N
An experimenta approach to form mater a relat onsh p toward atmospher c, k net c, aud o e ectron c and earth works. 6 hours a week Prerequ s te ART 332 or instruc tor approva

431 Special Problems in Sculpture. (3) F, S
Deve opment of a persona approach to scu pture em- phasis on form ind v dua prob ems and re ated color technology Profess ona pract ces and presentation May be repeated for cred t 6 hours a week. Prerequis tes. ART 332 instructor approval.

432 New Directions in Sculpture. (3) A
Examinat on of environment as resource for images and ideas Exper mentation n nontrad t ona methods and n- terre ating d sc p ines May be repeated for cred t. 6 hours a week Prerequisite. ART 332 or nstructor approval

436 Architectural Sculpture. (3) N
Sculptura concepts as related to arch tecture and other manmade env ronments Scale drawing mode s and re ef scu pture May be repeated for cred t 6 hours a week. Prerequisite ART 332 or nstructor approval

437 Non-Permanent Sculpture. (3) N
Art of a temporary nature ncluding sequentia and con ceptual works. Attitudes may be presented in f ms or other v sua media May be repeated for cred t. 6 hours a week. Prerequisite nstructor approva

438 Experimental Systems in Sculpture. (3) N
Systems and concepts for phase changes of mater a s, temperature pressure field t me compression extens on and e ectron c activat on of dimens onal forms. May be repeated for credit. 6 hours a week Prerequ site: nstruc tor approva

CERAMICS

ART 260 Ceramics for Non-majors. (3) F S, SS.

Handbu ding methods wheel throw ng, g aze and deco rat ve processes, Raku and stoneware f r ngs. 6 hours a week.

ART 261 Ceramic Survey. (3) F S, SS
Handforming methods, throw ng on the whee , decorat ve processes g aze appl cat on 6 hours a week Prerequi s tes ART 112 115

360 Ceramic Throwing. (3) F, S
Design ana ys s and product on of functiona pottery. Em phasis on throw ng techn ques, surface enr chment and glaze app cat on May be repeated once for cred t 6 hours a week. Prerequ site ART 261

364 Ceramic Handbuilding I. 3 F
Search for form us ng hand bui d ng techniques Kn f r ng and re ated prob ems Prerequ s te: ART 261.

365 Ceramic Handbuilding II. (3) S
Cont nuation of ART 364 with an add tional focus on arge sca e works surface treatments and g aze decora t on w th re ated k n f rng appl cations Prerequis te: ART 364 or nstructor approva

460 Ceramic Clay. (3) A
Research into var ous clay body formu ations loca natu ral mater a s, sl p g azes and engobes. 6 hours a week Prerequ s te ART 360 364; or nstructor approva

463 Ceramic Glaze. (3) A
G aze formulat on and ca cu at on us ng various g aze sur- faces and colors 6 hours a week Prerequis te ART 460 or nstructor approval.

466 Special Problems in Ceramics. (3) F, S, SS
Emphasis on persona expression w th n structure of seminars, cr tiques, stud o work Profess ona methods of presentation/documentation of work. May be repeated for cred t. 6 hours a week. Prerequ s te ART 364 or instruc tor approva

FIBERS

ART 276 Fiber Arts I. 3) F, S
Structura use of f ber ut liz ng a var ety of techn ques. Surface treatment nc ud ng bat k, b ock print ng, fold and t e-dye 6 hours a week

376 Fibers: Loom Techniques. 3) A
Invest gat on of oom control ed techn ques P ain weave, doub e weave tapestry w l be exp ored 6 hours a week. Prerequ s tes: ART 113, 276· or nstructor approva

377 Fibers: Surface Design. 3 A
Surface des gn techn ques. si k screen ng, painting stamp ng dye ng on fabric w be exp ored Prerequ sites ART 113 276 or nstructor approva

476 Advanced Fibers. 3 F, S
Experimentat on w th advanced techn ques n f ber and fabr c May be repeated for cred t 6 hours a week. Pre requ s tes ART 376, instructor approval.

METALS

ART 272 Jewelry I. (3 F S
Emphas s on fabrication n jewe ry mak ng Basic tech niques of form ng cutt ng and p erc ng, forg ng and sol der ng 6 hours a week.

372 Jewelry II. 3) F S
Fabr cated approach to jewe ry mak ng Techn ques n stone sett ng and surface embe l shment 6 hours a week Prerequis tes ART 113 115, 272; or instructor approva

373 Metalworking I. (3) A
Compress on d e and stretch form ng as app ed to ho low form construct on. Hot and co d forg ng techniques as ap p ed to smith ng 6 hours a week. Prerequis tes· ART 113, 115 272 or nstructor approva

472 Advanced Jewelry. 3 F, S
Jewelry mak ng w th emphas s on develop ng personal statements and craftsmansh p May be repeated for cred t 6 hours a week Prerequ s tes ART 372 nstructor approva

473 Advanced Metalworking. 3 A
Forg ng and form ng techniques n nd v dua zed d rec tions May be repeated for cred t 6 hours a week Pre requis tes ART 373, nstructor approva

WOOD

ART 274 Wood I. (3) F, S
Fundamenta woodworkıng techn ques to produce crea t ve funct ona 3-dimensional objects 6 hours a week.

374 Wood II. (3) F, S
Ind v dua and d rected prob ems ın wood, re ated to the product on of un que funct ona art objects. 6 hours a week Prerequıs tes. ART 113, 115, 274; or nstructor ap proval

378 Furniture I. (3) A
Design and bu d ng of contemporary furniture. Explora tion n the techn que of jo nery, am nat on, carv ng and f n sh ng procedures 6 hours a week Prerequ sites ART 113, 115, 274, or ınstructor approval

474 Advanced Wood. (3) F S
Extended experience and advanced techn ques ın the use of wood to create functiona works of art. May be re-peated for cred t. 6 hours a week Prerequisites ART 374; nstructor approval

478 Advanced Furniture. (3) A
Form concepts are exp ored n construction of nventive furniture Emphasis on media experimentat on May be repeated for cred t 6 hours a week Prerequ s te: ART 378

GRAPHIC DESIGN

ART 283 Letterforms I. (3) F
Drawing of letterforms w th focus on proport on and struc ture Introduct on to etterform nomenclature and c assifi cat ons 6 hours a week Prerequ s tes ART 113, 115; acceptance ınto graphic des gn program Corequıs te· ART 284

284 Visual Communications I. 3 F
Theoret ca and appl ed studies n shape, draw ng, and color. 6 hours a week Prerequisites ART 113 115 ac ceptance 'nto graph c des gn program Corequ s te ART 283

286 Visual Communications II. 3) S
Trans t on from theoret cal to app ed prob ems Emphasis on refinement of v sual sk s 6 hours a week Prerequ s tes ART 283, 284, acceptance nto graph c des gn pro gram Corequisite. ART 287.

287 Letterforms II (3) S

Cont nuat on of Letterforms I w th an emphas s on Lower case letters basics of pen wr t ng and font des gn 6 hours per week. Prerequıs tes ART 283, 284 Corequı s te: ART 286.

382 Graphic Representation. 3) F
Stud o pract ce n draw ng w th an app cation towards graph c commun cat on. May be repeated once for cred t 6 hours a week. Prerequ s tes ART 284 nstructor ap prova .

383 Typeset I. (3) S
Theoret cal exercises 'n spatia and textura qua ıties of type. Prob ems n tension, activation and balance Exer c ses n simp e typograph ca appl cat ons 6 hours a week. Prerequ s tes. ART 283, 284, acceptance nto graph c des gn program Prerequ s te ART 386

385 Typeset II. (3) F
Problems in compos tion, cho ce and comb nat ons of type faces, formats and the r app cat on to a var ety of design projects 6 hours a week. Prerequıs tes ART 285 286. Corequ s te ART 386

386 Visual Communications III. (3 F
Problems n spec fic design app cations such as poster packag ng pub ıcations, etc Emphas s on developmen of concepts n v sua commun cations. 6 hours a week Prerequ s tes ART 285 286. Corequ s te ART 385.

387 Visual Communications IV. (3) S
C ent oriented projects. Prob ems w be mu tifaceted and the emphases wi l be on cont nu ty of design ın more than one med um and format 6 hours a week Prerequ s te ART 386.

481 Visual Communications V. 3) F, S
Stud o prob ems w th an emphas s on ana ysıs prob em so v ng and profess ona portfo o preparat on 6 hours a week Prerequ s tes ART 387; nstructor approva

482 Visual Communications VI. (3) S
Ind vıdua and group projects w th outs de c ients Al proj ects cu m nate n an exh bit 6 hours a week. Prerequ site ART 481.

485 Graphic Design Pre-Professional Program. (3) F S, SS
Preprofess onal c ent/des gner situat ons from concept to pr nted work Stud o workshop and nternsh ps for se ected students May be repeated once for cred t 6 hours a week Prerequ s te nstructor approva

SPECIAL STUDIO ART

ART 444 Computer Art I. (3) F, S
A study of PC hardware and software for creatıng art Emphas s on computer graph cs h story, hardware soft ware configurat ons, DOS pr nc p es of 2D and 3D graph cs 2 hours lecture 2 hours stud o Prerequ s tes· ART 111, 112 or equ va ent, nstructor approva *[Satısfies General Studies Requ rement N3]*

621 Studio Problems. (3 F, S, SS
Advanced study ın the fo ow ng areas:

(a	Drawıng	(f	Ceram cs
(b)	Pa nt ng	(g)	Meta s
c	Photography	h)	Wood
d)	Printmak ng		F ber Art
e)	Scu pture	(j	Stud o Art

May be repeated for cred t 6 hours a week each sect'on Prerequ s te: nstructor approva

680 Practicum: M.F.A. Exhibition. (1 15 F, S SS
Stud o work ın preparation for requ red M.F.A. exhib tion Pub ıc exh b t to be approved by the student's superv sory comm'ttee and accompan ed by a f na oral exam nat'on Photograph c documentat on and wr tten statement of problem Prerequıs te approva of the student s supervi-sory comm ttee

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered

ART EDUCATION

ARE 301 Art in the Elementary School. (3 F S
The study of children's v sual art work from ear y ch d-hood to ear y ado escence 1 ecture, 4 hours studio For nonmajors only.

350 Art Education and Design. (3) F S
Profess on of art education, prınc p es of v'sua organıza t on; design as a trad t on n art and art educat on· se

quenc ng des gn nstruction 2 ectures, 2 hours stud o Prerequ s tes: ART 113 115 ARS 101, 102, or instructor approva .

420 Crafts for the Elementary School Teacher. 3) A
Pract cal laboratory experiences stressing a var ety of media and act vities for classroom teach ng (Not for M A cred t n art education.) 1 lecture 4 hours stud o.

450 Studio Art: Art History I. (3) A
Art trad t ons prior to the 20th century as a bas s for studio and art h story instruction. 2 lectures 2 hours studio Pre or corequ s te ARE 350.

470 Art Criticism: Aesthetics. (3) S
Tradit ons of aesthet cs and art criticism, conceptua is sues in contemporary art, education n the visua arts. 2 lectures, 2 hours stud o Prerequ s te ARE 450. Core qu s te: ARE 480 recommended.

480 Studio Art: Art History II. (3) S
Art trad tions of the 20th century as a bas s for stud o and art h story nstruct on. 2 ectures, 2 hours studio Must be taken before enrol ment n ARE 486 Art Educat on Strate g es and App icat ons Prerequ s te· ARE 450 Corequi site: ARE 470 recommended

486 Art Education: Strategies and Applications. (3) F
The imp ementation and eva uat on of art nstruction for K 12 popu at on Inc udes teaching of Saturday c asses in the Ch ldren s Art Workshop Prerequ s te ARE 480.

496 Methods and Assessment of Learning in Art (3) A
Ind v dua or group research on the assessment of art learn ng ncorporat ng theory and practice. Prerequisites: ARE 470, 480 486· or instructor approva

510 Art in the Self-Contained and Open Classroom. (3) A
A ternate teaching earning strateg es art concepts and sk s re evant to e ementary schoo art experiences for teachers

511 Issues in Art Education. (3) A
nvestigat on of ssues n art educat on.

515 Art Foundations of Art Education. (3) A
Foundat ons of art educat on with an emphasis on psy·cholog ca , ph osoph cal and h stor ca frames of refer ence

525 Art and Society. (3) A
Interre ationsh p of art society and soc a change and their relevance to areas such as government museums and techno ogy

540 Instructional Resources, Art Education. (3) N
Deve opment of aud o v sua materia s in art and nqu ry into strategies for the r mplementation May be repeated once for cred t

545 Perception and Learning. (3) A
Concepts of perception and earning n art nstruct on

550 Aesthetic Inquiry. (3) A
L terature on aesthet cs, methods of nqu ry and mpl ca t ons for art education

570 Analyzing Works of Art. (3) N
The cr t cal exam nat on of art or statements about art and the development of ways for gu d ng th s exam nat on.

575 Curriculum in Art and Education. 3) A
L terature n art educat on and educat on on exist ng strategies for deve oping curricu um, the ssues and prob ems of differ ng curr cu um orientations

610 Issues and Trends in Art Education. (3) N
Doctora eve nvest gat on of historica and contemporary ssues related to teaching and research n art education.

611 Curriculum Development in Art Education. (3) N
Doctora level inquiry nto the phi osoph cal, psycholog ca and socio og ca foundat ons of curricu um deve opment

Omnibus Courses: See pages 48 49 for omnibus courses that may be offered

ART HISTORY

ARS 100 Introduction to Art. (3) F, S, SS
Development of understand ng and enjoyment of art and its re at onship to everyday fe through the study of paint·ing scu pture arch tecture and des gn. May not be taken for credit by student who has comp eted ARS 300 nor used as art history cred t by Art majors. *[Satisfies Gen eral Studies Requirements. HU, H]*

101 Art of the Western World I. (3) F, S
H story of Western art from the Paleo th c period to the M ddle Ages *[Satisfies General Studies Requirements: HU, H]*

102 Art of the Western World II. (3) F, S
History of Western art from the Renaissance to the present *[Satisfies General Studies Requirements· HU, H]*

201 Art of the Non-Western World I. (3) A
H story of the art of the Asian cultures, with an emphas s on nd a, Ch na and Japan. *[Satisfies General Studies Requirements· HU G, H]*

202 Art of the Non-Western World II. (3) A
H story of the art of Afr ca Oceania and the New World. *[Satisfies General Studies Requirements: HU, G, H]*

300 Introduction to Art. (3) F, S
Course content same as ARS 100 but requ res a higher evel of accompl shment and comprehension. May not be taken for cred t by student who has completed ARS 100, nor used as art history credit by Art majors *[Satisfies General Studies Requirements HU, H]*

325 History of Christian Art. (3) N
Chr stian art from the 4th century in Rome to the present Meaning and use of architectura pa nt ng, scu ptural and decorative art forms Prerequis tes. ARS 101, 102; or n structor approva . *[Satisfies General Studies Require·ments. HU H]*

400 History of Printmaking. (3) A
History of the pr nt as an art form and ts relat on to other modes and forms of art stic expression. Prerequis tes ARS 101 102; or nstructor approva *[Sat sfies General Studies Requirements· HU H]*

402 Ancient Near Eastern Art. (3) N
H story of painting scu pture and arch tecture in Mesopo tam a, Egypt and the Aegean Prerequ sites ARS 101, 102; or nstructor approva *[Satisfies General Studies Requ rements· HU H]*

404 Greek Art. (3) A
Art and arch tecture of Greece and the He lenist c Emp re. Prerequ s tes ARS 101 102, or nstructor approva *[Sat isfies General Studies Requirements HU, H]*

406 Roman Art. (3) A
Art and arch tecture of Etrur a, Rome and the Roman Empire. Prerequisites: ARS 101, 102, or instructor

approval. *[Satisfies General Studies Requirements HU H]*

410 Early Christian and Byzantine Art. (3) A
Art and arch tecture of the ear y church and the Byzantine Emp re from the 4th to the 15th century Prerequ sites· ARS 101 102 or nstructor approva *[Satisfies General Stud es Requ rements HU H]*

412 Early Medieval Art. 3) A
Arch tecture scu pture and paint ng n the Lat n West from the 7th century to the end of the Ottoman Period. Pre requ s tes ARS 101, 102; or instructor approva *[Satis f es General Stud'es Requirements· HU, H]*

414 Romanesque Art. (3) A
Scu pture, paint ng, arch tecture and m nor arts n western Europe dur ng the Romanesque per od Prerequ s tes ARS 101, 102 or nstructor approva *[Satisfies General Stud es Requirements. HU, H]*

416 Gothic Art. 3 A
Pa nting, scu pture and arch tecture n western Europe during the Goth c period. Prerequ s tes: ARS 101 102 or nstructor approva *[Satisfies General Studies Require ments HU, H]*

418 Renaissance Art in Northern Europe. (3) A
Painting, scu pture and arch tecture dur ng the 1400s and 1500s north of the A ps Prerequ sites ARS 101, 102 or nstructor approval. *[Sat sfies General Studies Require ments· HU, H]*

420 Early Renaissance Art in Italy. (3) A
Pa nting, scu pture and arch tecture in ta y from 1300 to 1500 Prerequis tes ARS 101, 102, or nstructor approva *[Satisfies General Stud es Requ rements HU, H]*

422 Italian High Renaissance Art and Mannerism. (3) A
H story of Ita ian art dur ng the 16th century inc ud ng the ach evements and inf uence of Leonardo da V nc , Ra phae and M che ange o. Prerequ s tes ARS 101, 102 or nstructor approval. *[Satisfies General Studies Require ment HU]*

424 Italian Baroque Art. (3) A
Ita an pa nt ng scu pture and arch tecture of the 17th century Prerequ s tes ARS 101, 102, or nstructor ap prova *[Sat sfies General Studies Requ rements HU H]*

426 Art of the 17th Century in Northern Europe. (3 A
Baroque pa nt ng, scu pture and arch tecture in F anders the Nether ands France and England Prerequ s tes ARS 101, 102 or instructor approva *[Satisf es General Stud ies Requ rements HU H]*

428 Art of the 18th Century. 3 A
H story of pa nting scu pture arch tecture graph c arts and the decorat ve arts from 1700 to the French Revo u t on 1789). Prerequ s tes ARS 101 102; or instructor approva *[Sat sfies General Studies Requ rements. HU, H]*

430 Art of Spain and Its Colonies. (3) A
Arch tecture, paint ng and scu pture from 1500 to 1800 Colon a focus on Mex co the American Southwest and Andean South Amer ca Prerequis tes ARS 101, 102; or nstructor approva *[Satisfies General Studies Require ments. HU, H]*

432 Art and Revolution: European Art 1780–1830. (3) A
Impact of American and French Revo utions and the Na po eonic epoch on v sua arts Concentration on Goya, Dav d, Ger cau t B ake, etc Prerequ sites· ARS 101 102, or nstructor approval *[Sat sfies General Studies Requirement HU]*

434 Romanticism and Realism: European Art 1800–1855. (3) A
History of the v sual arts n the first half of the 19th cen tury. Prerequ s tes: ARS 101 102, or nstructor approva *[Satisfies General Studies Requirement HU]*

436 Impressionism and Late 19th-Century European Art. (3) A
History of paint ng, sculpture and graph c arts in latter half of the 19th century Prerequis tes ARS 101, 102, or n structor approva *[Satisfies General Stud es Require ment HU]*

438 Art of the 20th Century I. (3) A
Deve opments and d rect ons in art between 1900 and World War Prerequis tes ARS 101, 102· or instructor approva *[Satisfies General Stud es Requirement· HU]*

439 Art of the 20th Century II. (3) A
Art s nce World War I, w'th cons derat on of new con cepts and exper mentat on with med a and modes of pres entation Prerequ sites: ARS 101 102 438; or nstructor approval. *[Satisfies General Stud es Requirements: HU, H]*

442 American Art I. 3 A
Art n the Un ted States from European sett ement to 1850 Prerequ sites. ARS 101, 102; or nstructor approval.

443 American Art II. 3 A
Art n the Un ted States from 1850 to 1892 Prerequ s tes ARS 101 102; or nstructor approval

444 American Art III. (3) A
Art n the Un ted States from 1892 to World War Pre requ s tes: ARS 101 102 or nstructor approva

450 19th-Century Photography. (3) A
History of photography from the medium s preh story to 1914, personal t es processes, mages and deas. Pre requis tes· ARS 101 102, or nstructor approva *[Sat s fies General Stud es Requ rements HU H]*

451 20th-Century Photography. (3) A
Persona it es, processes mages and deas n photogra phy from 1914 to present. Prerequis tes ARS 101, 102 or nstructor approva *[Satisfies General Studies Re quirements HU H]*

454 Research and Writing in Photography. 3 A
Pr ncip es and pract ce of research and wr t ng in the h s tory and cr t c sm of photography Papers requ red Pre requ s tes ENG 101 102 or equiva ent ARS 450, 451 or nstructor approva *[Satisfies General Studies Require ment: HU]*

456 History of Art Criticism I. (3 N
H'story of theor es of crit c sm of the v sua arts. Read ngs from v sual arts cr tica l terature from Plato to 18th cen tury. Prerequ sites· ARS 101, 102, or nstructor approval. *[Satisfies General Studies Requirements HU H]*

457 History of Art Criticism II. (3) N
Theor es of crit c sm of the visual arts from ate 18th cen tury to present. Prerequ s tes ARS 101, 102, or nstruc tor approval. *[Satisfies General Studies Requirements HU H]*

458 20th-Century Art Criticism. (3) N
Sem na , nf uent a wr t ngs n deve opment of modern art cr t c sm Ro e of art cr t c art journa s n relat on to art

community. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirement: HU]*

459 Writing Art Criticism. (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. Prerequisite: ARS 458 or instructor approval. *[Satisfies General Studies Requirement: HU]*

462 Precolumbian Art I. (3) A
Architecture, sculpture, ceramics, painting and other arts of Mesoamerica prior to European contact. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, H]*

463 Precolumbian Art II. (3) A
Architecture, sculpture, ceramics, textiles, and other art of South America prior to European contact with focus on the Central Andes. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirement: HU]*

465 North American Indian Art. (3) A
Native American art forms of the United States and Canada from prehistoric times to present. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirement: HU]*

466 Southwest Indian Art. (3) A
American Indian art in the southwestern states from its origins to the present day. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, H]*

468 Shamanism and Art. (3) A
Performance arts as well as traditional art objects associated with the shaman in Siberia and North America. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, SB, G]*

469 Mexican Art. (3) A
Art of Mexico and related Central American cultures from the prehistoric to the contemporary schools. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, G, H]*

472 Art of China. (3) A
Study of major forms in Chinese art: ritual bronze, sculpture, ceramic, calligraphy, painting and architecture. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, G, H]*

473 Art of Japan. (3) A
Japanese art from the Joman period to the present. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, G, H]*

475 Chinese Painting. (3) A
From Ku K'ai-chin to Ch'i Pai-shih. Major artists, styles and movements in Chinese painting. Satisfies non-Western art history requirement. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, H]*

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: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: HU, H]*

498 Pro-Seminar. (3–6) A
Undergraduate seminar in topics selected from the following. 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	(j)	American Art

Prerequisite: instructor approval.

591 Seminar. (3–6) A
Graduate seminar in topics selected from the following. 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	(j)	American Art

Prerequisite: instructor approval.

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

ART AUXILIARY COURSES

ARA 202 Introduction to Photo Aesthetics. (3) F, S
Slide lecture course in understanding photography as a fine art form. *[Satisfies General Studies Requirement: H]*

460 Gallery Exhibitions. (3) F, S
Practical experience in all phases of department gallery operations and preparation of gallery publications. May be repeated for credit. Prerequisite: instructor approval.

485 Women's View of Art. (3) A
Study of women visual artists, their lives and the social, political, aesthetic and educational issues related to their art. Lecture, discussion, readings and studio experiences. 3 hours a week. Prerequisite: instructor approval.

488 Understanding Art. (3) F, S
Understanding art as an emergent cultural phenomenon with an emphasis on a critical examination of conceptual issues in art. Writing required. Prerequisites: ARS 101, 102; or instructor approval. *[Satisfies General Studies Requirements: L2, HU]*

Omnibus Courses: See pages 48–49 for omnibus courses that may be offered.

Dance

PROFESSORS:
LESSARD (PEBE 107B) JONES, LUDWIG
ASSOCIATE PROFESSORS:
CHLISTOWA KEUTER, MARION
ASSISTANT PROFESSORS:
KAPLAN MATT, MOONEY
INSTRUCTOR:
VISSICARO
SENIOR LECTURER:
NAGR N
CURATOR-OF-DANCE:
ROSEN
PROFESSOR EMERITUS:
GISOLO

Departmental Major Requirements

For advisement purposes, all students registering in a Dance degree program 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 se quence and special requirements. These are available in the Department of Dance office.

Bachelor of Arts Degree Curriculum

Dance. This major consists of a minimum of 53 semester hours in dance, of which the following are required: DAH 190, 401, 402; DAN 130, 131, 134, 135, 171, 172, 173, 174, 232, 234, 235, 262, 264, 265, 334, 340, 341, and 464. Fifteen addi tional hours approved by an advisor must be in no more than two related fields. Additional re quirements are listed on the departmental check sheet.

At least 50 semester hours, including 18 in the major, must be upper division. Grades in classes required for the major must be "C" or better. First semester students should take: DAH 190, DAN 134 Technique and Theory of Modern Dance, DAN 135 Technique and Theory of Bal let, ENG 101, MUS 100, and one General Studies requirement.

Bachelor of Fine Arts Degree Curriculum

Dance. This major consists of 75 88 semester hours with a concentration in either performance and choreography or dance education. Core courses required are: DAH 190, 401, 402; DAN 130, 131, 134, 135, 171, 172, 173, 174, 230, 232, 234, 235, 262, 263, 264, 265, 334, 340, 341, 464, 465, and 480. For the concentration in performance and choreography, additional requirements include DAN 331, 332, 335, 371, 434; MUS 100; MUS 347 or 355 or 356; and THP 101. For the specialization in Secondary Education, MUS 100, DAN 350, 351, 357, 359, and one hour of Jazz Dance must be completed as well as all state sec ondary certification requirements. Other require ments for each option are listed on the depart mental check sheet.

At least 50 semester hours, including at least 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: DAH 190, DAN 134 Technique and Theory of Modern Dance, DAN 135 Technique and Theory of Bal let, ENG 101, MUS 100, and one General Studies requirement.

Departmental Graduate Program

The faculty in the Department of Dance offer a program leading to the Master of Fine Arts de gree 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 Catalog* for requirements.

DANCE HISTORY

DAH 100 Introduction to Dance. (3) F, S
Or entat on to the f e d of dance focus ng on h story, sty es cu tural, and theatr ca aspects of the art form *[Satisfies General Studies Requirement· HU]*

190 Introduction to the Dance Profession. (1) F
Orientat on to the dance profess on ntroduc ng career op tions and un vers ty department resources Des gned for Dance majors.

300 Introduction to Dance. (3) F S
Course content same as DAH 100 but requ res a h gher eve of accomp shment and comprehension May not be taken for cred t by student who has comp eted DAH 100. *[Sat sf es Genera Stud es Requirement HU]*

301 Philosophy and Criticism of Dance. 3) F, S
Phi osophica ssues n dance and dance crit c sm w th emphasis on wr tten ana ys s and nterpretation. Prerequ site 1 semester of F rst Year Compos tion *[Satis fies General Stud es Requ rements L1, HU]*

401 Dance History I. (3 F
Cu tura and theatnca deve opment of dance from preh s tory through the 19th century Romant c per od includ ng the ear y h story of ba let. *[Sat sfies General Studies Re qu rements HU, H]*

402 Dance History II. 3 S
Cu tura and theatr cal development of dance from 19th century Romantic period through Contemporary t mes n cludes ba et, modern and musica theatre dance *[Satisfies General Stud es Requ rements HU H]*