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

Architectural Communications. AVC courses develop the student's understanding of commu nication theory as it applies to architectural de sign 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 which 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
Organizat ona , human performance and market inf u ences on the arch tecture f rm and ts projects. Read ngs, case studies and ana ys s of manager al problems and so ut ons Lecture, d scuss on Prerequisite AAD 560 or in structor approva

552 Architectural Management II. 3 S
E ements of project and financ a management n arch tec tura f rms Dec s on mode ng, resource p anning and control Read ngs and case stud es Lecture d scuss on Prerequisite AAD 560 or nstructor approva

553 Construction Contract Administration I. 2 F
Construct on contract adm nistrat on nclud ng budget con tro schedu ng cash f ow, changes and c a ms and mon tor ng systems for trad t onal, fast track and des gn bu ld methods 2 hours ecture 3 hours ab includ ng f eld tr ps. Prerequ s te: AAD 560

554 Construction Contract Administration II. 3) S
Advanced top cs and prob ems n construct on contract adm n strat on. Prerequ s'te: AAD 553 or nstructor ap prova

555 Architect as Developer. (3) F, S
Deve opment bu d ng rea estate, construction fund ng and acqu s t on and the sources for cap ta Prerequ s te nstructor approva

558 Specifications and Cost Analysis. (3) S
Coord nat on of work ng draw ngs construction specif ca tions and cost est mates Emphasis on methods office procedures contract cond tions bonds and bidd ng proce-dures Lecture Prerequ site graduate eve stand ng or nstructor approva

560 Professional Practice I. (3) F
Profess onal pract ce ssues nc ud ng ega requ rements, ethics, financ a and marketing mechan sms, manage ment, cl ent re at onsh ps and new deve opments n prac t ce. Prerequisite adm ssion to M Arch program or 'n structor approva

Special Courses: AAD 294 484, 494 498, 499 500 580 584, 590 591 592 593 594, 598, 599. (See pages 43–44

ARCHITECTURAL DESIGN AND TECHNOLOGY STUDIOS

ADE 221 Design Fundamentals I. 3 F
Exerc ses n bas c v sua organ zat on· ncludes des gn vo cabu ary princip es of 2D and 3D composit on co or and aesthetic react ons to des gn 1 hour ecture, 6 hours stu d o Prerequ s te major in co ege

222 Design Fundamentals II. 3 S
App cation of des gn fundamenta s to environmenta de s gn prob ems Introduces human sca e performance cri teria, funct onal and aesthet c spatia organ zat on and movement. 1 hour ecture 6 hours stud o. Prerequ s tes major n co ege; ADE 221 AVC 141, 160

321 Architectural Design Process Determinants. 3) F
Fundamenta s of architectura design prob em-so ving techn ques and the des'gn process. nvest gat on ana y s s synthes s and development of design projects Lec ture stud o and f eld tr ps. Prerequ s te· nstructor ap proval

322 Architectural Design Environmental Determi-nants. 5) S
Bu d ng and s te des gn n response to s te cl mate and other env ronmental determ nants Hous ng and other bu d ng types Lecture stud o and f eld trips Prerequ s te ADE 321

421 Architectural Design Human and Behavioral De-terminants. 5 F
Emphas s on the des gn of commun ty fac l t'es user needs and act v t es. Peop e and the r behav or as a pri mary arch tectura determ nant Lecture stud o and f e d trips 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 tural and urban serv ces Em phas s on soc etal needs and expectat ons Lecture, stu d o and f eld 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 studio and f eld tr ps 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 d ng systems, n arge structures and comp exes Lecture studio and f e d tr ps Prerequ s te· ADE 521

532 Earth Sheltering Techniques. (3 S
Pr nc p es of earth she ter ng for energy conscious bu ld ing nc ud ng or entat on, structure nsu at on mo'sture proof ng and bu d ng codes. Prerequisite· ATE 551

621 Advanced Architectural Design III. 5) F
Se ected top cs n comp ex bu d ngs Lecture stud o and fie d tr ps Prerequis tes ADE 522 nstructor approval

622 Advanced Architectural Design IV. (5) S
nd v dua student n t ated fina stud o project emphas z ng a f na synthes s of major arch tectura des gn determ nants Studio 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 tectural synthes s emphas z ng c mat c criter a and ana ys s w th emphas s

on appropr ate techno ogy and pass ve therma systems Prerequis te f rst profess onal degree or nstructor ap prova

662 Energy Efficient Design and Planning. 4 S
Laboratory and f e d exper ence n energy eff c ent des gn emphas z ng so ar energy and re ated renewab es n ur ban and nst tut ona comp exes for comfort prototypes Prerequ site ADE 661

Special Courses: ADE 294, 484 494 498 499 500 580 584 590, 591, 592, 593, 594, 598, 599 See pages 43–44

ENVIRONMENTAL ANALYSIS AND PROGRAMMING

ANP 331 Environmental Ana ysis. 3 F
Ana ys s of the natura and human env ronmenta determ 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 standing

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 preparat on and methods of eva u at on Prerequ s te· profess ona eve stand ng *[Sat sf es Genera Stud es Requ rement L2]*

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

442 Site Planning Principles and Analysis. 3 S
Effects of topography c mate energy zon ng and and scaping upon des gn deve opme t 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 generic m crocomputer software in so v ng arch tectura des gn prob ems Emphas s on the og c of prob em formu at 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, nc ud ng graph cs hardware, dev ce nde pendent packages, two and three d mens ona transforma t ons and data structures 2 hours ecture 3 hours ab Prerequ s te ANP 475 or nstructor approva

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 ana ys s ex st ng bu d ng evaiuat on and program preparat on. Prerequ s te th rd profess ona eve n arch'tecture or nstructor approva

561 Architectural Information Processing Systems. 3) S
Appl 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 requis tes graduate stand ng nstructor approva

562 Information Systems for Facilities Management. 3 F
Introduct on to database des gn and mp ementat on As sessment of fac ty management prob ems from nforma t on system po nts of v ew. Sem nar, ab Prerequ sites 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 c programs, nat ona and oca programs, zon ng aw, hous ng d str but on p ann ng princ p es and po c es des gn rev ew, sta dards and private deve op ment pract ce

577 Housing Environments. 3 S
Contemporary hous ng environments housing types and fe styles as determ ned by user preference dens ty de ve opment and property standards cost, commun ty and pr vacy secur ty dent ty movement and the need for open space

581 Urban Structure and Design. 3) F
The nature and dynam cs of urban zat on and ts re at on sh p to arch tecture and urban des gn nc ud ng growth decay soc a zat on p ann ng processes and v sual per cept on Case stud es. Prerequ s te profess ona eve stand ng

681 Professional Seminar: Societal Influences on Architectural Practice. 2 F S
Exam nat on of soc eta ssues confront ng the pract ce of arch tecture Sem nar Prerequ s te graduate stand ng or nstructor approva

Special Courses: ANP 294 484 494 498 499 500 580 584 590 591 592 593 594 598 599. See pages 43–44

ARCHITECTURAL PHILOSOPHY AND HISTORY

APH 100 Introduction to Environmental Design I. 2 F S
Survey of env ronmenta des gn nc udes h storic ex amp es and the theoret ca soc a , techn ca and env ron menta forces that shape them *[Sat'sf es General Stud es Requ rements HU G, H]*

101 Introduction to Environmental Design II. 2 F, S
Survey of env ronmenta des gn ssues respons b t es and d rect ons *[Satisf es Genera Stud es Requ rements HU H]*

300 World Architecture I/Western Cultures. 3 F
H stor ca and contemporary bu t env ronments of West ern c v zat ons Med terranean Europe and the Amer cas as man festat ons of cu tura h story and responses to en v ronmenta determ nants Non arch tecture majors on y. *[Sat sf es Genera Stud es Requ rements G H]*

301 World Architecture II Eastern Cultures. 3 S
H stor ca and contemporary bu t env ronments of Eastern c v zat ons M d East, Centra As a Far East and South Pac f c as man festat ons of cu tura h story and responses to env ronmenta determ nants *[Sat sfies Genera Stud es Requ rements G H]*

304 American Architecture. 3 N
Arch tecture n the U S from ear est co on a t mes to present Non arch tecture majors only *[Sat'sfies General Stud es Requirements HU H]*

305 Contemporary Architecture. (3 N
Europe and Amer ca from the foundat ons of the modern movement to the present Non arch tecture majors on y *[Sat sf es Genera Stud es Requ rements· HU G H]*

311 Survey of Mexican Architecture. 2 N
Overv ew of h stor ca through contemporary examp e of Mex can arch tecture, andscape and urban des gn *[Sat sf es General Stud es Requ rements: HU, H]*

313 History of Western Architecture I. (3) F
Representat ve bu d ngs and s tes w th emphas s on the r phys ca and soc a sett ngs from ant quity through the m ddle ages Prerequ s te jun or stand ng or nstructor approva *[Satisfies General Stud es Requirements HU H]*

314 History of Western Architecture II. 3 S
Representat ve examples of arch tecture and urban de- s gn w th emphas s on the r soc a and h stor ca contexts from the m dd e ages to the present Prerequisite jun or stand ng or nstructor approva *[Sat sfies General Stud es Requirement: H]*

348 Theory of Built Environments. 3 N
Focused study of bu t env ronmental forms, the r theoret ca foundat on and re at on to soc al processes. Prerequ site sophomore stand ng *[Satisfies General Studies Re qu rement HU]*

411 History of Landscape Architecture. (3 F
The phys ca record of human att tudes toward the and Se ected examp es of anc ent through contemporary and scape p ann ng and des gn

414 History of the City. 3) F
The c ty from ts anc ent or g ns to the present day w th emphas s on c t es of Europe and America dur ng the ast f ve centur es.

441 Ancient Architecture. 3 N
Arch tecture of the anc ent Med terranean world w th se ective emphas s on major h storica comp exes and monumenta s tes. Prerequ site APH 313. *[Sat sfies Gen eral Studies Requ rements HU H]*

442 Preservation Planning. 3 F
Pr nc p es and pract ces n plann ng for preservat on con servation and ne ghborhood redeve opment. Emphas s on eva uat on of h stor c resources Off campus f eld prac t cum requ red. Prerequ s te nstructor approva

443 Renaissance Architecture. 3) N
Se ected examp es of Rena ssance arch tecture and ur ban sm w th emphasis on the r h stor ca and cu tura set tings Prerequ s te APH 314 *[Satisfies General Stud es Requirements HU, H]*

444 Baroque Architecture. 3 N
Se ected examp es of Baroque arch tecture and urban sm w th emphas s on re at onsh ps between architecture and other arts Prerequ s te APH 314 *[Sat sfies General Studies Requirements HU, H*

445 19th-Century Architecture. 3 N
Arch tecture and urban sm n Europe and North Amer ca from the French Revo ut on to Art Nouveau Emphas s on the chal enge of new materia s and techn ques n the con text of revived and trad t ona arch tecture. Prerequ s te APH 314 *[Satisf es General Stud es Requ rements HU, H]*

446 20th-Century Architecture I. (3 F
Arch tecture n Europe and America from the foundat ons of the modern movement to the cu m nation of the nterna t ona style Prerequ s te major n co ege *[Satisfies Gen eral Studies Requ rements· HU G H]*

447 20th-Century Architecture II. 3) S
Deve opments n architecture s nce the nternat ona sty e Prerequisite. APH 446 *[Satisfies General Stud es Re qu rements HU G, H]*

681 Architectural Theory. (3) N
An exam nat on of arch tectural theory. Emphas s on ap p cation of theory to practice Sem nar Prerequ s te: n structor approva .

682 Architectural Criticism. 3 N
An exam nat on of arch tectura cr t c sm emphas z ng spec f c methods of cr t c sm and the r app cat on for aes thet c judgment Sem nar Prerequ s te nstructor ap prova

Special Courses: APH 294 484 494 498 499 500, 580, 584, 590, 591, 592 593 594 598 599 See pages 43–44

ARCHITECTURAL TECHNOLOGY

ATE 351 Environmental Control Systems I. 3) F
Arch tectura des gn mpl cat ons of so ar rad at on, heat and mo sture transfer Trends n env ronmenta contro and energy conscious des gn Pass ve techn ques to heat coo and ght 2 hours ecture 3 hours ab Prerequ s te adm ss on to upper d v s on

353 Architectural Construction I. 3 F
Bas c mater a s and methods of arch tectura construct on for res dent al sca ed systems nc udes effects of zon ng and code requirements Lecture ab Prerequ s te adm s s on to upper d v s on

361 Building Structures I. 3 F
Stat cs, dynam cs and strength of mater a s E ast c ty of structura mater a s, propert es of sect ons e ast c 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
Ana ys s and des gn of wood and masonry structura sys tems and connections 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
Select on and emp oyme t of materia s and systems ac cord ng to the r nature and the techn ques 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 des gn mp cat ons of HVAC systems Heat ng and coo ng oads, psychrometr cs, the refr gerat on cyc e a r water d str but 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 d 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
Analys s des gn and deta ng of concrete systems con sider ng cont nu ty, mu t story frames and shear wa s and ateral ana ys s Computer app cat on us ng ex st ng pro grams. Prerequ s te ATE 461

501 Introduction to Solar Energy. 3 S
Introduct on to theoret ca and p act 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 ca contemporary and pract ca nf uences of so ar and other resource systems on the des gned env ronment arch tectura andscape urban and reg ona mp cat ons of resource strateg es other renewab e resources

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

522 Desert Habitat on Technology. 3) F
Ana ys s of hab tat on approaches in nontechno og ca and techno og ca soc et es ar s ng from the nature of desert areas Prerequ s te ATE 352.

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

542 Building Thermal System Simulat on and Optimization. 3) S
Mathemat cal mode s of bu d ng enve ope and comfort cond t on ng systems w be deve oped to s mu ate bu d ng energy systems opt m zat on techn ques are a so 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 s ch as contro s heat exchangers heat transfer f uids n bu d ngs s emphas zed Prerequ s te ATE 541

550 Passive Cool ng in Bu ldings. 3 N
Theory class f cat on and eva uat on of pass ve and ow energy coo ng systems for therma comfort n bu d ngs. Lecture. Prereq s te ATE 452.

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

552 Advanced Modeling of Passive Systems. 3 S
Advanced computer a ded eva uat on 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 the des gn of bu d ngs Prerequ s te adm s sion to upper d v s on or nstructor approva .

554 Energy Conservation in Buildings. 3 S
Impact of natura forces on the des gn of bu d ngs empha s z ng pre des gn dec s ons and post construct on prac t ces ead ng to m n mum energy consumpt on. Invest ga t on of new energy sources Prerequ s te: ATE 452

557 Construction Documents I. 3 F
Product on of arch tectura work ng draw ngs 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 ec ture. 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 uation techn ques for des gn synthes s of energy re ated parameters n s te c mate, human comfort 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 env ronmenta prob ems w th emphas s on energy performance Se ected top cs ecture, ab. Prerequ s te. ANP 475 or 477

562 Energy Efficient Systems Evaluation. 3 N
F e d performan e data of act ve and pass ve solar sys tems and components s compared w th fundamental pr n c p es and formu at ons Prerequ s te ATE 521

582 Building Systems II. 3 S
Des gn of bu d ng systems nc ud ng e ectr ca p umb ng, security, commun cat ons, f re protect on and transporta *t on F e d tr ps 2 hours ecture 3 hours ab Prerequi* s tes ATE 452 553

588 Building Structures V. 3 F
New deve opments n h gh r se structura systems Effects of w nd and se sm c forces Prel m nary ana ys s, des gn and deta ng of ta l bu dings us ng code requ rements and *computer app cations Lecture, ab* Prerequ s te ATE 462

Special Courses: ATE 294, 484 494 498, 499 500 580 584 590 591 592 593 594, 598, 599. See pages 43–44.

ARCHITECTURAL COMMUNICATION

AVC 141 Design Graphics. (2 F S, SS
Orthograph c, 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 ma or n co ege.

160 Freehand Perspective Drawing I. 2 F, S SS
Freehand perspect ve draw ng methods app ed to draw ng ob ects and nter or and exter or env ronments in ne and tone 1 hour ecture 4 hours stud o. Prerequ s te ma jor n co ege

161 Freehand Perspective Drawing II. 2 F S SS
Co t nuat on of AVC 160 ntroduction of co or med a and ana yt ca and des gn draw ng exerc ses 4 hours studio Prerequis tes major n co ege AVC 160

301 Architectural Communication I. 2 F
Bas c graphic sk s, draw ng convent ons, va ues, graph c symbo s and etter ng sketch ng and presentat on vocabu ary. 2 afternoons n aboratory per week Lecture and f e d tr p. 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 im nary presentat on too s for the design profess ona Pre requ s te AVC 301 or nstructor approva

411 Architectural Watercolor Presentation Techniques. 2 N
Introduct on of arch tectural presentat on 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 nstruc tor approva

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

Special Courses: AVC 294, 484, 494, 498, 499, 500, 580, 584 590, 591 592, 593, 594 598 599 See pages 43–44

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 nationa and nternat ona ocat ons Cred t/no cred t May be re peated w th approva of d rector.

484 Clinical Internship. 3 SS
Fu t me nternsh p under the superv s on of pract t oners n the Phoenix area or other ocales Cred t/no cred t Pre requ s te nst uctor approval

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

Special Courses: ARP 294 484 494 498 499 500 580 584 590 591 592 593 594 598 599 (See pages 43–44

Design

PROFESSORS:
WOLF (ARCH 154), KROELINGER, REZN KOFF
ASSOCIATE PROFESSORS:
BLEY BUSH KNIGHT, N ELSEN WITT
ASSISTANT PROFESSORS:
BRANDT, JOHNSON, MAHAFFEY,
QUESADA, RATNER SADLER, VERNON
PROFESSORS EMERITI:
BENZ NGER, 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 faculty believe that the designers have a responsibility to the public and the communities which they serve the student not only learns 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 technically accomplished and conceptually sophisticated graduates who continue to evolve as practicing professionals With the help of an international network and a faculty of active design professionals, the aim is to educate young creative individuals who will achieve both a comprehensive understanding of products and interiors as related to the different cultures in which they exist.

Organization

The Department of Design offers three professional programs: Industrial Design, Interior Design, and Design Science. The programs are organized by the faculty of the department under the direction and administration of the chair.

Degrees/Majors

The faculty of the Department of Design offer the degree, Bachelor of Science in Design. Three majors are available. major in Industrial Design, major in Interior Design, and major in 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 which require detailed understanding of visual, tactile, safety, and convenience criteria. Industrial designers combine these considerations with practical concern for technical processes; the requirements of manufacturing, 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 collaboration 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 total 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 which 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. For detailed information about application requirements see the following section, application procedures.

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 timetable 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 honor 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 Hour
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 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, product development, presentation, and marketing.

Graduates of the program accept entry 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
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] or COM 222 or COM 225	3
DSC	100	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	3
PGS	100	Introduction to Psychology	3
DSC	101	Contemporary International Design	3
DSC	161	Vocabulary for Industrial Design	3

Sophomore Year

Fall (16			
PHY	111	General Physics[2]	3
PHY	113	General Physics Laboratory	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	Processes 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 course description for specific requirement(s each course fulfills

Industrial Design
Upper-Division Requirements
Junior Year

			Semester Hours
Fall (17)			
DSC	318	History of Graphic Design[1]	3
DSC	327	Presentation Graphics	3
DSC	354	Principles of Product Design	3
DSC	360	Industrial Design III	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[1]			6
		Upper Division Total	69
		B S Design Minimum Total	132

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

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

Interior Design. The curriculum in Interior Design is divided into a lower division first and second years, 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 offering greater enrichment in their studio disciplines, and contributing to the possibility for postsecondary level academic appointments giving the recipients highly sought-after academic credentials.

Interior Design
Lower-Division Requirements[1]
Freshman Year

			Semester Hours
Fall (14)			
ENG	101	First Year Composition or ENG 105 if qualified	3
MAT	117	College Algebra[2]	3
DSC	100	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
Social and Behavioral Science Elective[2]			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[2]	3
COM	207	Introduction to Communication Inquiry[2]	3
DSC	235	User Needs and Behavior in Interior Design	3
Approved Humanities or Social and Behavioral Science Elective[2]			3
Natural Science Elective with Laboratory[2]			4
Lower Division Total			57

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 course description for specific requirement(s) each course fulfills.

Interior Design
Upper-Division Requirements
Junior Year

			Semester Hour
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[1]			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 Behavioral Science Elective[1]			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 course description for specific requirement(s) each course fu fills.

[2] During the fifth year, the student concentrates on re search related to the development of a comprehensive project. This year is self directed in nature, and pre pares the student for independent thinking and creative problem solving. The fifth year experience re quires high expectations for producing professional work which 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 divisional programs of industrial de sign, architecture and planning, thus furthering a real life interdisciplinary problem so ving experience.

General Information

Upper-Division Application Procedures. Stu dents should write to the academic advisor for the application form well in advance of the applica tion deadline. For general information on portfo lios, ask for a copy of the *Portfolio Seminar* bro chure from the college academic advisor.

Upper-Division Application Deadlines. *April 13* Portfolio and application documents due in the department office by 4:00 P.M.

June 13. If the spring 1990 semester includes transfer course work, this is the deadline by which a student must submit his/her own tran scripts to the department. These may be 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 2 Acceptance notices mailed.

July 16. (1) Return of Letter of Acceptance. A signed receipt of acceptance of admission must be received by the department by this date (2) Noti fication of admission status for alternates. (3) Portfolios available for return.

Matriculation. Accepted students are expected to begin their upper division professional program at the beginning of the immediate fall term There is no spring admission to the upper divi sion.

Portfolio Format Requirements. Each appli cant 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 1. Application form, completely filled out with page one visible. (Application forms are available from the college Academic Advising Office.)

Page 2. Application form with page two visible.

Page 3. All high school transcripts. Put all these into one sleeve.

Page 4. College transcripts. Include all college transcripts for both ASU and transfer work. In cludes all work through the fall 1989 semester. Copies are acceptable. The academic advisor will forward your spring 1990 ASU transcripts. (For those with spring semester 1990 transfer work, the student is responsible for submitting these transcripts by June 13 so they may be added to their portfolio. The student is also responsible for getting an official transfer transcript sent directly to the Office of Undergraduate Admissions.)

Page 5. Evidence of admission (or readmission) to ASU. This may be a copy of the ASU Certifi cate of Admission or a Student Information Sys tem printout showing enrollment status obtained at a Registrar's Site.

Following Pages (usually 10–20 sheets). Include sufficient examples of studio and laboratory work to show the depth of your design and drawing skills. Include freehand and hardline drawings and examples of two and three dimensional de sign and graphics. Include a concise caption for each item that explains the work and list other pertinent information as applicable, including names of other team members, length of project, course and project description.

Students are encouraged to include additional materials, written or pictorial, that provide addi tional evidence of skills and abilities, as well as 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 indi cated. Original examples or slides must not be submitted. All examples must be photographs or other reproduction graphic media.

Return of Portfolios. Application documents (pages 1 5) remain the property of the department. However, the remaining portfolio will be returned after 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 appli cant provides written permission, another person may claim the portfolio. After one year un claimed portfolios are discarded. While care will

be 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 50–53. For a key to the letters and numbers on each list of degree requirements see page 193 or 53.

DESIGN

DSC 100 Introduction to Environmental Design. 2 F S
Survey of environmental design including historical 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 ideas. 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 proportion sequential development of two and three dimensional drawing skills 1 hour lecture 4 hours ab 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 ab 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 Introduction to Interior Design. 2 S
Interiors issues theories and philosophies Emphasis on subjective and objective analysis of problems of design and their solutions *[Satisfies General Studies Requirement HU]*

226 Color Sketching. 3 F S
Felt markers, quick representational and concept communication sketching. Forms in space light and shade Material reflectance properties 6 hours studio Prerequisites DSC 161 or equivalent· industrial Design major

227 Visual Methods for Problem Solving. 3 F
Introduction to conceptual design activity based on the mind eye media feedback loop Graphic language used to represent conjecture analysis synthesis of objects and their contexts Seminar studio Prerequisite DSC 161 or equivalent

228 Imaging and Visualization. 3 S
Design activities stressing graphic language abstraction practiced for presentation Structure of critic sm including description interpretation and evaluation are discussed Seminar studio Prerequisite DSC 227

231 Concepts for Interior Design. (3 F
Conceptual design development scale and proportion light texture form volume and spatial hierarchy passage and exposure 1 hour lecture 4 hours ab Prerequisite: DSC 171

235 User Needs and Behavior in Interior Design. 3 S
Applications of conceptual design to issues of programming and space planning user needs and behavior. 1 hour lecture, 4 hour ab Prerequisite DSC 231

242 Materials and Design. 3 F
Material as application in design introduction to characteristics and properties of metals, organic materials including plastics, and norganic materials 3 hours lecture

243 Process and Design. 3 S
Influences of industrial processing on design. Introduction to basic material as processing and post forming processes Emphasis on appearance enhancement and design constraints of material processing 3 hour lecture Prerequisite DSC 242

260 Industrial Design I. 3 F
Introduction to the method and process of the industrial designer Determinant necessary in small product design 1 hour lecture 2 hours studio Prerequisite: DSC 161 or equivalent

261 Industrial Design II. 3 S
Issues of physical form development related to product and design form development properties of paper, fiberwood metal and plastics 1 hour lecture 2 hours studio Prerequisite DSC 260 or equivalent

310 History of Interior Design I. 3 F
The design of interior spaces as expression of cultural influences to 1835 Lecture Prerequisite ARS 102 or instructor approval *[Satisfies General Studies Requirements HU H]*

311 History of Interior Design II. 3 S
Design of interiors as an expression of cultural influences from 1835 to the present Lecture Prerequisite DSC 310 or instructor approval *[Satisfies General Studies Requirement H]*

316 20th Century Design I. 3 F
Modern European and American design from 1900 to 1940 Emphasis on transportation product furniture exhibition and graphic design Lecture *[Satisfies General Studies Requirements HU H]*

317 20th-Century Design II. 3 S
Modern European Asian and American design since 1940 Emphasis on transportation product furniture exhibition and graphic design Lecture *[Satisfies General Studies Requirements HU H]*

318 History of Graphic Design. 3 F
Survey of development in the graphic arts innovative printing methods aesthetic values and social and cultural environments that shape them Lecture *[Satisfies General Studies Requirement HU]*

327 Presentation Graphics. 3 F
Methods for portfolio and professional product presentation using graphic media for information transfer are studied Aesthetic judgement organization and craftsmanship are stressed Seminar studio Prerequisite DSC

328 Graphic Design. (3 S
Packaging app cat ons and p ann ng are nvest gated and app ed to the deve opment of an dent ty for 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 Lecture

341 Interior Materials and Finishes. 3 F
Genera analys s of qua ty contro measures relat ng to n terior des gn mater a s, f n shes and performance cr tena Lecture 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 and the r operat ng env ronment. Lecture

354 Principles of Product Design. 3 F
Inf uences of phys ca and mechan ca concepts in product des gn; mechan sms, k nemat cs and fasten ng systems Concepts of ana ys s for product des gn. nf uences of concepts on aesthetics 3 hour ecture Prerequ s tes MAT 117 PHY 111

355 Material Design. 3 S
Mold des gn for part requirements mo ded ho es, threads; nserts fasten ng and jo n ng, decorat ng extrus on de s gn re nforced plast cs Lecture Prerequ s te DSC 354

360 Industrial Design III. 5 F
Methods of v sua th nk ng conceptua zat on and deat on re ated to bu d ng sk leve s n profess ona des gn pres entat on techn ques. 10 hours stud o Prerequ site depart ment approva .

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

364 Interior Design Studio I. 5 F
Stud o prob ems n nter or design re ated to behav oral re sponse in persona and sma group spaces 10 hours stu dio Prerequ s te: department approva

365 Interior Design Studio II. 5) S
Studio prob ems n nter or des gn w th emphas s on s sues of pub c and pr vate use of nter or places of assem b y 10 hours stud o Prerequis te department approva

367 Electronic Packaging. 3 N
ndustria des gn prob ems n packag ng electron c de v ces Emphas s is placed 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 decorat ve arts as an express on of cu tura nf uences and as an extens on of nterior spaces Pre requisite DSC 311 or nstructor approva *[Satisf es Gen eral Stud es Requirement HU]*

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

421 Concept and Style in Presentation Documents. 3 F
Methods of ana yz ng portfo o des gn for nteriors Form ing presentat on concepts and estab sh ng a commun ca t ons sty e Prerequ s te sen or standing

442 Specifications and Documents for Interiors. 3 F
Contract spec fica t ons documents, schedu es, and b d- d ng procedures for nterior des gn Lecture 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 n ter or furn ture and m work 1 hour ecture 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 wh ch contro the sensory nput from the amb ent env ronment Lecture 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 Lecture 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 nter or des gn Eva uation of ght sources for distribut on co or and cost Lecture Prerequ s te sen or stand ng

460 Design Project I. 5 F
Comp ete 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 stan dards 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 nation of des gn process and techn que. Ind 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 problems n nterior des gn re ated to commerc a spaces 10 hours stud o Prerequ s te department ap prova

465 Interior Design Studio IV. 5) S
Stud o prob ems n nter or design re ated to hea th and educationa 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 des gn theory, and cr t c sm Thes s project deve opment based upon the major's concentrat on. 10 hours stud o Prerequ s te. de partment approva

467 Interior Design Studio VI. 5 S
Advanced series of spec a zed projects or cont nuation of thes s project based upon the major's concentrat on. 10 hours stud o. Prerequ s te department approva

470 Professional Practice for Industrial Design. 3 F
Bus ness procedures management techn ques account- ng systems ethics and ega respons b t es of the des gn profess ons Lecture May be repeated for cred t Pre requisite sen or stand ng

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

474 Industrial Design Seminar Studio. 3 S
Large scale nterd sc p nary c ass project nvolv ng project p ann ng and contro des gn prototype development fea s b 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 als wh ch produce and en hance a successfu nternsh p exper ence Sem nar. Pre requ s te th rd year major n the department.

484 Internship. 3) SS
Fu l t me summer nternsh p under superv s on of pract t o ners in the Phoen x area or other loca es. Prerequ s te nstructor approva

520 Design Forecasting: Methods and Applications. 3) N
Projected app cat ons n des gn production 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 faci ty management process n arge sca e organ za tions. Plann ng, ong-range forecast ng and product v ty. Project management methodo og es us ng m cro based software programs Lecture

523 Facilities Planning and Management II. (3 N
The format on of faci t es po cy procedures and stan dards The fac l t es database space a ocat ons and management process Eva uat on of programm ng cr te ria Lecture

524 Illumination and Acoustics. 3) N
Research and aboratory nvest gat on of advanced i um nat on and acoust cs ssues of bu id ng des gn Emphas s on human factors and performance aspects Lecture Prerequ site· DSC 457 458 or equ va ent.

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

527 Modern Design Theory. 3) N
Aesthetic po t ca econom c and soc a theor es wh ch have shaped modern des gn theory as the bas s for de s gn ph osoph es. Lectures sem nars Prerequis te DSC 525 or equ va ent.

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 or equ va ent

544 Human Factors Systems and Documentation. 3 N
Advanced top cs associated with theory and methods of human factors in des gn nd v dua projects stress ng problem organ zat on, eva uat on and documentat on Lectures sem nars lab Prerequ s te DSC 344 or equ va ent.

552 Computer Simulation in Design. (3 S
The use of computer graphics as a med um to deve op and present mages of the environment for ana ys s and percept on. Lecture, ab.

553 Computer Imaging and Visual Perception. 3) S
Issues and appl cat ons of computer s mu at on as a too for descr b ng and test ng human nterface w th the env ronment. Lecture ab

558 Daylighting. 3) SS
Day ght ng as a design determ nant, concepts tech n ques, methodo ogy exper ments and case stud es. Lec ture, stud o

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

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

Special Courses: DSC 294, 394, 484, 494, 498, 499 500 580 584 590 591, 592 593 594, 598 599 (See pages 43–44

Also consu t Off Campus Academ c Services brochures for spec a course offer ngs.

Planning

PROFESSORS:
LAI (ARCH 135) BURGESS
ASSOCIATE PROFESSORS:
K M, WILL AMS
ASSISTANT PROFESSORS:
COOK, GARCIA, 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 planning, landscape archi tecture, and urban development. 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 de sign 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 urban design, land use planning, housing, natural resource management, and urban transportation

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 Develop ment. In addition, a professional graduate pro gram in urban planning is offered. The programs are organized by the faculty of the department under the direction and administration of the chair.

Degrees/Majors

The faculty of the Department of Planning offer the undergraduate degree, Bachelor of Science in Design and the graduate degree, Master of Envi

ronmenta Planning The Bachelor of Science in Design includes the following majors and concen trations: major in Urban Planning w th a concen tration in landscape architecture or urban plan ning and major in Housing and Urban Develop ment.

Urban Planning (concentrations in Landscape Architecture or Urban Planning). The B.S in Design with a major in Urban Planning requires four years of study. Following two years of pre paratory work, students take two years of courses that inc ude site planning, landscape architecture, urban design, comprehensive planning, socioeco nomic and environmental analysis, computer and analytical methods, planning law, and public-pol icy formulation and administration An intern ship is required between the third and fourth years. Many students continue planning speciali zation at the graduate level. Students select from two concentrations, landscape architecture or ur ban planning.

Students in the landscape architecture concen tration 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 in the urban planning concen tration are exposed to the theories, methods and interdisciplinary concerns of the profession of ur ban 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 interested in this upper division program should contact the department chair for more information.

Master of Environmental Planning. The De partment of Planning offers elective areas in ur ban planning and urban design under the Master of Environmental Planning degree (M.E.P) The M.E.P is an interdisciplinary degree offered by the College of Architecture and Environmenta Design. This concentration is a two year program and includes a three hour summer internship or approved elective and a six hour thesis or re search project for a total of 54 semester hours. For further information, see the *Graduate Catalog*

Admission

Lower-Division Program. New and transfer stu dents who have been admitted to the university and who have selected a program in the Depart ment of Planning as a major are admitted to the lower division program. Transfer credits for the lower-division program are reviewed by the col lege and evaluated as admissible to this curricu lum To be admissible, transfer courses must be equivalent in both content and level of offering. A review of samples of work is required for stu dio 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 and requires formal application and ac ceptance.

Upper-Division Program. Admission to the up per division programs of the Department of Plan ning 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 fa cilities, faculty, and qualified applicants A lower division program GPA of 3.00 may be re quired. For detailed information about applica tion requirements, see the following section titled application procedures.

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

Applications for admission to the upper-divi sion Housing and Urban Development program are made directly to the department chair. Appli cations must include a proposed curriculum de veloped 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 depart ment chair and faculty advisors.

Degree Requirements

The degree, Bachelor of Science in Design, re quires 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[1]

			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 Environmenta 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)*			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 Draw ng II	2
ADE	221	Design Fundamentals I .	3
PLP	322	Planning Methods Using Computers[2]	3
		Lower Division Minimum Total	65

[1] Transfer credits 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

* This course satisfies a General Studies requirement See course description for specific requirement s each 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[1] 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			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	Specia 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 course description for specific requirement(s each course fulfills.

[2] Courses that fulfill approved concentration electives for the concentrations should be selected in consulta t on 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 13* Portfolio and application documents due in the department office (Arch 135) by 4 00 P M.

June 13 If the spring 1990 semester includes transfer course work, this is the deadline by which a student must submit his/her own transcripts to the department These may be 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 2 Date acceptance notices are mailed.

July 16 (1) Return of Letter of Acceptance. A signed receipt of acceptance of admission must be received by the department by this date. (2) Notification of admission status for alternates. 3) Portfolios available for return.

Matriculation. Accepted students are expected to begin their upper d vision 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 (8¹ x 11 format only). The student's name is to be affixed to the outside. Items must appear in the following order.

Page 1 Application form, completely filled out with page one visible. (Application forms are available from the college Academic Advising Office.)

Page 2 Application form with page two visible.

Page 3 All high school transcripts. Put all these into one sleeve.

Page 4. College transcripts. Include all college transcripts for both ASU and transfer work. Include all work through the fall 1989 semester. Copies are acceptable. The academic advisor will forward your spring 1990 ASU transcripts. (For those with spring semester 1990 transfer work, the student is responsible for submitting these transcripts by June 13 so they may be added to their portfolio. The student is also responsible for getting an official transfer transcript sent directly to the Office of Undergraduate Admissions.)

Page 5 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). Include sufficient examples of studio and laboratory work to show depth of design and drawing skills. Include freehand and hardline drawings and examples of two and three dimensional design and graphics Include a concise caption for each item that explains the work and list other pertinent information as applicable, including names of other team members, length of project, course and project description

Students are encouraged to include additional materials, written or pictorial, that provide additional evidence of skills and abilities, as well as 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 1 5) remain the property of the department. However, the remaining portfolio will be returned after 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 will be 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 50–53. For a key to the letters and numbers on each list of degree requirements, see page 53 or 193

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, AZ 85287 1605.

URBAN PLANNING

PUP 100 Introduction to Environmental Design I. 2 F S
Survey of environmental design including studies 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

442 Environmental Planning. 3 N
Environmental planning problems, including floodplains, 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 specializations Studio Prereq site 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 location 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 and sub 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.

Special Courses: PUP 484, 494, 498, 499, 500, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 600, 680, 683, 684, 690, 691, 692, 693. (See pages 43–44.)

HOUSING AND URBAN DEVELOPMENT

PUD 359 Tourist Resort 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.

433 Building Codes and Ordinances. (3) N
Analysis of national, state and local building codes and ordinances relative to their impact in architectural programming, design and construction documentation.

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 man's attitude toward the land. Ancient through contemporary landscape planning and design. *[Satisfies General Studies Requirement: H]*

361 Landscape 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 Landscape 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.

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.

Special Courses: PLA 484, 494, 498, 499, 500, 580, 583, 584, 590, 591, 592, 593, 594, 598, 600, 680, 683, 684, 690, 691, 692, 693. (See pages 43–44.)

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 percent of work in general education and other non-business courses and 40 percent in courses offered by the College of Business, with the remaining 10 percent selected from either area by the student in consultation with his/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. Preparation for the teaching of business subjects in secondary schools is offered in cooperation with the College of Education. 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 of instruction offered by the College of Business are organized into groups in order 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 business and the general public. The center coordinates interdisciplinary sponsored research efforts which will 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 at Arizona State University. 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, or on site training and development programs.

The Center for Financial 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 system with such specific areas 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 receiving 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 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 will be designated as a preprofessional business program student. The student will follow the freshman 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 will not be allowed to register for 300 to 400 level business courses.

The Professional Program. The third and fourth years constitute the professional program of the undergraduate curriculum.

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

1. At least 56 semester hours with a minimum cumulative grade point average of 2.50;
2. ACC 211, 212 and CIS 200 and QBA 221 and ECN 111, 112 and ENG 101, 102 and MAT 119, 210; with a grade of "C" or better in these courses; a minimum 2.50 cumulative grade point average in these courses; and
3. At least 32 semester hours in General Studies, including ECN 111, 112 and ENG 101, 102; and MAT 119, 210; COM 100 or 230 or 259; a laboratory science class.

Failure to meet the requirements for admission to the professional program will result in the student's becoming ineligible 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. Non business students will be permitted to register for selected 300 to 400 level business courses only if:

1. At the time of registration each student has junior standing (56 semester hours completed),
2. They have a 2.00 cumulative GPA and a 2.00 GPA 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. Unclassified undergraduate business students will be permitted to enroll in selected 300 to 400 level business courses only during on line registration and only if:

1. They have at least a 2.50 ASU cumulative GPA; and
2. At least a 2.50 ASU cumulative business GPA at the time of on line registration; or
3. They have never attended ASU, i.e., they will be given a one semester opportunity to register during on line registration and establish GPAs 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 will not be permitted to register for 300 to 400 level business courses. All requests for overrides for upper division accounting courses are processed jointly by the Office of the Dean, Undergraduate Programs, and the School of Accountancy. Overrides for these courses are issued only with the specific written approval of the school's director.

Nondegree Graduate Students. Nondegree graduate business students not declaring a degree program will be permitted to enroll in selected 300 to 400-level business courses only during on line registration and only if

1. They have at least a 2.50 ASU cumulative GPA; and
2. At least a 2.50 ASU cumulative business GPA at the time of on line registration; or
3. They have never attended ASU, i.e., they will be given a one semester opportunity to register during on line registration and establish cumulative GPAs 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 will not be permitted to register for 300 to 400 level business courses. All requests for overrides to 300 to 400 level accounting courses will be processed joint y by the Office of the Dean, Undergraduate Programs and the School of Accountancy. Overrides for these courses are issued only with the specific written approval of the school's director.

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, will be assigned a faculty advisor upon the basis of the subject matter field in which he she is primarily interested. The student, in consultation with a faculty advisor, shall select 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
		Genera Studies	9 11
			15 17

Professional Business Program[1]

Fifth Semester

FIN	300	Fundamentals of Finance*	3
MKT	300	Princ ples of Marketing*	3
MGT	301	Management and Organization Behavior[2]	3
OPM	301	Operations and Logistics Management[2]	3
GNB	301	Administrative Communication	3
		General Studies	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]	3
		Major	6
		General Studies	5
		Electives	3
			17
	Total		126

Professional program students *only* may register for 300 to 400 level business courses

[2] Prerequisite for the major See departmental *Advisement Guide.*

[3] Prerequisite: completion of 96 hours including *all* other business core courses.

Transfer Credit. Students planning to take their first two years of work at a community college or at 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 will be 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 legal environment of business will be accepted as an exception to this policy, but only lower division credit will be 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 which are not taught in the colleges of business at any one of the three state universities will not be accepted for credit toward a bachelor's degree. Courses taught in the upper division business core at the three state universities must be completed at the degree-granting institution unless transferred from an accredited four year school. Normally, upper division transfer credits will be accepted only from AACSB accredited schools.

The following general pattern of courses is recommended for students completing their first two

years' work in a community college and who plan to transfer to Arizona State University without 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") will only be granted in cases where 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

School of Accountancy
B.S., major in Accountancy

Department of Decision and Information Systems
B.S., major in Computer Information Systems

Department of Economics
B.S., major in Economics

Department of Finance
B.S., major in Finance
B.S., major in Real Estate

Department of Management
B.S., major in Management

Department of Marketing
B.S., major in Marketing

Department of Purchasing, Transportation, Operations
B.S., major in Operations/Production Management
B.S., major in Purchasing/Materials Management
B.S., major in Transportation

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, as well as those with bachelor's degrees in business administration, will 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 liberal arts degree, the capable student will also begin 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, 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 which 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 where 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 comprised of an area of concentration and supporting course work that will best prepare students for conducting scholarly work in their area of interest The degree is granted upon the completion of an approved program of graduate study, successful completion of comprehensive written and oral examinations, and submission of an acceptable original research project presented in a dissertation.

Doctor of Philosophy in Economics. The degree is awarded upon 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, successful completion of comprehensive written and oral examinations, and submission of an acceptable original research project presented in a dissertation

Graduation Requirements

Bachelor of Science in Business. 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 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
CIS	200	Computers in Business	3
QBA	221	Statistical Analysis	3
GNB	301	Administrative Communication	3
BLW	305	Legal Environment of Business	3
FIN	300	Fundamentals of Finance	3
OPM	301	Operations and Logistics Management	3
MGT	301	Management and Organization Behavior	3
MKT	300	Principles of Marketing	3
MGT	463	Strategic Management	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, Eco

nomics, 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 prior to 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 54–80. 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

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

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

Must include two laboratory sciences, MAT 119 and 210 or 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*.

Other General Studies Courses

Additional general courses which 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 ENG 101 and 102 First Year Composition and one of the following communication courses COM 100, 230, 259 as part of the General Studies requirement

Total General Studies Courses 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 fulfill the following requirements:

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 grade point index of 2.00 or higher:
   a. for all business courses taken at this university, and
   b. for all courses comprising 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 index after the course has been repeated in residence with a passing grade and prior to 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 will complete 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 minimum GPA for all College of Business courses completed at ASU of 2.00 or be placed on probation. During any semester in which the student is on probation, the student will not be eligible to early register or participate in on line registration nor will the student be permitted to enroll in summer sessions courses in this college until the probationary period has expired and the student has been restored to good standing.

Disqualification. A student who has not achieved a minimum 2.00 cumulative grade point average in all courses completed at ASU and in all College of Business courses completed at ASU will be disqualified 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 2.00 cumulative grade point average in all courses completed at ASU and a minimum 2.00 grade point average in all College of Business courses completed at ASU.

Students who have been academically disqualified will not be permitted to enroll in summer sessions courses in this college until the disqualification period has expired and the students are reinstated.

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

Special Programs

Asian Studies. Students in the College of Business may pursue a program with emphasis in Asian Studies. As part of the Bachelor of Science degree requirements in business, at least 30 upper 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 101). Fulfillment of the requirements is recognized on the transcript as a bachelor's degree with a designation of the discipline Asian studies. It is possible to complete the certificate program in International Business Studies and the Asian studies emphasis concurrently.

Certificate in International Business Studies. See page 236–237 for requirements of this certificate.

Latin American Studies. Students in the College of Business may pursue a program with emphasis 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 above under certificate in 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 102). Fulfillment of the requirements is recognized on the transcript as a bachelor's degree with a designation of the discipline Latin American studies. 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.

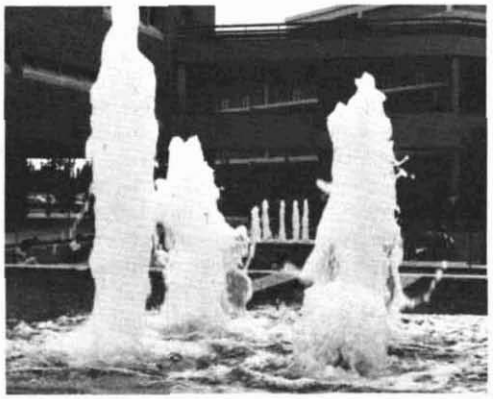
The student may enroll in any major offered by the College of Business. The candidate's degree in business administration, combined with directed linguistic and cultural studies, will provide the student with a unique educational experience and a broad background in the liberal arts and in business. 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, 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 prior to 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 228 for requirements of this certificate.



School of Accountancy

PROFESSORS:
FLAHERTY (BA 267A), BOATSMAN, BOYD, FRITZEMEYER (ASU WEST CAMPUS), HARIED, IMDIEKE, JOHNSON, McKENZIE, PANY, RECKERS, SCHULTZ, R. SMITH, TIDWELL, WILKINSON

ASSOCIATE PROFESSORS:
GOLEN, KAPLAN, KNEER, O'DELL, RENEAU, SHRIVER, D. SMITH, WYNDELTS

ASSISTANT PROFESSORS:
AHN, ANDERSON, CHRISTIAN, DeBERG, GRASSO, MITTELSTAEDT, MOECKEL, PEI, REGIER

LECTURER:
JONES

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 shall consist of the following 21 semester hours:

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

Note: 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; PHI 306, Applied Ethics, as part of their General Studies requirements.

An Accountancy major may take a maximum of 30 semesters hours of upper-division accounting courses as a part of the 126 semester hours required for graduation.

ACCOUNTANCY

ACC 211 Introductory Financial Accounting 3 F, S SS
Theory and pract ce of account ng app cab e to the accu mu at on external report ng and externa uses of f na c a account ng nformat on Prerequ s te sophomore stand ng.

212 Introductory Managerial Accounting. 3 F, S SS
Se ect on and ana ys s of account ng nformat on for nter nal use by management Prerequ s tes. ACC 211, sopho more stand ng

301 Management Uses of Accounting. 3 F, S
Uses of account ng nformat on for manager a dec s on mak ng budget ng and contro Prerequ s tes. ACC 212 non accountancy ma or

315 Financial Accounting and Reporting. 3 N
Account ng theory and pract ce re ated to uses of f nanc a statements by externa dec s on makers Prerequ s tes ACC 212 non accountancy ma or

321 Intermediate Accounting. 3 F S SS
Account ng theory and pract ce app cab e to determ na t on of asset va ues and re ated problems of ncome deter m nat on Prerequ s tes ACC 212 profess ona program bus ness st de t.

322 Intermediate Accounting. 3 F S
Account ng theory and pract ce app cab e to ab t es and owner s equ ty Spec a prob em areas re ated to ncome determ nat on and f nanc a report ng Prerequ s tes. ACC 321 grade of C or h gher profess onal program bus ness student

331 Cost Accounting. 3 F S
Cost accumu at on systems for product cost ng, cost be hav or concepts for p ann ng and contro w th the ntegra t on of quant tat ve methods Prerequ s tes ACC 212 MAT 119 or QBA 222 , 210 QBA 221, profess onal pro gram bus ness student

347 Accounting Information Systems. 3 F S
Informat on requ rements and transact on process ng pro cedures re evant to integrated account ng systems em phas z ng systems ana ys s and des gn, contro s and com puter process ng Prerequ s tes: C S 200; profess ona program bus ness student

351 Income Tax Accounting. 3 F S
Federal ncome taxat on of nd v dua s partnersh ps cor porat ons and fiduc ar es Estate and g ft tax Bas c tax p ann ng and research. Prerequ s tes ACC 212 profes s ona program bus ness student

432 Problems in Managerial Accounting. 3 N
Cases and computer app cat ons n dec s on mak ng, p ann ng and contro and cap ta budget ng. Prerequ s tes ACC 331 grade of C or higher profess ona program bus ness student major ng in Accountancy

452 Advanced Taxation. 3 F S
Advanced prob ems n bus ness and f duc ary ncome tax estate and g ft tax p ann ng and research Prerequ s tes ACC 351 grade of C or h gher , profess ona program bus ness student major ng n Accountancy

467 Management Advisory Services. 3 N
Concepts and methods of prov d ng adv sory serv ces w th respect to account ng nformation systems and f nanc al ana ys s Adm n strat on of consu t ng pract ces Pre requ s tes ACC 347 grade of "C" or h gher profess onal program bus ness student

475 Accounting in Public-Sector Organizations. 3 N
Princ ples of account ng and report ng budget ng and f nancial contro systems app ed n governmenta units and other non bus ness organ zat ons Prerequ s tes ACC 301 or 331 grade of C or h gher profess ona program bus ness student ma or ng n Accountancy

481 Auditing Theory and Practice. 3 F S
Concepts standards and methods n aud t udgment for mulat on nterna contro eva uat on program deve op ment and samp ng techn ques Eth ca and ega cons d erat ons Prerequ s tes ACC 322 347 grades of C" or h gher PH 306 profess ona program bus ness student major ng n Accountancy

483 Advanced Accounting. 3 F S
Account ng theory re ated to bus ness comb nat ons con so dated f nanc a statements fore gn operat ons partner sh ps and non bus ness organ zat ons Prerequ s tes ACC 322 g ade of C" or h gher profess ona program bus ness student major ng n Accountancy

495 Contemporary Accounting Theory. 3 F S
Theory of f nanc a account ng and report ng requ rements for prof t or ented enterpr ses. Prerequ s tes ACC 483 grade of C" or h gher profess ona program bus ness student ma or ng n Accountancy

502 Financial Accounting. 3 F S
F nanc a account ng concepts and procedures for exter na report ng Prerequ s te graduate degree program stu dent

503 Managerial Accounting. 3 F S
Manager a account ng concepts and procedures for nter na report ng Prerequ s tes. ACC 502; ECN 502; QBA 502

511 Tax Planning for Management. 3 A
Economic mp cat ons of se ected management dec s ons nvo v ng app cat on of federa ncome tax aws Recogn t on of tax hazards and tax sav ngs Prerequ s te ACC 503 or equ va ent

515 Professional Practice Seminar. 3 F S
H story structure, env ronment regu at on and emerg ng ssues of the account ng profess on

521 Tax Research. 3 F S
Tax research source mater a s and techn ques App 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 eva at 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 nternal report ng systems on organ zat ona de c s on and human behav or Des gn mp ementat on and eva uat on prob ems Prerequis te ACC 331 or 503

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

571 Taxation of Corporations and Shareholders. 3 F, S
Tax aspects of the format on operat on reorgan zat on and qu dation of corporat ons and the mpact on share ho ders Prerequ s 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 p ann ng s em phasized Prerequ s te ACC 351

575 Estate and Gift Taxation. 3 A
Tax treatment of wea th transfers at death and during fe time 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 spo a 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 aud tor n modern soc ety Advanced top cs n aud t ng theory and methods Contemporary ssues n aud t g Prerequ s te ACC 481

585 Analytical Methods in Accounting. 3 N
App cat on of quant tat 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
Prob ems n c ntrovers a areas Externa report ng re qu rements for se ected ndustr es nf uence of gover ment regu at on

587 Computerized Accounting Systems 3 F
Des gn and eva uat on of co puter based account ng n format on system Deve opment of computer based f nan c a mode s for p a n ng and co tro Prerequ s te ACC 347

591 Seminar in Selected Accounting Topics. 3 F S

791 Doctoral Seminar in Accounting. 3 F S

Special Courses: ACC 484 492 493 494 497 498 499 590, 592 593 598 599 690 692 700 790, 792 799 See pages 43–44

Decision and Information Systems

PROFESSORS:
KIRKWOOD BAC 549 , BURD CK, ECK, HERSHAUER KAZM ER, MAYER, PH L PPAK S WOOD

ASSOCIATE PROFESSORS:
BROOKS, HUSTON KEEFER KEIM O LEARY, ST. LOU S, VERD N

ASSISTANT PROFESSORS:
CARROLL GOUL, KULKARNI, RAMIREZ, REISER ROY WILSON

PROFESSOR EMERITUS:
McCREADY

The major in Computer Information Systems pre pares students for professional careers involving the analysis, configuration, 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 shall consist 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 shall select three hours of upper division credit approved in advance by the student's faculty advisor

Note All Computer Informat on Systems majors must complete CSC 100, Introduct on to Computer Science I CSC 100 may be counted in the business core in place of CIS 200.

Admission to field To be admitted to the Computer Information Systems field, a student must have completed the following courses with a minimum grade point average in these courses of 2 50. CSC 100 MAT 119, MAT 210 or higher level, 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 also 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.

The requirements for the certificate are:

1. Completion of a Bachelor of Science degree in business administration at Arizona State University.
2. Completion of a minimum of 14 semester hours of approved course work. The following eight (8) hours must be included.

			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 shall select an additional six hours of quantitative courses approved in advance by the advisor for the certificate program.

3 Completion of MAT 119, 210, 242, CIS 200; QBA 221, 321, 391; and the additional six hours of approved electives with a minimum grade point average in these courses of 2.50

NOTES:

1 MAT 270 may be taken in place of MAT 210.
2. Computer Information Systems majors may count CSC 100 in place of CIS 200.
3. 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 process ng bus ness data ntroduc t on to bus ness programm ng Not open to students w th cred t n a h gher eve C S c ass Prerequ s te MAT 210 Pre or corequ s te ACC 212 *[Sat sf es General Stud es Requirement N3]*

235 Computer Information Systems I. (3 F S
Deve opment of computer generated business reports from bus ness data f es Use of a h gh eve f e or ented anguage Prerequ s tes CSC 100· MAT 119 210 or 270 QBA 221

300 Computers in Business II. 3 N
ntroduct on to nformat on systems n bus ness Use of computers for bus ness prob em so v ng Prerequ s tes C S 200 F N 300 profess ona program bus ness student

307 Systems Modeling. 3 A
Procedures for nvest gating and ana yz ng dec s o sys tems Use of spec al anguages as too s of ana ys s and s mu at on Prerequ s tes CSC 100· MAT 119 210 or 270 profess ona program bus ness student

330 Interactive Business Systems. 3 F S
A gor thms data structures d a ogue and representat on techn ques, program generators for nteract ve app ca t ons Prerequ s tes. CIS 235 CSC 100.

335 Computer Information Systems II. 3 F S
Overv ew of bus ness software concepts and recent deve opments Bus ness app cations of the computer v a h gh eve procedure or ented anguages Prerequ s tes ACC 212 C S 235.

420 Business Database Concepts. 3 F S
Overv ew app cat ons and management of bus ness da tabase systems and methods. Prerequ s tes C S 330 335

430 Advanced Topics in Information Systems. 3 N
App cat ons deve opment and advanced programm ng concepts Program structure and des gn Software deve opment cyc e. Prerequ s tes nstructor approva , profes s ona program bus ness student

440 Systems Analysis and Design. 3 F S
Pr nc p es and app cat ons of computer based manage ment nformat on systems and ana ys s and des gn Pre requ s te CIS 420

502 Management Information and Decision Support Systems. 3) F S
Fundamenta s of computer based management informa tion and dec s on support systems Prerequ sites. com p et on of a f rst year MBA courses QBA 502.

505 Information Systems. 3 A
Data structures for nformat on representat on and ma n pu at on database management systems des gn of da tabase and nformat on systems Prerequ s tes CIS 335 and a computat o a programm ng anguage or nstructor approva

510 Systems Models and Simulation. 3 A
Des gn of computer based dec s on systems Simu at on as a research and dec s on mak ng too Prerequ s tes MAT 210 QBA 502 a computat ona programm ng an guage

515 Management Information Systems. 3 A
Systems theory concepts app ed to the co ect on, reten t on and d ssem nat on of nformat on for management de c s on mak ng. Prereq s te· C S 335 or 502

520 Systems Design and Evaluation. 3 A
Methodo og es of systems ana ys s and des gn ssues n ude project management nterface organ zat ona re qu rements constra nts documentat on, mp ementat on, contro and performance eva uat on Prerequ s te CIS 505 or equ va ent

530 Information Systems Development. 3 A
Eva uat on of anguages and qua ty assurance techn ques for system mp ementat on and ma ntenance Prerequ s te CIS 505

535 Distributed Information Systems. 3 A
ntroduct on to network ng and ts mpact on nformat on systems n bus ness Prerequ s te C S 505 or ACC 587

541 Business Database Systems. 3 A
Comparat ve ana ys s of h erarch ca network and re a t ona systems Theory of nformat on storage and retr eva and des gn of bus ness nformat on structures Prerequ s tes. C S 505 or equ va ent, 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 lan 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

Special Courses: C S 394 484 492 493 494 497 498 499, 500 590 592 598, 599 690 691 692 700, 790 791 792 799. See pages 43–44

QUANTITATIVE BUSINESS ANALYSIS

QBA 221 Statistical Analysis. 3 F S
Methods of statist ca descr pt on App cat on of probab ty theory and stat st ca nference n bus ness Prerequ s tes· MAT 119, 210. *[Sat sf es Genera Stud es Requ rement N2]*

321 Intermediate Business Statistics. 3 A
App cat on of egress on and ana ys s of variance mode s to bus ness and econom c prob ems Prerequ s tes QBA 221 or equ va ent profess ona program bus ness student.

391 Intermediate Management Science. 3 A
Study of mathemat ca mode s and so ut on techn ques wh ch can be used to a d dec s on makers Prerequ s tes: MAT 119 210 242, QBA 221 profess ona program bus ness student

405 Sampling Techniques in Business. (3 A
P ann ng, execut on and ana ys s of surveys n bus ness research Prerequ s tes· QBA 221 or equ valent profes s ona program bus ness student

410 Applied Business Forecasting. 3 A
App cat on of forecast ng techn ques n bus ness and n st t t ona env ronments Prerequ s tes QBA 321 profes s ona prog am bus ness student

421 Advanced Business Statistics. 3 N
App cat ons of probab ty and stat st ca nference to bus ness dec s on Probab ty theory dec s on theory and Bayes an nference Prerequ tes MAT 270 QBA 221 profess ona program bus nes student

450 Decision Analysis Applications. 3 N
mp ementat on of quant tat ve techn q es f r the a a ys s and o ut on of manager a prob ems Prerequ s tes QBA 391 405, 410 profess ona program bus ness student

502 Manager al Decis on Analys s. 3 F S
Fundamenta s of quant tat ve ana ys s to a d management de s on mak ng unde uncerta nty Prerequ s tes MAT 210 computer sk s grad ate degree p og am student

505 Management Sc ence. 3 A
Quant tat ve approaches to dec s on mak ng nc ud ng n ear programm g and s mu at o w th an emphas s on bus ness app cat ons Prerequ s tes MAT 210 QBA 5 2

510 Managerial Statistics. 3 A
Stat st ca methods u ed dec s on ak ng nc ud ng ana ys s of var a ce s mp e and mu t p e near regress n Prerequ s tes MAT 21 QBA 502

524 Nonparametr c Statistics. 3 N
Nonparametr c stat st ca tests for oca t on d spers on trend assoc at on c rre at a d good ess of f t Non metr c sca ng techn ques Prerequ s tes MAT 21 QBA 510

525 Applied Regression Models 3 F
S mp e near regre s on mu t p e regress on nd cator var ab e and og st c eg ess on Emphas s o bus ness and econom c app cat ons Prerequ s tes MAT 210; QBA 510

527 Categorical Data Analysis 3 A
D s rete data ana ys s n bus ne s research Mu t d men s ona cont gency tab es a d other d screte mode s Pre requ te QBA 525

528 Exploratory Data Analysis 3 A
ntr duces student t p c p es and method of exp ra t ry data ana ys s Prereq s te QBA 502

530 Experimental Design. 3 A
Exper menta de gns u ed bus ess research Ba anced and unba anced factor a des gns repeated meas ures des gns and mu t var ate ana y s of var ance Pre requ s te QBA 525 o equ va ent

535 Multivariate Methods. 3 A
Advanced stat st ca methods used n bus ness research Mu t var ate a a ys s f a soc at on and nterdependence Prerequ s te QBA 525

540 Forecasting. 3 A
Foundat on of tat st ca forecasts and forecast nterva s app cat on of c ass ca and ompute ass sted forecast ng methods to bus ess forecast g prob ems Prereq s tes MAT 210 QBA 5 2

550 Intermediate Decision Analysis. 3 A
Quant tat ve dec on ana ys s methods for bus ness dec s on mak ng under uncerta nty nc ud ng dec s n d a grams sub ect ve probab t es and preference assess ment Prerequ s tes MA 210 QBA 502

552 Statistical Decision Theory. 3 A
Stat st ca dec s on methods for bus ness dec s on mak ng under uncerta nty, nc ud ng Bayes an nference opt ma stat st ca dec s ons and va ue 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 probab st c mode s for quant tat ve bus ness ana ys s Prerequ s tes MAT 210; QBA 502

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

562 Network Flow Models. 3 A
ntroduct on to etwork structure app cat ons and a go r thms deve opment of data structures for network algo r thms 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 propert es of so ut ons and a gor thms for con stra ned and unconstra ned m n m 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

Special Courses: QBA 499 See pages 43–44

Economics

PROFESSORS:
BOYES BAC 651 BRADA, BURGESS, COCHRAN, FA TH, GOOD NG, HOFFMAN HOGAN, JACKSON, K NGSTON, KNOX, LADMAN McPHETERS SCHLAGENHAUF

ASSOCIATE PROFESSORS:
BLAKEMORE COX, DeSERPA, HAPPEL, LOW, McDOWELL, MELV N MENDEZ, ORMISTON SMITH WINKELMAN

ASSISTANT PROFESSORS:
F NN, MIZZ (ASU WEST CAMPUS), WRASE

LECTURER:
ROBERTS

PROFESSORS EMERITI:
LOWE PLANTZ

The study of economics affords an opportunity for the student to acquire a general knowledge of the methods by which goods and services are al located, incomes generated, and why prices, em plovment, money and financial markets behave as they do. Some knowledge of economics is crucial not only for those intending to participate in the bus ness world, but also for those intending to pursue graduate educations in law, or other busi ness fields, or to work in the world of journalism and communication. Economists obtain positions at universities, in government, in financial institu tions, brokerage houses, private nonfinancial cor porations, in the international organizations, such

as IMF and the World Bank, as financial journal ists, and as marketing and management specialists in domestic and international firms.

Economics majors are required to take MAT 270, Calculus with Analytic Geometry I and earn a minimum grade of "C" before taking upper division courses in economics

The major in Economics shall consist of 18 semester 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 ECN 314 are required They must be taken after the completion of MAT 270 and prior to other upper division courses in economics Concurrent enrollment in ECN 313 and ECN 314 is permitted. Concurrent enrollment with one of the above and other upper-division courses in economics is subject to approval of the faculty advisor.

ECONOMICS

ECN 111 Macroeconomic Principles. (3) F S SS
Basic macroeconomic analysis Economic institutions and factors determining income levels price levels and employment levels *[Satisfies General Studies Requirement: SB]*

112 Microeconomic Principles. 3) F S SS
Basic microeconomic analysis Theory of exchange and production, including the theory of the firm *[Satisfies General Studies Requirement SB]*

313 Intermediate Macroeconomic Theory. (3) F, S SS
Determinants of aggregate levels of employment, output and income of an economy. Prerequisites ECN 111 112 MAT 270 grade of C or higher *[Satisfies General Studies Requirement· SB]*

314 Intermediate Microeconomic Theory. (3) F S, SS
Role of the price system in organizing economic activity under varying degrees of competition. Prerequisites ECN 111 112, MAT 270 (grade of "C" or higher). *[Satisfies General Studies Requirement SB]*

315 Money and Banking. (3 N
Functions of money. Monetary systems, credit functions banking practices and central banking policy This course cannot be applied to the Economics major Prerequisite· ECN 111 *[Satisfies General Studies Requirement SB]*

331 Comparative Economic Systems. (3 N
Alternative institutions past and present, for organizing the social division of labor Property rights, information and incentives in industrial societies Prerequisite: ECN 111 or 112. *[Satisfies General Studies Requirements SB G]*

360 Economic Development. (3 A
Theories of economic growth and development. Role of capital formation technological innovation population and resource development in economic growth Prerequisites ECN 111, 112 *[Satisfies General Studies Requirements. SB G]*

365 Economics of the Soviet Union and Eastern Europe. 3 N
Origins and analysis of contemporary institutions Comparative development and differentiation in the 20th century Prerequisites· ECN 111, 112 *[Satisfies General Studies Requirements SB G]*

404 History of Economic Thought. 3 A
Development of economic doctrines theories of mercantilism, physiocracy classicism neoclassicism Marxism and contemporary economics Prerequisites ECN 313 314 *[Satisfies General Studies Requirement SB]*

421 Labor Economics. 3 A
Origins of labor movement analysis of labor unions labor markets collective bargaining and current policy issues Prerequisite ECN 314 *[Satisfies General Studies Requirement SB]*

436 International Trade Theory. 3 A
The comparative advantage doctrine, including practices under varying commercial policy approaches The economic impact of international sequ brium Prerequisites ECN 313, 314 *[Satisfies General Studies Requirements SB, G]*

438 International Monetary Economics. 3) F, S SS
History, theory and policy of international monetary economics Balance of payments and exchange rates. International financial markets including Eurocurrency markets Prerequisites ECN 313 314 *[Satisfies General Studies Requirements SB, G]*

441 Public Finance. 3 A
Public goods, externalities voting models public expenditures taxation and budget formation with emphasis on the federal government Prerequisite ECN 314 *[Satisfies General Studies Requirement SB]*

453 Government and Business. 3 A
Development of public policies toward business Anti trust activity Economic effects of government policies Prerequisite ECN 314 *[Satisfies General Studies Requirement SB]*

480 Introduction to Econometrics. 3 A
Elements of regression analysis· estimation hypothesis tests prediction Emphasis on use of econometric results in assessment of economic theories Prerequisite ECN 314 *[Satisfies General Studies Requirement N2]*

484 Economics Internship. 3 F S SS
Academic credit for professional work organized through the internship Program Prerequisites ECN 313 314; outstanding academic record

485 Mathematical Economics. 3 A
Integration of economic analysis and mathematical methods into a comprehensive body of knowledge with in contemporary economic theory Prerequisites ECN 313 314 *[Satisfies General Studies Requirement N2]*

498 Pro-Seminar. 3 A
Chosen from selected topics, e g money development urban economics economic regulation area studies etc Prerequisites ECN 313, 314

502 Managerial Economics. 3 F S
Application of economic analysis to managerial decision-making in areas of demand production, cost and pricing. Evaluation of competitive strategies Prerequisite graduate degree program student

504 Development of Economic Analysis. 3 A
H stor ca deve opment of economic theory Emphasis on the deve opment of econom c ana ys s from preclass cai econom cs through Keynes

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

510 Microeconomic Theory and Applications. (3 A
Theory of exchange product on and pr c ng n a market economy Inf uence on bus ness and econom c env ron ment Prerequ s te· ECN 112

511 Macroeconomic Analysis I. 3 A
The nat on s ncome output, emp oyment and general pnce evel 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 capita st c and m xed systems Prerequ s te ECN 314

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

514 Microeconomic Analysis II. 3) A
Advanced top cs n m croeconom cs Emphas s on genera equ l br um we fare econom cs and product on and cap ta theory Prerequ s te ECN 512

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

517 Monetary Policy. 3 N
Determ nants of the money supp y and nterest rate eve s Federa Reserve po cy and ts effect veness Prerequ s te ECN 516

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

522 Labor Economics II. 3 N
Extensions cr t c sm of abor market theories. App ca t ons to a var ety of po cy ssues Prerequ s 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 contem porary 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 f cat on Theory and po t ca economy of commerc a po cy Resource transfers and the role 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 a 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 c spend ng and taxa t on. Impact of centra governmenta act vity on resource al ocat on and ncome d str but on Prerequ s te ECN 512

553 Industrial Organization. 3 N
Analys s of structure conduct and performance n ndus tna 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 prob ems ssues and po cy dec s ons fac ng the esser-deve oped nat ons of the wor d Prerequisites ECN 511 512

572 Regional Economics. 3 N
ntroduct on to export base nput output, near program-ming s mu at on and econometr c mode ng as too s of re g ona ana ysis. Prerequ site. ECN 512

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

581 Econometrics II. 3) A
Advanced top cs n econometr cs Emphas s on extending the s mp e near mode and on s multaneous re ation sh ps Prerequisite ECN 580

584 Economics Internship. 1 3 SS
Academ c cred t for professiona work organ zed through the nternsh p Program Prerequ sites ECN 511 512

591 Seminar in Selected Economics Topics. 3 N

594 Conference and Workshop in Economics. 1 2) F S
Working papers by department faculty and outs de speak ers are presented and discussed Econom cs ABDs wi a so present the r thes s proposal. Prerequ site. nstructor approva .

791 Doctoral Seminar in Economics. 3) A

Special Courses: ECN 394 484 492 493 494 497, 498, 499 590, 592 593 594, 598 599, 690 692, 700, 790, 792 799 (See pages 43–44

Finance

PROFESSORS:
GUNTERMANN, JENNINGS, JOEHNK, KAUFMAN, KRAFT, NELSON, POE, SUSHKA

ASSOCIATE PROFESSORS:
SM TH (BA 352) ARANDA, BOHLMAN, BOOTH, BUTLER, CESTA, DAVIS, HOFFME STER, LOCK MART N, MYLER OLNEY, WILT

ASSISTANT PROFESSORS:
AMEL, BROADMAN CHANG, GALL NGER (ASU WEST CAMPUS), HERTZEL, REISS

PROFESSORS EMERITI:
ANDERSON DAUTEN 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, or 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. All students must complete ACC 321, Intermediate Accounting, before taking 400 level finance courses. 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 Analysis and Portfolio Management	3

To complete the major, the student must:

1. Select one additional 400 level finance course designated in the *Catalog* with the prefix FIN; *and*
2. Select two additional upper division courses approved by the Department of Finance faculty and published in the departmental *Advisement Guide, and*
3. Complete two upper division accounting courses including ACC 321, Intermediate Accounting, and one of the following.
   ACC 322 Intermediate Accounting
   ACC 331 Cost Accounting
   ACC 351 Tax Accounting
   ACC 347 Accounting Information Systems
   ACC 322 is particularly recommended. Students have the option of including one or both of these accounting courses as part of their major or as electives to satisfy the semester hour requirements for the baccalaureate degree.

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 of the following:

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

and one additional upper division course approved by the Department of Finance faculty.

FINANCE

FIN 251 Principles of Personal Investments. 3 F S
Investment concepts for individual investors fundamentals of investment techniques and principles of sound investment. For nonmajors. Course may be used only for elective credit by College of Business students.

300 Fundamentals of Finance. 3 F, S, SS
Theory and problems in financial management of business enterprises. Prerequisites: ACC 212, ECN 112, QBA 221.

331 Financial Markets and Institutions. 3 F S
Analysis of financial markets and intermediaries. Theory of financial intermediation, interest rate theory, money and capital market instruments, government regulation. Prerequisites: FIN 300, professional program business student.

361 Managerial Finance. 3 F S
Theories and problems in resource allocation, cost of capital, CAPM and capital budgeting, asset valuation, capital structure and financing policy. Prerequisite: FIN 300.

421 Security Analysis and Portfolio Management. (3 F S
Security analysis theory and practice. Selection and management of financial asset portfolios. Securities markets and portfolio risk return analysis. Prerequisites: ACC 321, FIN 331, 361, professional program business student.

427 Speculative Securities. 3 A
Study of stock options, index options, convertible securities, financial futures, warrants, subscription rights, arbitrage pricing theory. Prerequisites: FIN 421, professional program business student.

431 Management of Financial Institutions. 3) A
Asset/liability and capital management in financial institutions. Influence of market factors and regulatory agencies. Emphasis on commercial banks. Prerequisites: ACC 321, FIN 331, professional program business student.

441 Financial Planning. 3 A
Integrates finance, insurance, real estate, investments, taxation and law into the life cycle of financial planning process. Prerequisites: ACC 321, FIN 300, professional program business student.

451 Working Capital Management. 3 N
Analysis of short term profitability and quidity. Emphasis on managing cash, accounts receivable, inventory and current debts. Prerequisites: ACC 321, FIN 300, professional program business student.

461 Financial Cases and Modeling. 3 A
Case oriented capstone course in managerial finance. Contemporary issues of quality management, capital budgeting, capital structure and financial strategy. Prerequisites: ACC 321, FIN 361, professional program business student.

481 Risk Financing. 3 N
Identification, measurement and treatment of risk financing. Control, retention and transfer as alternate approaches to the risk of loss. Prerequisites: FIN 300, professional program business student.

502 Managerial Finance. (3 A
Theory and practice of financial decision making includes risk analysis, valuation, capital budgeting, cost of capital

and work ng cap ta management Prerequ s tes ACC 502, ECN 502 QBA 502

521 Investment Management. 3 A
Va uat on of equ t es f xed ncomes and opt ons f nanc a futures n an nd v dua secur ty and portfo ontext mathemat ca asset a ocat on approaches Not open to students w th cred t n F N 421 Prerequ s te: F N 502

531 Capital Markets and Institutions. 3 A
Recent t eoret ca and operat ona deve opments n eco nom c sector affect ng cap ta markets and nst tut ons Not open to students w th cred t n F N 431 Prerequ s te F N 502

561 Financial Management Cases. 3 N
Case or ented course n app cat ons of f nan e theory to management ssues Acqu s t on a ocat on and manage ment of funds w th n the bus ness enterpr se Work ng cap ta management, cap ta budget ng cap ta structure and f nanc a strategy Prerequ s te F N 502

581 Theory of Financial Decisions. 3 A
Theor es and app cat ons of manage a f nance and n vestments. Cap ta budget ng cap ta structure d v dend theory and va uat on Prerequ s te F N 502

791 Doctoral Seminar in Finance. 3 A
a nvestment S'90
nvestments and market theory; eff c ent markets hy pothes s opt on and commod ty market Prerequ s te F N 581
b F na c a Inst tut ons and Markets F 90
Econom c and monetary theory app ed to f nanc a markets and nst tut ons, mp cat ons of f nanc a structure for market performance and eff c ency. Pre requ s te F N 581
c F nanc a Management F 89
F nanc a theory perta n ng to cap ta str cture div dend po cy va uat on, cost of cap ta and cap ta budget ng Prerequ s te F N 581

Special Courses: F N 484, 492 493 494, 497 498 499 584 590 591 592, 593 5 8 599 690 692 700 790, 792, 799 See pages 43–44.

REAL ESTATE

REA 251 Real Estate Principles. 3 A
Regu at on pract ces ega aspects and profess ona op port n t es of the rea estate ndustry Cannot be app ed to Rea Estate ma or

300 Real Estate Analysis. 3 A
App cat on of econom c theory and ana yt ca techn ques to rea estate markets Top cs nc ude aw f nance ap pra sa market ana ys s, nvestments deve opment Pre requ s te profess ona program bus nes student

331 Real Estate Finance. 3 A
Lega market and nst tut ona factors re ated to f nanc ng proposed and ex st ng propert es Empha s on current f nanc ng techn ques and quant tat ve methods Prerequ s tes FIN 300 profess o a program bus ness student

401 Real Estate Appraisal. 3 A
Factors affect ng the va ue of rea estate Theory and pract ce of appra s ng and preparat on of the appra sa re port Appra sa techn ques Prerequ s tes REA 300 pro fess ona program bus ness student

402 Income Property Appraisal. 3 N
Va uation of net ncome streams for var ous types of n come produc ng propert es Prerequ s tes REA 401· pro fess ona program bus ness students

441 Real Estate Land Development. 3 A
Ne ghborhood and c ty growth. Mun c pa p ann ng and zon ng Deve opment of res dent a , commerc a ndustria and spec a purpose propert es Prerequ s tes REA 300; profess ona program bus ness student.

456 Real Estate Investments. 3 A
Ana ys s of nvestment dec s ons for var ous property types Cash f ow and rate of return ana ys s Prerequ s tes F N 300, profess ona program bus ness student

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

Special Courses: REA 484 492 493 494 497, 498, 499 590, 592, 593, 598 599 See pages 43–44

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 estab sh ng bus ness po cy

306 Business Law. 3 F, S
Lega aspects of contra ts, sa es commerc a paper se cured transact ons do uments of tit e etters of cred t and bank depos ts and co ect ons.

307 Business Law. 3 F S
Lega aspects of agency, partnersh ps corporat ons regu at on of bus nesses, bankruptcy and property.

308 Business and Legal Issues in Professional Sports. 3 N
The econom c structure of profes ona sports a d 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 ied to the rea estate f e d and to the f e ds of t t es mortgages, end ng and trust work

412 Insurance Law. 3 N
Lega concepts and doctr nes app cab e to the f e d of n surance. Prerequ s tes 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 soc a respons b ty as regu atory and po t ca strateg es Prerequ s tes ACC 503 F N 502, MGT 502· MKT 502

INSURANCE

INS 251 Principles of Insurance. 3 N
Coverages ava ab e, buy ng methods regu at on, c a ms, n urance nst tut ons, career opportun t es

321 Life and Health Insurance. 3 N
Types and uses of fe and hea th po c es, ndustry organ zat'on regu at ons, underwrit ng and other company op erat ons Prerequ s te· profess ona program bus ness student

331 Property Insurance Principles and Coverage. 3 N
Pr nc ples of property and ab i ty nsurance, ndustry or ganizat on types and forms of coverage and commerc a coverage fundamentals Prerequ s tes: NS 251 or n structor approval 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 plann ng Prerequ s te: profess ona program bus ness student

General Business

PROFESSOR:
HENN NGTON
ASSOCIATE PROFESSORS:
SMELTZER (BA 319), GARCIA, GILSDORF, LEONARD, LYNCH, MURRANKA, A. SMITH
ASSISTANT PROFESSOR:
FANN
PROFESSORS EMERITI:
BATY, BOGGS, JACKS, LEWIS, C SMITH, TATE

The general business faculty serve the College of Business by teaching the Bachelor of Science de gree upper division business core requirement, Administrative Communication. In addition, the faculty teach Managerial Communication, a core course in the Master of Business Administration degree.

GENERAL BUSINESS

GNB 233 Business Communication. (3 N
Written and ora report ng. Organ zat on, ana ys s and presentation of bus ness nformat on us ng e ectron c and other med a Prerequ s tes· ENG 102 and at east sopho more stand ng. *[Satisf es Genera Stud es Requ rement L1]*

301 Administrative Communication. 3 F S, SS
ntrapersonal, nterpersona and adm n strative commun cat on. 2 ectures, 1 rec tation Prerequ s tes: C S 200 ENG 101 102 grade of C" or h gher n these courses *[Satisfies General Stud es Requ rement L1]*

431 Business Report Writing. 3) A
Organ zation 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 F, S
Methods of co ect ng nformat on pert nent to bus ness prob em so v ng nc ud ng des gn co ection analys s, interpretat 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 appropriate commun cat on strategies Pre requ s te MGT 502

504 Professional Report Writing. 3 A
Preparat on and presentation of profess onal reports

507 Business Research Methods. (3 A
Techn ques for gather ng nformat on for bus ness dec s on making Selection, des gn and comp etion of a bus ness or ented research project

591 Seminar. (3 N
Topics 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

Special Courses: GNB 394 484, 492 493 494 497 498, 499 590 592, 593 594 598 599 690 692 700 790, 791 792 799 See pages 43–44

School of Health Administration and Policy

PROFESSORS:
SCHNELLER BA 252 BO SSONEAU
ASSOCIATE PROFESSORS:
DUNDAS, K RKMAN L FF WILLIAMS
ASSISTANT PROFESSORS:
HUGHES, MONDRAGO N, OHSFELDT

The Graduate Program in Health Services Administration

The School of Health Administration and Policy offers the Master of Health Services Administra tion (M.H.S A.) Students enrolled in the school may earn the concurrent M H S A M B A de grees. The school also collaborates with the Col lege of Law to allow students to earn, concur rently, the M H S A J D degrees

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 the largest proportion of program graduates have aspired to and successfully received employment in hospi tals, 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 con tinually evolving health care system Since so many of the features of the environment of health services are subject to periodic change (e.g , reim bursement and informations systems , substantial emphasis is on building the basic ski ls and ana lytic perspectives necessary to encounter and react to change through innovation and action.

The program has a special commitment to pro vide students with an understanding of the com petitive nature of the health care system Since so many of the features of the environment of health services are subject to periodic change, substan tial emphasis is placed on building basic skills to

understand and scan environments and 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.

To accomplish its mission to establish a pattern for skill acquisition, ideology, and style necessary for entry into the job marketplace and mobility to careers as chief executive officers in target organizations, the curriculum provides students with: (1) understanding, analysis and application, which are essential for effective health care administration; (2) internship, residency and project experiences for sharpening skills and bridging the gap between academics and practice; and (3) opportunities to interact with practitioners in the classroom as well as in other structured field relationships.

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

502 Health Care Organization. 4 F S
Concepts, structures, functions and values which characterize contemporary health care systems in the United States

505 Community Health Care Perspectives. 4 F S
Epidemiological social biological 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 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
Multihospital systems

593 Applied Project. 1–6 F S, SS
Supervised on site experience in advanced development of manager a skills in health services administration and policy. Minimum of 10 weeks Prerequisites 18 hours of credit toward program of study director approval

Special Courses: HSA 590 591, 592 598 599 See pages 43–44.

International Business Studies

Certificate in International Business Studies

The program of studies leading to the certificate 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:

MK	435	International Marketing
MGT	459	International Management
TRA	463	International Transportation
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

2. At least 18 semester hours of approved elec tives in international and area studies. A minimum of six semester hours must be in courses which provide a cross cultural per spective from the global point of view of one or more disciplines. A minimum of nine se *mester hours must be in courses which pro* vide an understanding of one region of the world.
3. Evidence of competence in a foreign lan guage equivalent to one year of college study. Since careful planning and selection of courses are necessary to meet the require ments 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 Mu t d sc p nary ana ys s of nternat ona econom c and fi nanc a env ronment. Operat ons of mu t nat ona f rms and the r nteract on w th home and host soc et es Prerequ s te ECN 112 *[Sat sfies Genera Stud es Requ rement. G]*

591 Seminar in International Business. (3 N Descr pt ons of the fo ow ng courses can be found n the appropr ate departmenta st ng

ACC 591 Sem nar n Mu t nationa Tax
ECN 331 Comparat ve Econom c Systems
ECN 360 Econom c Deve opment
ECN 365 Econom cs of the Sov et Un on and Eastern Europe
ECN 436 Internat ona Trade Theory
ECN 438 Internat ona Monetary Econom cs
ECN 531 Econom c Systems and Organ zat ons
ECN 536 Internat ona Trade Theory
ECN 538 Internat ona Monetary Theory and Po cy
ECN 561 Econom cs of Deve op ng Nations
MGT 459 nternat ona Management
MGT 494 Spec a Top cs nternat ona Management
MGT 559 nternat ona Comparat ve Management
MGT 593 App ed Project nternat ona Management
MKT 435 nternat ona Market ng
MKT 494 Specia Top cs App ed Internat ona Bus ness
MKT 591 Sem nar Market ng n nternat ona Operat ons
MKT 593 App ed Top cs App ed Sem nar n *nternat ona Marketing*
TRA 463 nternationa Transportat on

Management

PROFESSORS:
PENLEY (BA 367E), BASK N (ASU WEST CAMPUS) BOHLANDER, GROSSMAN, KREITNER MONTANAR PAST N REIF WHITE

ASSOCIATE PROFESSORS:
BASSFORD, BRENENSTUHL, CARDY COOK, HOM, HUTT (ASU WEST CAMPUS), KELLER, KINICKI, MANZ MOORHEAD, OLIVAS SHIPPER VAN HOOK

ASSISTANT PROFESSORS:
CARSON DAVY, GOOD NG, JACOBSON, KEATS, MALEKZADEH ASU WEST CAMPUS , NAHAVAND (ASU WEST CAMPUS REGER

PROFESSORS EMERITI:
COCHRAN, DAV S HE ER, 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 the or ganization 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 the opportunity 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 undesir able organizational outputs given realistic con straints. 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:

			Se e ter H ur
MGT	311	Personnel Management	3
MGT	352	Human Behavior n Organizations . .	3

Three of the following five courses

MGT	433	Management Decision Analys s	3
MGT	434	Social Responsibi ity 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 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 which 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 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 and behavioral 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 moral 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
Learning theory orientation and basic evaluation training, management development resource materials and methods Prerequisites MGT 311 professional program business student

423 Industrial Relations and Collective Bargaining. 3 A
Processes and procedures of collective bargaining Scope and negotiation of union contracts

424 Employee Selection and Appraisal. 3 A
Concepts and methods of personnel selection and performance appraisal Includes job analysis, measurement and legal issues Experiential exercises emphasized Prerequisite MGT 311

433 Management Decision-Analysis. 3 A
Decision making concepts and methods in the private and public sectors and their application to organizational problems Understanding of individual and group decision making Prerequisites MGT 301, professional program business student

434 Social Responsibility of Management. 3 A
Relationship of business to the social system and its environment Criteria for appraising management decisions Managers as change agents Prerequisites MGT 301, professional program business student.

440 Entrepreneurship. 3 A
Opportunities risks and problems associated with small business development and operation

441 Venture Design and Development. 3 N
Analysis design and development of a business plan for a new venture Prerequisite. ACC 212.

442 Small Business Management. 3 N
Students acting as management consultants apply business principles and make recommendations to small businesses while learning to manage small firms Prerequisite. business core except MGT 463

447 Management and the Impact of Technology. 3 N
The impact of technology on strategic planning and human resources management in business organizations

448 Management and the Impact of Technology: Research. 3 N
Development of research strategies and cases for studying the impact of technology on management theory and practice in business organizations Prerequisite MGT 447

452 Organizational Behavior Applications. 3 A
The complex set of behavioral forces and relationships that influence organizational effectiveness. Intervention strategies and application skills Prerequisites MGT 352, professional program business student

459 International Management. 3 A
Concepts and practices of multinational and foreign firms Objectives strategies policies and organizational structures for operating in various environments Prerequisite MGT 301

463 Strategic Management. 3 F, S SS
Strategic formulation and administration of the total organization, including integrative analysis and strategic planning Recommended for last semester of senior year Prerequisites completion of 96 hours, including all other business administration core requirements professional program business student *[Satisfies General Studies Requirement L2]*

468 Management Systems. 3 A
Systems theory and practice applied to organizational process and research Organizations seen as open systems

interacting with changing environments. Prerequisite: MGT 301.

502 Organization Theory and Behavior. (3) F, S
Important concepts and applications in management including motivation, leadership, group dynamics, organization design, decision-making, communication and organization change. Prerequisite: graduate degree program student.

503 Complex Organizations. (3) N
Concepts and applications in macro organization theory. Topics include organization structure, strategic choice, culture, boundary spanning, effectiveness and different perspectives of interorganizational relations.

520 Problems in Personnel Management. (3) A
Selecting, developing, maintaining and utilizing a competent labor force. Case studies of personnel problems. Preparation of a written personnel program.

522 Labor Relations and Public Policy. (3) A
State and federal legislation. Recent decisions of courts and labor boards. Legal rights and duties of employers, unions and public.

559 International Comparative Management. (3) A
Analysis of comparative management practices, problems and issues. Management strategies for the multinational organization. Impact of national and cultural environments.

589 Strategic Management. (3) F, S
Formulation of strategy and policy in the organization, emphasizing the integration of decisions in the functional areas. Prerequisites: ACC 503; CIS 502; ECN 502; FIN 502; GNB 502; MGT 502; MKT 502; OPM 502; QBA 502; completion of at least 36 hours of program of study credits.

591 Seminar. (3) N
Topics such as the following will be offered:
(a) Managerial Planning and Control
(b) Competitive Strategy
(c) Ethics
(d) Human Resources Systems

791 Seminar: Doctoral Seminar in Management. (3) A
Topics such as the following will be offered:
(a) Organizational Behavior
(b) Organizational Theory
(c) Research Design and Methodology
(d) Strategic Management
(e) Human Resource Management

Special Courses: MGT 484, 492, 493, 494, 497, 498, 499, 584, 590, 592, 593, 598, 599, 690, 692, 700, 792, 799. (See pages 43–44.)

Marketing

PROFESSORS:
B. J. WALKER (BAC 471), BROWN, GWINNER, HUTT, JACKSON, OSTROM, REINGEN, ROWE, SCHLACTER

ASSOCIATE PROFESSORS:
BELLIZZI (ASU WEST CAMPUS), BELTRAMINI, BLASKO, CROSBY, EVANS, GOURLEY, MOKWA, STEPHENS, SWARTZ

ASSISTANT PROFESSORS:
BITNER, CHO, KALE, KLEINE, MARINE, SINHA, B. WALKER, WARD

PROFESSORS EMERITI:
BESSOM, DOWNING, HARRIS, OVERMAN, SCHMIDT, ZACHER

Study in the field of marketing involves analysis of the ways business firms plan, organize, administer and control their resources to achieve marketing objectives. Focus is placed on market forces, growth and survival of firms in competitive markets, and the marketing strategy and tactics of the firm. Through 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 shall consist 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, shall 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. Prerequisite: 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. Prerequisite: 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.

Special Courses: ADV 484, 492, 493, 494, 497, 498, 499, 590, 592, 593, 598, 599 (See pages 43–44.)

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 marketing 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
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
Application of management concepts to the administration of the sales operation. Prerequisite. MKT 302.

412 Promotion Management. 3) A
Integration of the promotional activities of the firm including advertising, personal selling, public relations, and sales promotion. Prerequisite: MKT 302.

424 Retail Management. 3) A
Role of retailing in marketing. Problems and functions of retail managers with various retail institutions. Prerequisite: MKT 300.

434 Industrial Marketing. 3) A
Strategies for marketing products and services to industrial, commercial and governmental markets. Changing industry and market structures. Prerequisite: MKT 302 or instructor approval.

435 International Marketing. (3 A
Analysis of marketing strategies developed by international firms to enter foreign markets and to adapt to changing international environments. Prerequisites: MKT 302 or instructor approval; professional program business student.

444 Marketing Channels. 3) N
Distribution channels used by firms engaged in marketing and manufacturing. Strategies for marketing channels management. Relationships among marketing intermediaries. Prerequisites: MKT 302, professional program business student.

460 Strategic Marketing. 3) F S SS
Policy formulation and decision making by the marketing executive. Integration of marketing programs and considerations of contemporary marketing issues. Prerequisites: MKT 302, 304, 351, professional program business student.

502 Marketing Management. 3) F S
Managing the marketing function; market and environmental analysis, marketing planning, strategy and control concepts. Development and management of marketing programs. Prerequisite. ECN 502.

520 Strategic Perspectives of Buyer Behavior. 3 N
Concepts and theories from the behavioral sciences as they relate to marketing strategy formulation. Prerequisite: MKT 502 or equivalent, or instructor approval.

522 Marketing Information. 3) A
Marketing research, marketing information systems and modern statistical techniques in marketing decision making. Prerequisite. MKT 502.

563 Marketing Strategy. 3) A
Planning and control concepts and methods for developing and evaluating strategic policy from a marketing perspective. Prerequisite: MKT 502.

591 Seminar. 3) A
Topics such as the following will be offered:
(a) Product Strategy
(b) Channel Strategy
(c) Promotion Strategy
(d) Marketing in International Operations
(e) Marketing Strategy in Not for Profit and Public Sector Organization
(f Services Marketing
(g) Advertising Strategy

791 Doctoral Seminar in Marketing. (3) F S

Special Courses: MKT 484, 492, 493, 494, 497, 498, 499, 584, 590, 592, 593, 598, 599, 690, 692, 700, 790, 792, 799 (See pages 43–44.)

Purchasing, Transportation, Operations

REGENTS' PROFESSOR:
FARR S
PROFESSORS:
RUCH (BA 323 FEARON HENDRICK, METCALF, SHROCK, VELLENGA
ASSOCIATE PROFESSORS:
CALLARMAN, DANIEL PEARSON
ASSISTANT PROFESSORS:
GR TZMACHER, LANDEROS, SIFERD, D. SM TH DAN ELS, V. SMITH DAN ELS
SENIOR LECTURER:
W GGINS
PROFESSOR EMERITUS:
REUTER

Operations/Production Management

OPM majors study the planning and control of in ternal operations of manufacturing and service businesses. Topics covered include job design, facilities location and layout, work measurement, production planning and scheduling, quality con trol, inventory control, materials management, purchasing, and transportation. The goal is to de sign, implement and operate a productive system to produce goods and services in a competitive global economy OPM 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	Production and Operations Management	3
PUR	432	Materials Management	3
OPM	435	Service Operations Management	3
OPM	440	Productivity and Quality Management	3
TRA	445	Logistics Systems	3
OPM	475	Operations Strategies	3

Purchasing/Materials Management

The major includes the functions of planning, or ganizing, 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, pur chasing 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 shall consist of the following 18 semester hours:

			Semester Hours
OPM	331	Production and Operations Management	3
PUR	355	Purchasing	3
TRA	345	Traffic and Distribution Management	3
PUR	432	Materials Management	3
PUR	455	Purchasing Research and Negotiation	3
PUR	479	Purchasing and Materials Management Strategy	3

Transportation

The major in Transportation covers the manage ment 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 lo gistics 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 shall consist of the following 18 semester hours.

			Semester Hours
TRA	301	Principles of Transportation	3
TRA	345	Traffic and Distribution Management	3
PUR	355	Purchasing	3
PUR	432	Materials 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
dentif cat on and ntegrat on of major components of op erat ons and ogist cs management and the r mpact on organ zat ona product v ty and performance Prerequ s te: profess ona program bus ness student

331 Production and Operations Management. 3) F, S
Use of resources n produc ng goods and services Con cepts of plann ng, schedu ng and contro ng productive act v t es and phys ca resources Prerequ s tes OPM 301· profess ona program bus ness student

335 Methods Management. (3 N
Theory and pract ce n work design methods mprove ment and work measurement. Re ationsh p of att'tudes

and product v ty. Prerequ s tes OPM 301, 331 or nstruc tor approva profess ona program bus ness student

435 Service Operations Management. 3 A
Operations management techn ques used n manufactur ng and the r app cat on in serv ce organ zat ons Pre requ s tes: OPM 301, 331 or nstructor approval profes s ona program bus ness student

440 Productivity and Quality Management. 3 A
Product v ty concepts at the nat ona organ zat ona and ndiv dua eve s Qua ty management and ts re at onsh p to product v ty n a organ zat ons Prerequ s tes OPM 331 or nstructor approva profess ona program business student

470 Production Systems. 3 A
Systems theory and management funct ons, bas c too s of systems ana ys s organ zat ona systems des gn, systems app cat ons systems s mu at on Prerequ s tes. OPM 331; profess ona program bus ness student

475 Operations Strategies. 3 F, S
ntegrates operat ons management nto strateg c p ann ng mp ementat on and contro Prerequ s tes OPM 331 435 440 PUR 432, profess ona program bus ness student

502 Operations and Logistics Management. 3 F S
Conceptua foundat ons for the tota operat ons and og s t cs funct ons for a types of organ zat ons App cat on of ana yt ca methods to product on prob ems Pre equ s tes. ECN 502 QBA 502

581 Management of Production. 3 A
Ana ys s of the product on funct on from a manager a po nt of v ew Conceptua foundat ons ana ys s of major prob ems and dec s on processes

591 Seminar. 3 N
Top cs such as the fo ow ng w be offered.
a) Product on Systems Research
b) H gh Tech Operat ons
c Operat ons Strategy
(d Serv ce Operat ons
e Product v ty
f Qua ty

791-A Doctoral Seminar in Production Operations Management. 3 A

791-B Doctoral Seminar in Logistics Systems. 3 A

Special Courses: OPM 484 492, 493 494 497 498 499, 584 590, 592, 593 598, 599 690 692 700 790 792, 799 (See pages 43–44

PURCHASING MATERIALS MANAGEMENT

PUR 355 Purchasing. 3 F S
Management of the purchas ng funct on nc ud ng organ zat on procedures supp er se ect on qua ty nventory dec s ons and pr ce determ nat on Prerequ s tes OPM 301 professiona program bus ness student

432 Materials Management. 3 F S
Ana ys s and manager a ntegrat on of the mater a f ow process w th n an organ zat on, nc ud ng purchas ng pro duct on and nventory contro and MRP Prerequ s tes OPM 301 profess ona program bus ness student

455 Purchasing Research and Negotiation. 3 F, S
Current ph osophy methods and techn ques used to con duct both strateg c and operat ons purchas ng research and negot at on Inc udes negot at on s mu at ons Pre requ s tes OPM 301 331 PUR 355 profess ona program bus ness student

479 Purchasing and Materials Management Strategy. 3 F, S
Synthes s of purchas ng production transportat on to pro v de a systems perspect ve of mater a s management Deve opment of strateg es Prerequ s tes OPM 331; PUR 355 432, 455 TRA 345; profess ona program bus ness student.

532 Materials and Purchasing Management. 3 A
Ana ys s of the ncom ng f ow of mater a s and the eco nom c env ronment n wh ch the mater a s acqu s t on and a ocat on funct ons operate

591 Seminar. 3 N
Top cs such as the fo ow ng w be offered:
a Contract ng
b Systems Acqu s t ons
c Purchas ng Research

791 Doctoral Seminar in Purchasing and Materials Management. 3 A

Spec al Courses: PUR 484 492 493 494 497 498, 499 584 590, 592 593 598 599 690 692 700, 790 792 799 See pages 43–44

TRANSPORTATION

TRA 301 Principles of Transportation. 3 F S, SS
Econom c character st cs, regu at on and pub c po cy m p cat ons of ra motor a r water and p pe ne transporta t on Manag ng the shipper s transportat on needs. Pre requ s te upper d v s on stand ng or nstructor approva

345 Traffic and Distribution Management. 3) F S
Manag ng transportat on requ rements n bus ness enter pr ses ana ys s of sh pper carr er re at onsh ps and the ega env ronment w th respect to rates and serv ces Pre requ s te profess ona program bus ness student

405 Urban Transportation. 3 N
Econom c, soc al, po t ca and bus ness aspects of pas senger transportat on Pub c pol cy and government a d to urban transportat on deve opment Prerequ s te upper di v s on stand ng or nstructor approva .

445 Logistics Systems. 3 F, S
Manag ng the f rm s og st cs activ t es ntegrat ng trans portat on, nventory, warehous ng fac ty ocat on, cus tomer serv ce and re ated act v t es n a systems context. Prerequ s te profess ona program bus ness student.

460 Carrier Management. 3 A
Ana ys s of carr er econom cs, regu at on management and rate mak ng pract ce eva uat on of pub c po cy is- sues re ated to carr er transportat on Prerequ s te pro fess ona program bus ness student

462 Problems in Transportation. 3 N
Current prob ems of transportat on operat on phys ca d s tr but on and og st cs carr er management and pub c transportat on po cy. Prerequ s tes TRA 301 profess ona program bus ness student

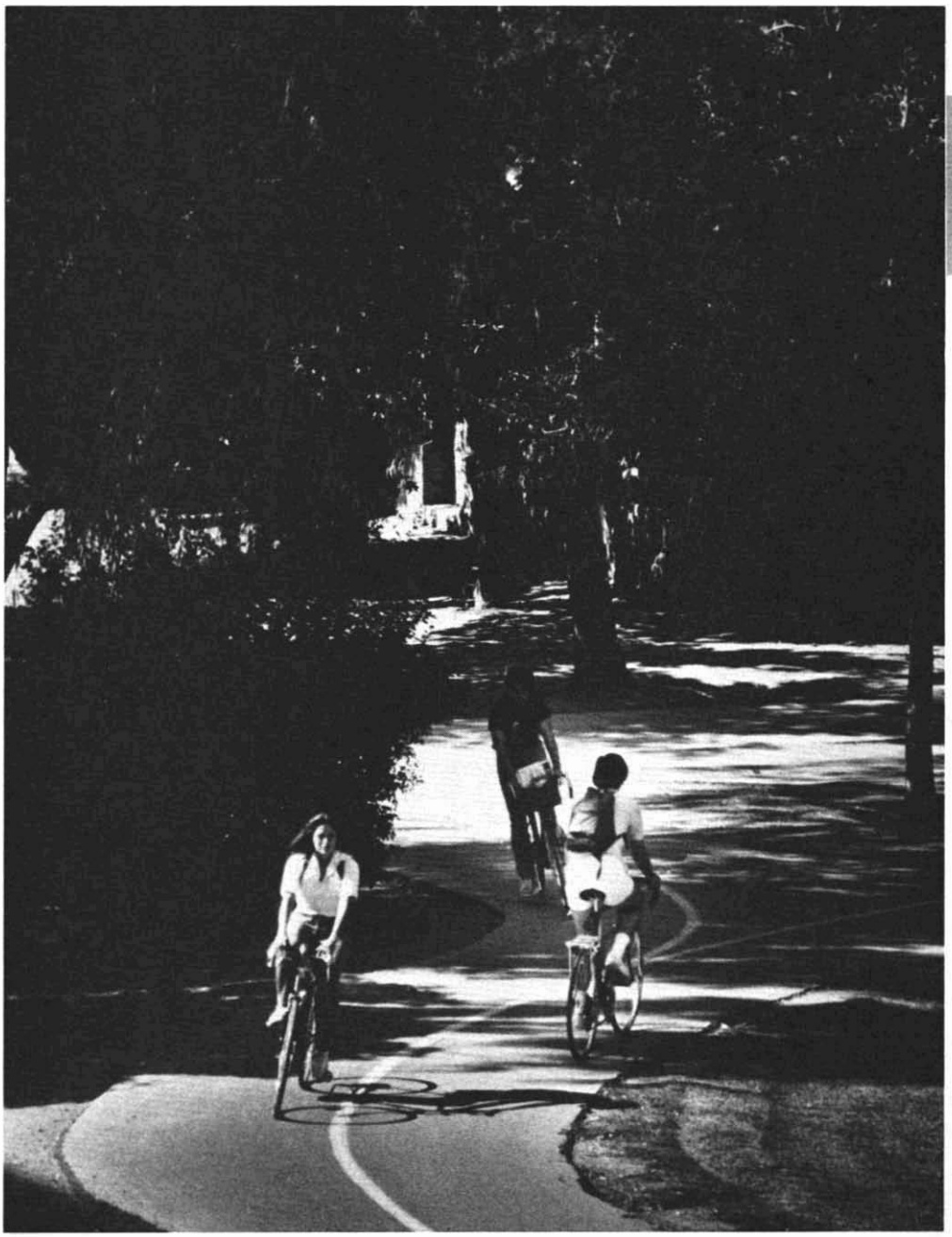
463 International Transportation. 3 A
Ro e of transportation n nternat ona bus ness econom c and ega env ronment· carr er operat ons and pract ces manag ng the f rm s nternat ona transportat on needs. Prerequ s te upper d v s on stand ng or nstructor ap prova

541 National Transportation Policy. 3 F
Po cy a ternat ves and prob ems n transportat on nterre at onsh ps of compet ng transportation modes, relat on sh ps of pub c vestment to pr vate operat ons

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

Special Courses: TRA 484, 492, 493, 494, 497, 498, 499, 584, 590, 592, 593, 598, 599, 690, 692, 700, 790, 792, 799. (See pages 43–44.)



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
- Higher Education
- Educational Policy Studies

Division of Psychology in Education
Program Areas
- Counseling
- Counseling Psychology
- Educational Psychology
- Educational Technology

Services to students and the community are provided through two centers. 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.

In addition to the two centers established by the Board of Regents, other administrative units and college centers provide services to students and the community.

The *Office of Student Affairs* assists individuals interested in professional 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.

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 Center at ASU.

Degrees

Bachelor of Arts in Education
Master of Arts
Master of Counseling
Master of Education
Education Specialist*
Doctor of Education
Doctor of Philosophy

* Applications are currently not being accepted for the Education Specialist program.

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 Professional Teacher Preparation Program (PTPP) offered by the College of Education. Students completing the program will be 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 majors which provides specialized instruction and preparation. These majors are: (a) Elementary Education, (b) Elementary Education with an option in bilingual education and English as a Second Language, c Early Childhood Education, (d Secondary Education, and (e) Special Education.

The Elementary Education major 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/ESL option prepares students to work in bilingual/ESL settings in grades K 8. The Early Childhood major prepares students to work in infant programs and preschools, as well as become eligible for certification in grades K 8. The Special Education major 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, liberal arts minor and 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.

The Secondary Education major provides preparation for teaching subjects in grades 7 12. Major and minor teaching fields approved by the

College of Education are offered in departments of the Colleges of Liberal Arts and Sciences, Business, and Engineering and Applied Sciences. Students with teaching majors in the College of Fine Arts will 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. They have an advisor in the Office of Student Affairs and an advisor in their major teaching field

Admission

Preprofessional Admission

Students admitted to Arizona State University wishing to enroll in the College of Education may declare their preprofessional status during their freshman or sophomore year At that time, students should seek advisement within the College of Education through its Office of Student Affairs, Payne Hall, Room B 7. Admission to Arizona State University and the College of Education does not guarantee admission to the PTPP.

Professional Program Admission

Consideration for admission to the Professional Teacher Preparation Program (PTPP requires that students:

1. Complete a minimum of 56 semester hours of appropriate university course work with a cumulative grade point average of 2.50 or higher;
2. Achieve passing scores on the *Professional Skills Test PPST)* which assesses basic skills in reading, writing, and mathematics,
3. Submit a copy of the official notice of admission 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 the setting of these dates is based on the testing schedules established in Arizona for the PPST

Applicants should be aware that since PPST scores must be included for an application to be complete, they should plan to take the PPST *well in advance* of application deadlines In most cases, the PPST can be taken during the sophomore year or immediately after the completion of English and math General Studies requirements.

Admission to Arizona State University and the College of Education does not guarantee PTPP admission.

Admission to the PTPP is highly selective and based on available resources. **Not all students who meet minimum requirements will be 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' course work at a community college or four year institution in Arizona should consult academic advisors during those two years for advice in planning a General Studies sequence of courses which will meet Arizona State University General Studies requirements

Out of state transfer students should contact the Undergraduate Admissions Office. (See page 32 of this *Catalog*.

The Arizona State University Admissions Office should receive the application for admission to the university, transcripts, and applicable test scores at least three months before the application deadline date for PTPP admission for the semester the student intends to enroll

Advisement

For any major in the PTPP, students should seek early advisement in the Office of Student Affairs (Payne Hall, B 7) and become familiar with specific program and College of Education requirements Students in Secondary Education must also consult an advisor in departments offering major fields of study in the College of Liberal Arts and Sciences, Business, Engineering and Applied Sciences, or Fine Arts. All students pursuing the Secondary Education major should seek early advisement from the Office of Student Affairs in the College of Education. They will have an advisor in the Office of Student Affairs and an advisor in their 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 Students should consult an advisor early in their co ege course work in order to select General Studies courses carefully. The university General Studies guidelines are on pages 50–53 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 54–80. General Stud es courses are also identified following course descriptions according to the following key

Key to General Studies Credit Abbreviations

L	L tc acy an l Crit ca Inqu ry C re Courses Interme hate le vel
L?	Literacy and Critical Inquiry Core Courses Upper division
N1	Numeracy Core Courses Mathematics
N?	Nu me a y Core C urses Statistics and Quant tative Reason ng
N3	Nun era y C ore Courses Computer App cati ns
HU	Humanit es and F ne Arts Core Courses
SB	Social and Bel aviora Science Core Courses
S1	Natural Science Core Courses Introductory
S2	Natural Scienc Core Courses Addit onal Courses
G	G oba Av areness Courses
H	Histor c t Awareness C urses

Program of Study

Students adn itted to the PTPP must file a pro gram of study during the first semester of the pro gram. A program of study for the four semester professional program will include core courses for *all* students, regardless of major or option se lected. Additional courses are required to meet degree requirements in the specific majors or op tions of Early Childhood Education, Elementary Education, bilingual education and English as a Second Language, Secondary Education, and Special Education To complete a program of study in four semesters, full time study is re quired. The program is sequential in nature and semesters may not be combined

The general pattern isted below should be fol lowed 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. A minimum of 56 hours of approved General Studies courses must be completed before the professional se quence in any major is begun.

Any exceptions to the above requirements must be approved by the Standards and Appeals Com mittee of the Division of Curriculum and Instruc tion

Human Development Specialization. Ele mentary, bilingual education and English as a Second Language, Early Childhood, Secondary, and Special Education students enrolled in the PTPP must complete an 18 semester hour spe cialization in human development. Elementary, bilingual education and English as a Second Lan guage, and Early Childhood students are required to include MCE 446, Understanding the Cultur ally Diverse Child, as part of their human devel opment specialization. Special Education stu dents are required to include SPE 314, Introduc tion to Bi ingual/Multicultural Special Education, in their human development sequence of courses

Academic Specialization. Elementary, bilin gual education and English as a Second Lan guage, Early Childhood, and Special Education students in the PTPP must also complete an 18 semester hour academic specialization in an area taught at the school level at which they plan to teach. The academic specialization must be taken outside the College of Education

Four-Semester Requirements Professional Teacher Preparation Program

Elementary Education (K–8) Major

Semester I — 7 semester hours

DCI	396	Field Experience
EDP	301	Learning and Motivat on in Education
EDP	303	Hun an Development
SPF	301	Culture and Schooling

Semester II 7 semester hours

CBE	300	Computers in Education
DCI	302	Principles and Applications of Effective Instruction
DCI	303	Classroom Organization and Management
DCI	396	Field Experience
EDP	302	Assessment and Eva uation 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 Pract cum

Semester IV 14 semester hours

EED	478	Student Teaching 12
SPF	401	Theory and Practice n Educat on (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
CBE 300 Computers in Education
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

Semester III 9 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 12
SPF 401 Theory and Practice in Education 2)

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 7 semester hours
CBE 300 Computers in Education
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

Semester III 11 semester hours
ECD 401 Instructional Strategies Social Studies, Creative Arts
ECD 402 Instructional Strategies Math, Science
ECD 404 Language Arts
ECD 496 Field Experience
RDG 401 Decoding and Reading
RDG 402 Reading Practicum

Semester IV — 14 semester hours
EED 478 Student Teaching (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
CBE 300 Computers in Education
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

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 12)
SPF 401 Theory and Practice in Education 2)

Special Education (K–12) Major

Semester I — 15 semester hours
CBE 300 Computers in Education
EDP 301 Learning and Motivation in Education
EDP 302 Assessment and Evaluation in Education
EDP 303 Human Development
EED 404 Language Arts
SPE 311 Orientation to Education of Exceptional Children
SPE 314 Introduction to Bilingual/Multicultural Special Education

Semester II 15 semester hours*
ECD 402 Instructional Strategies Math, Science
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 — 12 semester hours*
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 — 12–15 semester hours
SPE 478 Student Teaching 12)
(three additional hours required for third endorsement

* *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 also occurs near the end of programs of study in the postbaccalaureate programs.

Applications for student teaching are required the semester prior to the student teaching semester. To be accepted for student teaching, students must have met the following requirements:

1. Attained an overall GPA of 2.50 or better;
2. Attained a GPA of 2.50 or better in their professional course work;
3. Completed all required professional course work;
4. Removed all academic deficiencies such as grades of "D," "E" or "I" prior to placement, and
5. Completed an application procedure and receive approval to student teach from the Office of Professional Field Experiences.

Normally, student teaching is only possible during fall and spring semesters. Student teachers must adhere to the calendar, regulations, and philosophy of the school 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 which interfere with the heavy demands placed upon them.

Graduation Requirements

Candidates for the degree of Bachelor of Arts in Education are required to complete an approved program of study 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 245 of this *Catalog*. Candidates must file for graduation through the Office of Student Affairs (Payne Hall, B 7) in order to be recommended by the faculty of the College of Education for graduation.

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 (Payne Hall, B 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 middle school education, bilingual education and English as a Second Language (ESL). The bilingual education endorsement is required of all teachers specifically responsible for providing bilingual instruction. The English as a Second Language (ESL) 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, positive attitude, and satisfactory performance in field experiences.

To be considered in good standing, students must maintain an overall cumulative grade point average *and* a grade point average in PTPP course work of 2.50 or higher. Any first- or second-semester PTPP student whose cumulative and PTPP course work grade point averages fall below 2.50

is placed on academic probation or suspended from enrollment in the next semester of the PTPP program. Students suspended from the program must repeat all PTPP courses in which grades below "C" have been received. They must also remove all other conditions of their suspension before enrolling for courses in the next semester of the program. Students with a cumulative ASU or PTPP course GPA below 2.50 or with a grade in a PTPP course of "D" or lower are not permitted to enroll for third semester PTPP courses.

Students on academic probation or suspension must seek advice from the Office of Student Affairs prior to registering for additional course work.

Probation and suspension status for academic reasons begin on the first day of classes of the semester following 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. Students placed on probation or suspension for any reason have their 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 (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 which lead to teaching certification are designed for those who hold a bachelor's degree in an area other than education. The college offers postbaccalaureate programs in Elementary, Early Childhood, Secondary, and Special Education. Students who wish 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 they wish to be certified to teach,
2. 2.50 GPA or better,
3. Passing scores on the preprofessional skills test (PPST), and
4. Submission of a completed application form by appropriate deadlines in the semester prior to admission.

Admission to postbaccalaureate programs is highly selective and based on available resources. **Not all students who meet the minimum requirements will be admitted to the program.** Students admitted to the postbaccalaureate programs who do not begin course work within one calendar year of their date of admission must reapply for admission.

Students who also wish to pursue a master's degree should contact the program coordinator in their intended area of study. They must meet the admission requirements of both the College of Education and the Graduate College.

A program of study must be filed within the first semester after admission to any postbaccalaureate program. Applications for student teaching are required during the semester prior to the student teaching semester. Postbaccalaureate students are subject to the College of Education retention and disqualification standards on pages 249-250 of this *Catalog*. 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. Emphasis in multicultural education is offered at the undergraduate level. Courses in Indian education, multicultural education, and bilingual 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 and the dean of the college. 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. Exceptions to this policy may be approved if the correspondence course work has been approved in advance 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 Education include a core of courses designed to give students an understanding of the context of American education and of the methods of scholarship by which our 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 their program since they 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 educational inquiry from controlled, quantitative to qualitative, naturalistic. Emphasis on locating and critically interpreting published research.

502 Introduction to Quantitative Methods. (3) F, S, SS
Topics in statistical analysis, measurement, research design. Exploratory data analysis, estimation theory, statistical inference. Use of computers for data analysis.

503 Introduction to Qualitative Research. (3) F, S, SS
Terminology, historical development, approaches (including ethnography, ethnomethodology, critical theory, grounded theory, hermeneutics), qualitative versus quantitative social sciences; methods of inquiry.

504 Learning and Instruction. (3) F, S, SS
Introduction to psychology of learning and instruction. Includes the foundations of learning theories and their application to educational practice.

505 American Education System. (3) F, S, SS
Political, social, historical and philosophical analyses of American education at all levels. Examination of primary sources, legal findings, case studies.

Division of Curriculum and Instruction

(Payne Education B-225, 965–1644)

PROFESSORS:
J. E. BELL J. W BELL, BERLINER B TTER, EDELSKY, EDWARDS, FAAS GRYDER, HAGGERSON, HIGG NS, HOWELL, MALONE MOORE, MOYER PRIETO RAY RUTHERFORD SATTERTHWAITE SCHON, SEARFOSS, SILVAROL SVOBODA ASU WEST CAMPUS WALLEN, ZIM LES ZUCKER

ASSOCIATE PROFESSORS:
GREATHOUSE (ED B 225), ANDERSON, AXFORD BENAVIDES BLANCHARD CHR ST E, CHR ST NE, COHEN COHN EEDS, F NER, HARDT JACOBS, KAM NS, KNAUPP, MANERA McCOY McGOWAN, Mc SAAC, NELSON PETERSON, RADER ROBERTS STAHL, STALEY THOMAS, VALLEJO, WAMACKS, WILSON W SEMAN

ASSISTANT PROFESSORS:
CASEY DICKERSON ASU WEST CAMPUS), FREDER CK, GOMEZ, GUZZETT HATF ELD HURSTON KLE N KNUPFER, ROBB NS SERNA SURBECK SWISHER

PROFESSORS EMERITI:
ARMSTRONG BATCHELOR M BELL BOYD BROOK, CHASEY COOK, CROUCH, DUDEK, FRAS ER FRAZIER, FULLERTON, G LL, GR FF TH, HOOVER JEL NEK JONES, K ESOW, KINGSBURY KOZAC K LAMM, LEE, McGRATH MITCHELL, O BE RN O'BR EN, OLMSTED, PODL CH R CE, ROVER, SCHALL, SHOFSTALL, STEERE SULL VAN, SUNDWALL, VEATCH

Program Areas

Adult Education
Educational Media and Computers
Elementary and Early Childhood 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 elementary and early childhood education, secondary education, and special education settings. Concentrations available at the undergraduate level include Indian education, multicultural education and bilingual education. Programs of study leading to special endorsement by the Arizona Department of Education are bilingual education, English as a Second Language (ESL), reading and library science

Postbaccalaureate programs leading to teaching certification are available in Elementary and Early Childhood Education, 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
Principles of teaching identified by research on teaching effectiveness Application of principles to classroom practice Formajors only Prerequisite EDP 303

303 Classroom Organization and Management. 2) F S
Develops understanding and application of classroom organization and management principles strategies and procedures. For majors only Prerequisite EDP 303

396 Field Experience. 0 F S
Observation and limited participation in a school setting Focus on observation of development, learning management, instruction, assessment and motivation Corequisite semesters I and II of the PTPP

Educational Media and Computers

COMPUTER-BASED EDUCATION

CBE 300 Computers in Education. 1 F, S SS
An introduction to word processing, databases spreadsheets, teacher utility programs and evaluation of educational software Required for education majors

421 Computer Literacy. 3 F S SS
Survey of the ro e of computers n tra n ng and educat on Emphas s on current app cat ons *[Satisf es General Stud es Requ rement N3]*

423 Computer Applications. 3 F, S, SS
Introduction to computer app cat ons for nstruct on

480 Teaching Business Subjects. 3 N
Organ zat on and presentat on of appropr ate content for bus ness subjects n the secondary schoo

491 Organization and Management of Cooperative Programs. (3) N
Work study programs for bus ness occupat ons n h gh schools and commun ty co eges.

503 Tests and Measurements in Business Education. (3 N
Construct on admin strat on and eva uat on of tests n bus ness sub ects

505 Current Literature in Business Education. 3) N
Cr t ca ana yses genera zat ons and trends

506 Information Processing for Business Teachers. 3 N
Deve opment of curr cu um, esson p ans and strateg es for teach ng nformat on process ng, hardware software eva uations and equ pment acqu s t on techn ques

510 Principles of Business Education. 3 N
H'story, ph osophy, pr nc ples and object ves of bus ness educat on.

511 Computer Applications in Education. 3) F, SS
Use and eva uat on of computers for word process ng n format on management graph cs, and author ng nstruc tion n educat ona sett ngs

512 Instructional Development in Business Education. 3 N
Emerg ng curricula and nstruct ona strateg es n business educat on

515 Observation and Work Experience. 3) N
Observat on and or partic pat on n bus ness

522 Evaluating Computer Materials. 3 F S, SS
Se ect on ut zat on des gn and evaluat on of nstruc t ona computer mater als Prerequ s te CBE 421 or n structor approva

523 Computer Programming for Instruction. (3) S SS
Computer programm ng for nstruct ona purposes Pre requ s'te CBE 423 or nstructor approva .

637 Computers in Elementary School Curriculum. 3 SS
ntroductory experiences w th educat ona uses of comput ers; computer awareness, fam y soc eta mpact, c ass- room appl cat ons software curr cu um deve opment, BA SIC LOGO anguages m crocomputers.

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 re ated advanced technolog es n edu cat on.

702 Research in Technology-Based Education. 3 F
Cr t ca exposure to theor es, research, and methods n techno ogy based educat'on

791 Seminar. (3) N

Special Courses: CBE 492, 493, 494 580 584 590 591 592 598, 692, 791 792 (See pages 43–44)

EDUCATIONAL MEDIA

IME 411 Introduction to Media Production. (3) F, SS
App cat ons of v sua teracy to the des gn and product on of med a to enhance presentat ons Lecture and lab

455 Animation and Special Effects. 3) F, S
An exam nat on of the art, sc ence and mpact of an ma- t on and other spec a effects used n fi m.

521 Instructional Media Design. (3) F S
Prepar ng spec f cat ons for nstructional telev sion film, s de tape programs, and computer based instruct on.

522 Desktop Publishing. (3) F, SS
Des gn and product on of educat ona mater a s us ng computer based word process ng graph cs, and page lay out programs Lecture and ab

523 Telecommunication for Instruction. 3 F, S
Instruct ona uses of sate te, te econference, and elec tron c networks for d stance earn ng.

524 Instructional Photography. 3 F
The camera, f m exposure, compos tion and ght ng. Pre paring s des for nstructiona presentat ons

525 Presentation Graphics. 3 S, SS
Design production, and use of computer graphics for group presentat ons. Prerequ s te. ME 521 or instructor approva

527 Instructional Television. 3 F
Des gn and product on of nstruct ona programs for telev - s on Lecture and ab. Prerequ s te: ME 521 or nstructor approva

528 Advanced Photographic Media Production. (3 S
Des gn and product on of mu t media nstruct ona pro grams Emphas s on s de tape format Lecture and lab. Prerequ s te ME 521 or nstructor approval.

560 Current Issues and Problems in Media/Computer Education. 3 N
Cr t ca analys s of current pract ces n nstruct ona med a/ computer Prerequ s te 6 hours n IME CBE or nstructor approva

584 Instructional Media Internship. (1–6) F, S, SS
Prerequ s tes EDT 502 IME 521; nstructor approva .

Special Courses: IME 494 498 499, 500, 580, 583 584 590, 591 592, 593 594, 598 599. (See pages 43–44.

Elementary Education

EARLY CHILDHOOD EDUCATION

ECD 308 Introduction to Early Childhood Education. 3 S
An overv ew of the ear y ch dhood educat on field nc ud ng profess onal opt ons histor'ca roots, and current theo ries and po 'cy deve opments at nat onal, state and ocal eve s

310 Educational Environments: Infants/Toddlers. (3) F, S
Organ z ng p ann ng and mp ement ng educat onal prac- t ces based on developmenta theories wh ch w l enab e ear y ch dhood educators to prov de opt ma earn ng env'- ronments for nfants and toddlers Prerequ s te. ECD 314.

311 Social Studies in Early Childhood Education. 3) F S, SS
Deve opment of democrat c v ng in a areas of the cur r cu um Objectives, prob em solv ng se ect on of content, scope and sequence construct on of nstruct ona mater a and resources Exper ences w th ch dren.

312 Educational Environments: Nursery Kindergarten. 3 F S SS
Cons ders a l aspects of curricu um Ph osophy pr n c p es pract ces prob ems, and eva uat on n the nte grated exper ence program.

314 The Developing Child. 3 F, S, SS
Prov des a base for understand ng and work ng w th young ch dren Exam nes a aspects of development of ch dren b rth through e ght w th mp cat ons for teachers and parents Prerequisite CDE 232 or equ va ent

322 Communication Arts in Early Childhood Education. 3 F S, SS
Factors affect ng anguage deve opment Sett ng cond t ons for earn ng n sten ng speak ng read ng and wr t ng Prerequ s te ENG 213 or equ va ent

378 Practicum in ECD. 3 F, S
Prov des a f e d based exper ence n se ected ear y ch d hood sett ngs outs de the pub c schoo s pr or to student teach ng . Prerequ s te ECD 314

401 Instructional Strategies: Social Studies, Creative Arts. 3 F, S
Presents mater a s techn ques and resources for a bal anced program of soc a stud es and aesthet c express on appropr ate for ch dren preschoo through 3rd grade w th emphas s on the ntegrated curr cu um Corequ s tes ECD 402, 404, 496, RDG 401 402

402 Instructional Strategies: Math, Science. 3 F S
Emphas zes deve opmenta y appropr ate educat ona strateg es and nstruct ona techn ques n teaching mathe mat cs and sc ence to ch dren preschoo through 3rd grade w th n an ntegrated curr cu um approach Prerequ s tes B O 100 MTE 180, PHS 110 or equ va ent Core qu s tes ECD 401 404 496, RDG 401 402

404 Language Arts. 2 F S
Presents theory on the soc a nature of ora and wr tten anguage and congruent c assroom pract ces Corequ s tes ECD 401 402 496 RDG 401 402

411 Early Childhood Education: Programs and Materials. 3 F S SS
Pr nc p es, exper ments research stud es and recent trends as factors re ated to the educat on of ch dren through e ght years of age Prerequ s te ECD 312 or equiva ent

496 Field Experience. 0) F, S
App cat on of course content n a P 3 sett ng Emphas s on observat on, focus on ch d centered curr cu um, p an n ng and de ver ng nstruct on and assessment Corequ s tes ECD 401 402 404, RDG 401, 402

522 Developmental Social Experiences in Early Childhood Education. 3 S
Mater a s techn ques aesthet c express on creat ve ac t v t es and values n the ntegrated curr cu um Prerequ site ECD 311 or equiva ent

525 Communication Arts in Early Childhood Education. (3) F
Prob ems and trends of current programs and ora an guage development Effort to br ng together anguage ac qu s t on f ndings with educational pract ces Opportun ty for se f directed earn ng study Prerequis te ECD 322 or equiva ent

527 Mathematics in Early Childhood Education. 3) F
Theory and pract ce n the use of man pu at ve mater a s for teach ng mathemat cs to preschoo and pr mary grade ch ldren Prerequ s te EED 380 or equiva ent

544 Play Education. 3 S, SS
Theor es of p ay and the educat onal mp cat ons of each Pract ca app cat ons at the early ch dhood leve

555 Modern Practices in Early Childhood Education. 3 F S
Trends and pract ces, nstruct ona and resource materi a s, methods and techn ques n ear y ch dhood educat on Prerequ s te· ECD 312 or equ va ent

733 Social and Emotional Development. 3 A
nqu ry nto the soc a and emot ona deve opment dynam cs n ch dren, such as peer re at onsh ps, se f concept parent ng processes, w th mp cat ons for teachers

744 Evaluative Procedures: Young Children. 3 S
A cr t ca exam nat on and use of deve opmenta y appro pr ate eva uat ve procedures for ch dren b rth through e ght

Special Courses: ECD 294 298 394 492 493 494 497, 498 499, 580 583, 584 590, 591 592 593 594, 598, 599 680, 683 684, 690 691, 692 693, 700 780, 783 784 790 791 792, 799 See pages 43–44.

ELEMENTARY EDUCATION

EED 320 Teaching Science to Children. 3 F, S SS
Deve ops students persona phi osoph es of the nature of e ementary schoo sc ence why teach sc ence and how ch dren earn sc ence Know edge and sk s n p ann ng nstruct on us ng nstruct ona mode s ntegrat ng the cur r cu um emp oy ng current sc ence programs and mater a s and eva uat ng ch dren s earn ng L m ted to students adm tted to the postbaccalaureate cert f cat on program

333 Communication Arts in the Elementary School. 3 F S SS
Factors affect ng anguage growth Sett ng cond t ons for teach ng ora and written L m ted to students adm tted to the postbacca aureate 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 c assroom L m ted to students adm tted to the postbaccalaureate 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 n the e ementary grades L mited to students adm tted to the postbacca aureate cert f cat on program

366 Observation and Participation. 1 3 F, S SS
Students observe and work d rect y w th e ementary ch dren n a c assroom s tuat on nc udes a cr t cal L m ted to students adm tted to the postbacca aureate cert f cat on program

380 The Teaching of Mathematics in the Elementary School. 3 F, S, SS
A begnn ng course n methods and mater a s used Labo ratory exper ences and computer app cat ons w th curr cu um matena s C assroom observat on requ red L mited to students adm tted to the postbacca aureate cert f cat on program Prerequ s te· MTE 180

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 esson plann ng and models of nstruct on 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 ntegrat ng modern techno og es prob em so v ng, man pu at ves, current research and ear ng theor es Prerequ s te MTE 180 Corequ s tes EED 401 404 496 RDG 401, 402.

404 Language Arts. 2 F, S
Presents theory on the soc a nature of ora and wr tten anguage and congruent c assroom pract ces Corequ sites EED 401, 402 496, RDG 401 402

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 thes zed experience n curr cu um nstruct on and c ass room management Prerequ s tes 2 50 GPA complet on of profess ona course sequence, approva of Profess ona F eld Exper ences

496 Field Experience. 0 F S
App cat on of course content n a K 8 schoo classroom Emphas s on observat on, pupi management p ann ng and de very of nstruct on, and assessment Corequ s tes EED 401, 402 404, RDG 401 402

511 Principles of Curriculum Development. 3 F S SS
Contemporary curr cu um theories Curr cu um as an nter re 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 cnt ca exam nat on of schoo anguage arts teach ng focus ng on theoret ca assumpt ons regard ng ora and wr tten anguage deve opment

528 Social Studies in the Elementary School. 3 F, S SS
Prob ems and trends of current programs Deve opment of a ba anced and art cu ated program of soc a stud es Pre requ s te EED 355 or equ va ent

529 Science in the Elementary School. 3 F S
Prob ems and trends of current programs Deve opment of a ba anced and art cu ated sc ence program Prerequ s te EED 320 or equ va ent

530 Outdoor Education. 3 S, SS
Use of var ous outdoor sett ngs as aborator es for c ass room re ated exper ence, study observat on, nquiry re search, and recreat on

537 Mathematics in the Elementary School. 3 F S, SS
Contemporary mathemat cs teach ng. Content, mater a s and approaches to nstruct on Prerequ site EED 380 or equ va ent

578 Student Teaching in the Elementary School. 9–15) F, S
Superv sed teach ng for postbacca aureate students syn thes zed exper ence n curr cu um nstruct on, and c ass room management Prerequ s tes comp et on of 21 hours of dent f ed course work from an approved program of study, a GPA of 2.50 postbacca aureate nondegree or 3.00 (postbacca aureate degree approva of Profess ona Fie d Expenences

581 Diagnostic Practices in Mathematics. 3 S SS
Spec f c sk s n d agnos ng treat ng ch dren's earn ng d f f cu t es n mathemat cs nc udes pract cum exper ences n dent fy ng strengths weaknesses and n t a remed a t on Prerequ s te EED 380 or nstructor approva

585 Contemporary Issues in Elementary Education. 3 S SS
A sem nar wh ch deve ops an understand ng of a broad range of contemporary ssues Ass sts n estab sh ng an nformed profess ona v ew Prerequ site EED 511 or equ valent

670 Qualitative Research in Elementary Education. (3 S
Survey of ethnograph c and natura stic studies of teracy, m croethnograph c, ethnomethodo og ca and soc o ngu s t c stud es of c assroom nteract on, ethnograph es of e e mentary schoo ng Prerequ s te: COE 503

720 Language in Education. 3 A
Soc o ngu stic sem nar on language ssues n educat on anguage acqu s t on c assroom nteract on, anguage att tudes re at on anguage and c ass gender ethn c ty

Special Courses: EED 294 298 394, 492 493 494 497 498, 499 580 583 584 590 591, 592 593 594, 598, 599 680 683 684 690 691 692, 693, 700 780 783, 784 790 791 792 799 See pages 43–44.

Multicultural Education

MULTICULTURAL EDUCATION

MCE 446 Understanding the Culturally Diverse Child. 3 F S SS
Phys ca soc a psycho og ca deve opmenta , and edu cat ona needs of ch dren from cu tura y and ngu st ca ly d fferent popu at ons Mu t d sc p inary approach w be presented

447 Methods of Teaching the Culturally Diverse Child. 3 A
Techn ques for organ z ng and provid ng spec a educa t ona exper ences for students from cu tura y and l ngu s t ca y d fferent popu at ons Prerequ s te. MCE 446

Specia Courses: MCE 394 492 493, 494, 497 498, 499 580 583 584, 590 591, 592 593 594 598, 599 See pages 43–44

BILINGUAL EDUCATION

BLE 401 Teaching Science and Social Studies to Children. 4 F, S
ntroduct on of teach ng strateg es to be ut zed n work ng n b ngua ESL c assroom sett ngs Corequ s tes BLE 402, 405 406 407 496

402 Teaching Strategies in Mathematics. 2 F S
ntroduct on and mp ementat on concepts for teach ng mathematics to m nority anguage popula ons Corequ s tes BLE 401, 405 406 407 496

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 eva uat on concepts are ntroduced Prerequi s te ENG 213 or equ va ent Corequ s tes: BLE 401 402 406 407 496.

406 Reading Practicum. (1 F S
Supervised schoo based exper ence n teach ng read ng to b ngua ESL students. Corequ s tes BLE 401 402, 405, 407, 496

407 Language Arts. 2 F S
Theory of the soc al nature of oral and wr tten anguage and congruent c assroom pract ces for students preparing to teach b ngual 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 thes zed experience n curr cu um nstruct on and c ass room management n a b ngua education ESL setting Prerequisites 2 50 GPA comp etion of profess ona course sequence approva of Off ce of Profess ona F e d Exper ences

496 Field Experience. 0 F, S
App cat on of course content n a b ngual/ESL schoo sett ng. Emphas s on observation pup management, p ann ng and de ver ng nstruct on and assessment. Corequ s tes BLE 401, 402, 405, 406 407

511 Introduction to Language Minority Education. 3) A
Prov des an overv ew of mode s of b ngua educat on and focuses on genera teach ng strateg es for b ngua c ass rooms. Pr man y Span sh Eng sh cons derat ons

514 Bilingual Multicultural Aspects of Special Education. 3 S
Theor es and ssues related to the educat on of b ngua and cultura ly d verse except ona chi dren

515 Instructional Methods for Bilingual Students. 3 F S
Prov des an ntroduct on to the deve opment and mp em entat on of nstruct ona strateg es appropr ate for lan guage m nor ty popu at ons.

516 Teaching Strategies for Native American ESL Programs. 3 A
nc udes nstruct ona act v ty deve opment cu tura char acter st cs, and nfus on of cu tura y re evant content n ESL programs of nstruct on

522 Literacy Biliteracy Development. 3 S
Exam nes approaches to f rst and second anguage de ve opment for anguage m nor ty students

528 Social Studies for Bilingual ESL Teachers. 3 S
Prov des anguage and nstruct ona methodo og es re e vant to b ngua mu t cu tura students n soc a stud es content de vered n Span sh and Eng sh

533 Reading-Teaching Bilingual Students. 3 F S
Acqua nts teachers w th theory and pract ce n second anguage acqu s t on and w th strateg es for deve op ng word recogn t on and comprehens on n nat ve anguage and second anguage read ng Span sh Eng sh empha s s

535 Sociolinguistic Issues in Bilingual Education. 3 F
Survey of ma or theoret ca ssues e g anguage s tu ations commun cat ve competence, anguage attitudes nterre at ng anguage soc a processes and b ngua edu cat on

541 Nature of Bilingualism/Second Language Acquisition. (3 A
B ngua and second language acqu s t on w th specia emphas s n the Mex can Amer can chi d Psycho og ca and soc o og cal aspects w be stressed

543 Bilingual Education Models. 3) A
Bi ngua education programs n other countr es ana ys s of po it ca soc a econom c and educat onal mp cat ons pract ce n p ann ng b ngua educat on curr cula See a so offer ngs under MCE, SED, SPE and SPF on pages 255 258–261 and 263 264

561 Parent Involvement in Language Minority Education Programs. 3 F, S
Course des gned to g ve students, teachers and other personne ns ghts n work ng w th parents, parent organi zat ons, community groups and other agenc es on educa t on re ated ssues

580 Practicum. (1–6 F S
Prov des for pract ca app cat on n schoo settings of pr n c p es of b ngua educat on or Eng ish as a Second Lan guage.

Special Courses: BLE 394 494, 498 499 580, 584 590 591, 592 593 594, 598 690, 691 784, 790 791 799 See pages 43–44

INDIAN EDUCATION

IED 411 Foundations of Indian Education. 3 F S
H stor ca deve opment of nd an affa rs and Ind an educa t on nc ud ng contemporary educat onal ssues trad t onal nd an concepts of educat on and nd an cu tures

422 Methods of Teaching Indian Students. 3 F
Ph osoph es methodo og es, and mater als used n Ind an educat on Exam nation of oca and tr bal c assroom ma ter a s Exper mentat on w th new teach ng concepts Pre requ site IED 411

424 Curriculum and Practices for Indian Education. 3 S
Curr cula ph osoph es and research n nd an educat on Techn ques for curr cu um deve opment, change and m provement Prerequ s te ED 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 mentat on w th new counse ng concepts Prerequis te ED 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 s te ED 411

500 PS: Administration and Management of Indian Education Programs. 3 A
Exam nat on of adm n strat ve and programmat c pract ces re ated to the schoo ng of Amer can Ind an popu at ons

502 PS: Development of Indian Cultural and Language Materials. (3 A
Prov des a cu tura anguage approach to curr cu um de ve opment Exam nat on of nstruct onal mater a s used n American Ind an b ngua /b cu tura educat on programs

511 Community Schools in Indian Education. (3 A
Deve opment mp ementat on and adm n strat on of n d an commun ty schoo s Techniques and methods for ef fect ve schoo commun ty re ations

522 Family Literacy in Language Minority Communities. 3 F S SS
Exam nes theor es and pract ces re ated to teracy deve opment n adults Spec al emphasis s g ven to Nat ve Amer can fam es.

544 Role of Tribal, State, and Federal Government in Indian Education. 3 A
Exam nes responsib t es and re ationships of each agency n the operat on of Ind an educat on programs Ana yzes eg s ation f nanc a resources, and tr ba con trol.

594 Workshop in Indian Education. (6) SS
Pract ca approaches to teaching Ind an students Curricu lum and materials deve opment commun ty nvolvement current ssues, and research exam ned

Special Courses: ED 394 492 493 494 497 498 499 580, 583 584 590 591, 592 593, 594 598, 599 (See pages 43–44)

Reading and Library Science

READING

RDG 301 Content Area Reading: Decoding. (1) F S
Requ red course for a secondary educat on candidates ntroduces theory and nstructional strateg es for earn ng from text across academic d sc p nes.

302 Content Area Reading: Practicum. (1 F S
Superv sed f e d exper ences apply ng nstruct ona strate g es ntroduced n RDG 301 Required course for a sec ondary educat on cand dates Prerequ 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 classroom read ng programs and pract ces Course pro v des bas c teacher sk s eva uat on c assroom environ ments and read ng methods D scuss on sessions might be nc uded Lim ted to students adm tted to the postbac ca aureate certif cation program. Prerequ s te. ENG 213 or equ va ent

315 Decoding in Reading. 3) F, S, SS
Emphas zes nguist c and psycho nguist c aspects of read ng. nc udes teach ng sound symbo correspon dences through phonics methods. D scuss on sess ons m ght be nc uded L m ted to students adm tted to the postbacca aureate cert f cat on program Prerequ's te: RDG 314

401 Decoding and Reading. (2) F S
Requ red course for elementary, ear y ch ldhood and spe cia educat'on cand dates Decod ng phonics), vocabu ary comprehens on and eva uat on concepts are ntro duced Prerequ s te ENG 213 or equivalent Corequ sites ECD 401 402 404 496 RDG 402; *or* EED 401 402 404 496 RDG 402, *or* CBE 300; EDP 301, 303, EED 320 RDG 402 SPE 311, SPF 301.

402 Reading Practicum. 1) F, S
A superv sed schoo based pract cum ut z ng d agnost c and treatment procedures with ch dren experiencing read ng d ff cu ty. Requ red for e ementary, early chi dhood, and spec a education cand dates Corequis tes· ECD 401, 402 404, 496, RDG 401; *or* EED 401 402, 404, 496, RDG 401 *or* CBE 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 princip es and methodology, includ ng decod'ng Corequisite RDG 480

480 Practicum: Secondary Reading. 1 F, S
Provides for pract ca app cat on of content read ng pr n c ples n an on site secondary schoo sett ng Corequ s te. RDG 467.

481 Practicum: Elementary Reading. (3) F S, SS
Preservice students test and tutor chi dren who are experi enc ng d fficulty with read ng This practicum s schedu ed in ocal schoo s under direct co ege supervision L mited 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 f c pro fess ona sk s n decod ng, comprehens on and evalu ation. 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 strategies concern ng learning from text across subject matter d'sc p nes Core qu s te RDG 508

508 Practicum: Content Area Reading. (1 F S SS
Practical app icat on of content area read ng pr nc p es n 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
Acquaints teachers w th theory and pract ce in second an guage acquis't on and w th strateg es for deve op ng word recogn tion and comprehens on in nat ve anguage and second anguage read ng (Span sh Eng sh emphas s)

544 Comprehensive Secondary Reading Methods and Programs. (3) S
Teaching methods, program deve opment/eva uat on, and resource work as carried out by the contemporary secon dary read ng specia ist. Prerequ s tes: RDG 507 508

550 Directed Experiences in Reading. 3) F, S, SS
Pract cum experience ut z ng d agnostic and nstruct on techn ques of the c assroom for correct ve read ng reme d at on Part c pants tutor ass gned students tw ce a week. Laboratory sections Prerequ s te· RDG 505 or nstructor s approva Required for specia read ng endorsement

556 Diagnostic and Treatment Procedures in Reading. (3) F, S SS
Basic and spec al zed d agnostic and nstruct on tech n'ques for correct ve and c n ca read ng remed at on Re qu red for special reading endorsement Prerequ site RDG 505.

557 Reading Clinic Experience. 3) F
Pract cum experience uti z ng spec a zed diagnost c and nstruction techn ques for c in ca read ng remed at on Part c pants tutor ass gned students tw ce a week Rec ommended for spec a read ng endorsement Laboratory sections. Prerequisite RDG 556 or nstructor approva

581 Learning to Read with Literature. 3 F, S SS
For c assroom and specia read ng teachers The role of terature n the acqu s t on and deve opment of iteracy Spec fic suggestions for he ping ch dren earn to read us ng literature as the med um of instruct on. Prerequ s te: teaching cert f cate

629 Seminar: History of Reading Instruction and Research. (3 S
Recurrent themes, prom nent author t es and s gn f cant research and publ cat ons n the h story of read ng educa t on and re ated curr cula Prerequis te nstructor ap prova

630 Research in Reading. 3 S
For advanced graduate students nterested n app ed re search prob ems terature of read ng nstruct on and ma jor ssues re ated to read ng research Prerequ s te n structor approva

Special Courses: RDG 294 298 492 493, 494 497 498, 499 580, 583 584 590 591, 592 593 594 598 599 680 683, 684 690 691 692 693 700 780 783 784 790 791 792 799 See pages 43–44

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 you g readers

510 Library Automation. 3 S
L brary uses of computers Fundamenta concepts and s sues n the f e d of brary automat on Prerequ s te LIS 571 581 or nstructor approva

533 Current Library Problems. 3 F
Cr t ca ana ys s of current pract ces and prob ems n schoo brar ansh p Prerequ s tes LIS 540 561 571 581 or nstructor approva

534 Evaluation of Literature for Young Readers. 3 S
App y ng standards of terary cr t c sm to terature 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 Dec mal C ass f cat on of pr nt and nonpr nt brary mater a s

561 Selection of Library Materials. 3 F
Pr nc p es and procedures used n the se ect on of materi a s for the schoo brary.

563 Library Materials for Children. 3) F
Se ect ng and us ng pr nt and nonpr nt mater a s to support the e ementary schoo curr cu um

564 Library Materials for Adolescents. 3 F
Se ect g and us ng pr nt and nonpr nt mater a s to support the secondary schoo curr cu 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 span c and Span sh speak ng ch dren and ado es ents

571 Basic Reference Resources. 3 S
Prov d ng 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 med a centers. Pre requ s tes: L S 540 561, 563 or 564 571

584 School Library Internship. 1–6 F S
Prerequ s tes LIS 410 540 561 571 581 Concurrent enrol ment n LIS 581 s perm tted

Special Courses: L S 492 493 494 497, 498 499, 580 583, 584 590, 591, 592, 593, 594, 598, 599. See pages 43–44

Secondary Education

SECONDARY EDUCATION

SED 403 Principles, Curricula, and Methods. 4 F S
Advanced eve of deve opment of know edge and sk s of nstruct ona p ann ng and methods of teach ng and eva u at ng n the se ondary schoo Observat on part c pation requ red Corequ site SED 496

478 Student Teaching in the Secondary Schools. 3 12 F S
The pract ce of teach ng The re at onsh p of theory and pract ce n teach ng Prerequ s tes SED 403 spec a methods approva of Off ce of Profess ona F e d Exper ences

480 Special Methods of Teaching Social Studies. 3 F S
Interd sc p nary approaches product on and co ect on of mater a s

496 Field Experience. 0 F S
App cat on of course content n a secondary schoo set t ng. Emphas s on observat on pup management p an n ng and de ver ng nstruct on and assessment Corequ ite SED 403

501 Introduction to Effective Instruction. 6 F S SS
Introductory course for postbacca aureate cert f cat on pro gram n secondary education Emphas s upon develop ng bas c c assroom management nstruct on and eva uat on nc udes a f e d ass gnment of at east 120 hours Pre requ s te adm ss on to postbaccalaureate cert f cation program

522 Secondary School Curriculum Development. (3 F, S, SS
Soc a processes, ssues pr nc p es patterns and proce dures n curr cu um deve opment

533 Improving Instruction in Secondary Schools. 3) F S, SS
Ana yses of procedures methods, techn ques, and experi ments n teach ng n secondary schoo s Prerequ s tes SED 478, 578

566 Evaluating Secondary School Programs. (3 N
Deve opment of eva uat ve cr ter a for secondary schoo programs Prerequ s tes SED 478 578.

577 Issues and Trends in Secondary Education. 3 N
Ana yses of ay and profess ona reports prob ems and s sues n Amer can secondary educat on Prerequisites SED 478, 578

578 Student Teaching in the Secondary Schools. 3–12) F, S
The pract ce of teach ng The re at onsh p of theory and pract ce n teach ng Post Bacca aureate students on y Prerequ s tes comp et on of approved post bacca aureate program· a m n mum 2 50 GPA approva of Off ce of Pro fess ona F e d Exper ences

588 Human Relations in the Secondary Schools. 3) A
Prob ems n human re at ons nherent n the nteract on of pupi s, teachers adm n strators nonprofess ona 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 Prerequ s 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 nstruction Prerequ s te SED 533

Special Courses: SED 294 298 394 484, 492, 493, 494 497, 498 499, 580 583 584, 590, 591, 592, 593 594 598, 599, 680, 683 684 690, 691 692, 693, 780 783 784, 790, 791 792 799 See pages 43–44)

HUMANITIES EDUCATION

HUE 101 Ideas and Values in the Humanities. (4) F, S
Interre ation of art arch tecture, terature mus c, ph oso phy re g on and theatre and other perform ng arts in the modern world 2 lectures 2 d scuss on meetings per week *[Satisfies General Stud es Requirement. HU]*

102 Ideas and Values in the Humanities. (4) F S
See HUE 101 *[Sat sfies General Stud es Requirement· HU]*

118 Encountering the Arts. (3 F S
Introductory course emphas z ng persona contacts w th the f ne and perform ng arts. Attendance of a w de range of events, w th analys s and eva uat on

130 Introduction to Popular Culture. 3) F S
Reflections of American va ues n 20th century popu ar arts. Mus c, pr nt art, te ev sion, rad o mov es, the esthet cs of popu ar culture *[Satisf es General Stud es Require ment HU]*

401 Humanities in World Cultures. (3–6) N
A human t es study program of fore gn trave . F ne and perform ng arts of the var ous wor d cultures May be re peated for cred t Prerequ site· nstructor approva

480 Methods of Teaching the Humanities. 3) N
Methods of instruct on organ zat on discussion and pres entation of the courses n the nterdisc pl nary human t es. Prerequisites HUE 101, 102 or instructor approval

530 Popular Culture in America. (3 F
The uses of e sure t me from a h storical perspect ve. Ar eas of concern nc ude te evis on and rad o, f m and stage music art and paperbacks

585 Philosophical Foundations of the Humanities. (3) N
Issues n inte lectua trad t ons of the Western wor d that are bas c to the interd sc p inary humanit es Prerequ s te human ties educat on graduate stand ng or nstructor ap- prova .

Special Courses: HUE 294 394 497, 499, 500, 584, 590, 591, 592 594, 598 599 600, 680 684, 690 691, 692. (See pages 43–44)

SAFETY EDUCATION

SAE 466 Safety Education. (3 N
Safety educat on n home schoo , and p ace of emp oy ment

Special Courses: SAE 492 493 494, 497 498, 499, 580 583, 584 590 591 592, 593 594, 598 599 (See pages 43–44.)

ADULT EDUCATION

AED 500 Educational Research. (3 N
Introductory course n the ana ys s, product on and use of educationa research n the fie d.

510 Introduction to Adult Education. (3) N
H stor ca development core content and pr ncipa areas of adu t educat on

511 Program Development in Adult Education. (3) N
An andr gog ca approach to plann ng programs for adu ts Emphas s on agenc es

512 Characteristics of Adult Learners. (3) N
Character st cs of the adu t earner throughout the fe span

514 Instructing Adults. (1 A
Theory and practice for nstruct ng adu ts

522 Introduction to Educational Gerontology. (3) A
Educat ona cons derat ons and methods used n teaching o der adults from the perspectives of psycho ogy and edu cat ona gerontology

555 Adult Basic Developmental Education. (3) A
Roles 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 comparison of adult education programs and faci t es n selected countr es

Special Education

SPE 311 Orientation to Education of Exceptional Children. 3) F S SS
Inc udes g fted m' d y hand capped, severe y handicapped and the b ngua mu t cu tura exceptional ch ld. *[Satisfies General Stud es Requirement SB]*

312 Mental Retardation. 3 F, S, SS
Character st cs and assessment specific to menta retar dat on Term no ogy, deve opment, educat ona program m ng and therapeut c procedures w be emphas zed. Prerequ s te SPE 311

314 Introduction to Bilingual Multicultural Special Education. (3) F, S, SS
Theoret ca background and pract ca applicat on of gen era ssues regard ng the educat on of b l ngual mu t cu tu ra hand capped ch dren Prerequ site SPE 311.

336 Behavioral and Emotional Problems in Children. (3 F, S, SS
Character st cs and assessment spec fic to emot ona ly and behav ora y d sturbed ch dren Term no ogy deve opment, and educat ona programm ng emphas zed Pre requ s te: SPE 311

361 Introduction to Learning Disabilities. (3) F, S SS
Characterist cs and assessment spec f c to earn ng d s abi t es. Term no ogy, deve opment and educat ona pro- gramming emphas zed. 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 relat ons, teach ng the g fted and teach ng the se vere y hand capped Prerequ s te SPE 311.

412 Evaluating Exceptional Children. (3) F, S
Normat ve and criterion referenced d agnostic techn ques nc ud ng formative eva uat on. Emphas s upon app ca tion Pract cum required. Prerequ s tes EDP 301, 302, EED 404; SPE 311. Coreq u s tes: ECD 402; RDG 401 402 SPE 413 496.

413 Methods in Language, Reading, and Arithmetic for Exceptional Children. 3 F S
Methods techniques and materials for use in prescriptive teaching Practicum included Corequisites SPE 412 496

414 Methods and Strategies in Behavior Management. 3 F S
The organization and delivery of instruction including formative evaluation techniques Techniques of behavior management Practicum included Prerequisites SPE 412 413 ECD 402 RDG 401 402 Corequisites SPE 411 415 496

415 Social Behavior Problems of Exceptional Children. 3 F S
Analysis and intervention in social behavior problems of exceptional population Practicum included Prerequisites SPE 412 413, ECD 402 RDG 401 402 Corequisites SPE 411 414 496

455 Early Childhood and the Handicapped 3 S
Early childhood education as it applies to the handicapped child

478 Student Teaching in Special Education. 3 15 F S
Y grade only Prerequisites 1 approval of special education program coordinator 2 completion of SPE 311 414 415 and basic introductory course in area of student teaching. and 3 completion of other specified prerequisites

496 Field Experience. 0 F S
Application of course content in a special education setting Emphasis on observation pupil management planning and delivering instruction and assessment Corequisite SPE 412 413 or 411 414 415

511 The Exceptional Child 3 F, S, SS
Educational needs of exceptional children and adults Not recommended for students who have completed SPE 311

512 Individuals with Mental Retardation. 3 F SS
Etiology diagnosis and management of individuals with mental retardation Current trends in prevention, programming and teacher preparation Not recommended for students who have completed SPE 312

513 Teaching Students with Mental Retardation. 3 S SS
Specific methods, materials and curriculum for students with mild or moderate retardation Prerequisite SPE 312 or 512

514 Bilingual Multicultural Aspects of Special Education. 3 S
Theories and issues related to the education of bilingual and culturally diverse exceptional children

515 Methods for the Remediation of Learning Problems of Exceptional Children. 3 S SS
Methods and materials for remediating the basic academic problems of exceptional children Prerequisites SPE 511 a methods course in the teaching of reading and mathematics.

531 Behavior Management Approaches with Exceptional Children. 3 F SS
Behavior management approaches for classroom behavior of exceptional children Prerequisite SPE 511 or equivalent

536 Characteristics of Children with Behavioral Disorders. 3 F SS
Variables contributing to behavior patterns of behaviorally disordered children

538 Methods of Teaching Students with Behavioral Disorders. 3 S SS
Development of methods for managing the academic and social behavior of behaviorally disordered children and youth in educational settings Prerequisite SPE 336 or 536

551 Teaching Young Children with Special Needs. 3 S
Methods materials and curriculum for preschool and primary aged children with special needs Prerequisites SPE 455 511 or equivalent

552 Management of Individuals with Severe Handicaps. 3 F
Instruction and management of school aged and adult individuals with severe physical multiple handicaps Prerequisites SPE 511 or equivalent instructor approval

553 Developmental Functional Assessment. 3 F
Teacher focused developmental functional assessment of preschool and severely physically and multiply handicapped individuals Field experience required Prerequisites SPE 511 512 574 or equivalents

554 The Parent/School Partnership. 3 S
Includes knowledge and procedures for involvement and training of parents and caregivers of preschool and severely handicapped individuals Field experience required Prerequisites SPE 455 511 or equivalents

561 Characteristics Diagnosis of Learning Disabilities. 3 F SS
Theories related to learning disabilities including identification and characteristics

562 Methods of Teaching Students with Learning Disabilities. 3 S SS
Various methods and intervention strategies for remediating learning disabilities of children and youth Prerequisite SPE 361 or 561

563 Methods of Teaching Adolescents with Mild Handicaps. 3 A
Identification remediation and alternative curriculums for exceptional students at the secondary school level Social and academic variables

574 Educational Evaluation of Exceptional Children. 3 F SS
Design and statistical considerations of normative and criterion referenced tests Collection, recording and analysis of data from formative evaluation Prerequisites SPE 511 or equivalent; a methods course the teaching of reading and mathematics

575 Current Issues in the Education of Exceptional Children. 3 F SS
Mainstreaming noncategorical financing legal diagnostic labeling, legislative, and other critical and controversial issues related to the education of exceptional children

576 Precision Teaching. 3 S
Theory and techniques which apply to systems of formative evaluation Emphasis on precision teaching

577 Mainstreaming Methods. 3 S
Successful mainstreaming methods practical problem solving sessions related to teachers classroom needs, and individual contracts focusing on mainstreaming issues are addressed

578 Student Teaching in Special Education. 9–15 F S
Y" grade only Prerequisites completion of specified courses and approval by the special education program coordinator

579 Vocational Programs for Individuals with Mental Retardation. 3 F
Curr cu um p ann ng and methods of teach ng n secon dary schoo and post schoo programs Work eva uat on work study she tered emp oyment Prerequ site SPE 312 or 512

582 Classroom Research with Exceptional Children. 3 S
Introduct on to nterpret ng research Spec f c research techn ques w th pnmary emphas s on c assroom research nc uding app ied behav or ana ys s

585 Creativity: Research and Development. (3) S
Nature of creativity exp ored n terms of ph osophical un derp nnings, emp r ca ev dence human deve opment se f actua zat on and the eco ogy surround ng the crea t ve event

586 Advising the Gifted Child. 3 A
Focus on educat ona p ann ng and gu dance, soc a and emot ona development, and fam y problem so v ng re gard ng needs of g fted ch dren

587 Controversies in Educating the Gifted. (3 F
In depth analys s of major controversies n educating 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
G fted ch ldren s character st cs dent f cat on needs school and home env ronments, def n t ons, and m sun derstand ngs Research by Pressey, Stan ey, Terman and others

589 Methods in Teaching the Gifted. (3) S, SS
Methods in teach ng e ementary and secondary schoo g fted chi dren, nc uding nd v dua zed and computer as s sted 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 ca terature focused on the dent f cat on, evaluat on, and c assif cat on of ex cept ona ch dren

675 Causation of Handicapping Conditions. (3 F
Ana ys s of the phys o og ca and env ronmenta factors wh ch ead to hand capp ng cond t ons Emphasis g ven to the deve opment of pr mary prevent on

774 Characteristics of Exceptionality. 3) F
Ana ys s of the terature descnbing earn ng educat ona persona socia and cognitive characterist cs of excep t onal ch dren

775 Intervention Program in Special Education. 3) S
Ana ys s of the research terature focused on ntervent on programs for preschoo , schoo aged and ado escent/ adu t except onal persons

781 Research and Evaluation in Special Education. 3 S
Issues and prob ems n conduct ng research and or eva uat on programs nvo v ng except ona chi dren

Special Courses: SPE 294, 298, 394 484 492, 493, 494, 497 498, 499 580, 583 584 590, 591 592, 593 594, 598 599, 684 690, 691 692 780, 790 791, 792 799. See pages 43–44

Division of Educational Leadership and Policy Studies

(Farmer Building, ED 108, 965–6357)

PROFESSORS:
APPLETON (ED 107), FENSKE, GLASS, HUFF, HUNNICUTT, JOHNSTON, JORDAN METOS, NORTON RICHARDSON, SHAFER SMITH, R. STOUT WEBB

ASSOCIATE PROFESSORS:
BOGART, HARTWELL LEVAN, PAD LLA, T PPECONN C WALKER

ASSISTANT PROFESSOR:
CASANOVA

PROFESSORS EMERITI:
ASHE, BELOK BONTRAGER, DEMEKE, DRAKE, MENKE M. STOUT, WARREN, WOCHNER WOOTON

Program Areas

Educational Administration and Supervision
Higher Education
Educational Policy Studies

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 govern ment agencies. Graduates will be able to examine educational institutions, theories, and practices within broad economic, historical, political, so cial, 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 deci sions. Each strand brings together the methods and perspectives of the social sciences and the so cial and philosophical foundations of education.

* Applications are currently not being accepted for the Educational Specialist program.

Faculty within the division are involved in both databased and theoretical research. Qualitative 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 throughout the country

Educational Administration and Supervision

Member University Council for Educational Administration

EDA 501 Competency Performance in Educational Administration. 6 F S SS
The nature of educational administration, the concept of competency as it applies to educational administration

510 Introduction to Organization and Administration of American Public Schools. 3 F, S
Organizational structure and administration of public education are explored through the application of legal and ethical concepts and relevant information of the social sciences Crosslisted as SPF 510

511 School Law. 3 F S SS
Constitutional statutory and case law that relates to all school personnel pupils the school district and other governmental units Contracts dismissals tenure, retirement pupil liability of personnel and district, school district boundary changes, bonding

521 Evaluation of Teaching Performance. 3 F
In depth analysis of legal bases of teacher appraisal teacher competency, measurement of teacher performance and application of performance appraisal systems

524 Theory and Application of Educational Administration. 3 F SS
History and development of public school administration in the United States, current organizational patterns for public education at local intermediate state and national levels current theoretical positions in educational administration

525 Human Relations and Societal Factors in Education. 3 N
Interrelations between problems of educational administration and interdisciplinary social sciences Communications skills moral, authority and perception Concepts from political science economics and social psychology useful to the administrator Activities include computer simulation laboratory and off campus assignment

526 Instructional Supervision. 3 F S SS
Administering curriculum improvement, in service education evaluating and improving teaching competence administrative instructional responsibilities.

527 Managerial Functions in School Administration. 3 F
Relates to the work of the central district office staff and the school principalship Use of human resources educational planning and organization and management of time

538 Administration of the Community School. 3) N
Philosophy, history, organization and operation of the community centered school Introduction of the community education concept into a school system and making it operational.

544 Public School Finance. 3) F
Measures of ability efforts and educational need; capital outlay funding tax revenues, federal state, and local financing alternatives and major issues and trends in the financing of public education

548 Community Relations in Education. (3) N
Administrative factors of primary importance in developing community involvement in public schools Emphasis on theory and skills of school system and individual communication

549 Programming and Financing Community Education. 3) N
In depth investigation of components programs effective as a vehicle for community education in areas schools plans which help schools change models for funding community education Prerequisite EDA 538 or instructor approval

555 Educational Facility Planning. 3 F
School building needs educational planning for facilities responsibilities of architects duties of contractors, equipping and furnishing of school buildings

568 Role and Responsibility of Supervising Teacher. 3 N
Experiences and content for those planning to become supervisors of student teaching in teacher education programs In service training for those in student teaching

571 School Business Management. (3) F S SS
Purchasing budgeting accounting payroll management auditing financial reporting insurance, and administration of nonteaching personnel and services

573 School Personnel Administration. 3) S
Organization for personnel services, development of policy to govern selection orientation placement, remuneration transfers separations, and development of morale among instructional and noninstructional personnel.

576 The School Principalship. 3) F S SS
Problem and laboratory approaches used to provide application of administrative activities of elementary and secondary schools

634 Instructional Leadership. (3 N
Curricular practices and processes used by instructional leaders who plan, organize, and coordinate the professional activities in elementary and secondary schools. Prerequisite: EDA 526.

675 Politics of Education. 3) S
Social science theory and research are used to consider the political context of educational policy making

676 The School Superintendency. (3 S
Critical examination of the school superintendency and the primary functions of this educational position The duties responsibilities activities and problems of the school superintendent are included The unique leadership role of the school superintendent is examined Prerequisite instructor approval

679 Administration of Special Programs in Education. 3 N
For personnel administering special educational services, responsibilities of superintendents, principals, supervisors and directors for special education student personnel, audiovisual library science, and others

711 Administrative Leadership. 3 F
Emphas s on research n eadersh p appl cat on of re search f nd ngs to adm n strat ve and superv sory func t ons n educat ona endeavors Prerequ s tes. 30 semes ter hours educationa admin strat on adm ss on to doc tora program

722 Administration of Instructional Improvement. 3 S
Recent research re at ng to adm n strat ve and superv sory respons b t es for the mprovement of the educat ona p ogram. Effect ve processes by adm n strators, superv sors, consu tants and coord nators Prerequ s tes. 30 semester hours n educat ona adm n strat on· adm ss on to doctora program

733 Admin strative Management. (3 S
Recent research re at ng to schoo management Schoo f nance, aw bu d ngs transportat on food serv ces and supp y management Prerequ s tes 30 seme ter hours n educat ona adm n strat on adm ss on to doctora pro gram

Special Courses: EDA 494 498 580 583 584 590, 591 592 593 594 598, 599 680 683 684, 690 691 692 693, 700 780 783 784, 790 791, 792 799 See pages 43–44

Higher Education

HED 510 Introduction to Higher Education. 3 F S
An overv ew of Amer can h gher educat on nc ud ng ph lo 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 h gher educat on

516 Management Concepts in Higher Education. 1 N
ntroduct on to concepts of management theory and prac t ce

533 The Community-Junior College. 3 F, S
H story, funct ons organ zat on and current ssues Meets Ar zona commun ty co ege course requ rement for cert f cat on

611 Curriculum and Instruction. 3 S
Curr cu um deve opment nstruct ona organ zat on and mprovement of nstruct on n h gher educat on. Prerequ s te HED 510

644 Higher Education Finance and Budgeting. 3 S
F nanc a p ann ng and budget ng n h gher educat on nst tut ons ssues re ated to f nanc ng pub c and pr vate co eges and un vers t es Prerequ s te· HED 510

649 Law of Higher Education. 3 F
Ana ys s of ega ssues re ated to h gher educat on exami nat on of key court dec s ons Prerequ s te. HED 510

689 Administration. (3 F
Theory and pract ce of adm n strat on n h gher educat on nst tut ons. Prerequ s te HED 510

Special Courses: HED 580 583, 584, 590, 591, 592, 594, 683 684, 690 691, 692 693, 790 791, 792 799. See pages 43–44.

Educational Policy Studies

SPF 111 Explorat on of Education. 3 F, S
Educat on as an nstrument n the deve opment of the nd v dua and soc ety ts s gnif cance as an Amer can nst tut on *[Sat sf es Genera Stud es Requ rement SB]*

301 Culture and Schooling. 2 F S
For the profess ona teacher preparat on program an overv ew of the cu tura , soc a and po t ca m eus n wh ch forma schoo ng takes p ace n the Un ted States For educat on majors on y

333 Basic Issues in Education. 3 F, S
mportant contemporary soc oph osoph ca ssues educa tors 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 preparat on program The ana ys s and nterpretat on of c assr om behav or from perspect ves der ved from ph osophy, soc a sc ence and aw For educat on majors on y

411 History of American Education. 3 N
Soc al cond t ons deas, and nst tut ons wh ch formed American educat on *[Sat sf es Genera Stud es Requ re ment SB]*

457 Third-World Women. 3 F
Econom c soc opo t ca and demograph c context for un derstand ng the roles of th rd wor d women n hea th fam y work educat on and commun ty Prerequ s te 6 hours of soc a sc ence cred t or nstructor approva Cross sted as FAS 494, NUR 457 WST 457 *[Satisf es Genera Stud es Requ rements SB G]*

510 Introduction to Organization and Administration of American Public Schoo s. 3 F S
Organ zat ona structure and adm n strat n of pub c edu cat on are exp ored through the app cat on of ega and eth ca 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 at onsh p of schoo and soc ety and the ro e of edu cat on n soc a change

515 Education of Women. 3 A
Ana ys s of roles and status of women educat ona prac tices and a ternat ves

520 Cultural Pluralism and Education. 3 N
Ph osoph c ana ys s of the concept of cu tura p ura sm and ts soc a mp cat on for Amer ca educat on

533 Comparative Education in the Western World. 3 F
Educat ona pract es and trad t ons n the ead ng nat ons of Europe and the Sov et Un o

534 Education and Change: Developing Nations. 3 S
Educat on as econom c and soc opo t ca change agent n Afr ca, As a the M dd e East and Lat n Amer ca

543 Bilingual Education Models. 3 F
B ngua educat on programs n other countr es ana ys s of pol t ca soc a econom c and educat ona mp cat ons; pract ce n p ann ng b ngua educat on curr cu a.

544 Philosophical Foundations of Education. 3 F S, SS
Theories of educat on n anc ent med eva and modern class ca and contemporary ph osoph es

566 History of Education. 3 F S
Deve opment of educationa nst tut ons and ideas in the Western Wor d from anc ent times to the 20th century

711 Social and Historical Foundations of Education. 3 S SS
Prob ems of Amer can educat on and the r sociohistor ca context

Special Courses: SPF 294, 298 484, 492 493 494, 497 498, 499 580 583 584 590 591, 592 593 594 598, 599, 600 680 683 684 690 691, 692 693, 780 783 784 790, 791 792 799 See pages 43–44)

Division of Psychology in Education

(Payne Education B-301, 965–3384)

PROFESSORS:
HELMSTADTER (ED B 301A , BERLINER, BERNSTE N, CAB ANCA, CARROLL, GERLACH, GLASS GR NDER, GU NOUARD, HARR S, HORAN, KERR KRUS KULHAVY McWH RTER, NELSEN NOBLE, OKUN, ROB NSON SATTLER, SM TH, SNYDER STOCK, STROM, SULL VAN, VAN WAGENEN

ASSOCIATE PROFESSORS:
ARCIN EGA ASHER BARONA BETZ, BROWN BURKE, CHRIST ANSEN, COHN, CUMMINGS, GROSS, HACKETT, HALADYNA (ASU WEST CAMPUS), KINNIER, METHA MOORE SHELL

ASSISTANT PROFESSORS:
ELAWAR (ASU WEST CAMPUS), KLE N, HAAS (ASU WEST CAMPUS NOLEN (ASU WEST CAMPUS)

PROFESSORS EMERITI:
BENEDICT, BLACKHAM, BLAESSER, BOETTO, CHURCHILL, DAANE, DAV S, GAFFNEY, KIMLER MAZEN MILLER MOULTON, N CHOLS, R CHARDSON, STAFFORD, VERG S WREN

Program Areas

Counseling
Counseling Psychology
Educational Psychology
Educational 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 Educational Technology. Doctoral degrees are offered in the program majors of Counselor Education, Counseling Psychology (a program accredited by the American Psychological Association), Educational Psychology, and Educational 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, human development; and learning.

Students applying to any of these graduate programs in Counseling Psychology or Educational Psychology are required to submit scores on the Graduate Record Examination. The Miller Analogies Test may be substituted for the GRE in the areas of Educational Technology and Counselor Education. All degree programs require the successful completion of comprehensive examinations.

Additional information on graduate programs may be obtained directly from the division office. Please specify 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 earn ng

512 Introduction to the Helping Relationship. (3 F S, SS
ntroduct on to the sk' s used n the he p ng profess ons and an examinat on of the sett'ngs in wh ch they occur

522 Personality Development. 3 F, S, SS
Interact on of affect ve and cogn t ve factors n persona ty deve opment at d fferent age eve s Various persona ty theories examined

523 Psychological Tests. 3 F, S, SS
Standard zed tests n the study of the nd v dua with em phas s on test score nterpretat on in counsel ng.

534 Occupations and Careers. 3 F, S SS
The wor d of work career deve opment, educat on, and train ng for occupat ona entry and mob ty

545 Analysis of the Individual. 3 F, S SS
Theory and methods common y used n study ng the nd v dua . Observat ona methods d agnostic nterv ews, structured and sem structured methods for assessing persona ity Pre or corequ s te CED 523.

567 Group Procedures. 3) F S, SS
Socia psycholog ca factors determ n ng nteract on effec tiveness and mora e n sma groups Techn ques of observat on, assessment and leadersh p

577 Counseling. (3) F S SS
Pr nc p es and app cat on of counse ng w th part cu ar emphas s on counse ng theor es Prerequis tes CED 512, 523, 534 545; adm ss on to M C or schoo counse or cert'f cation program

655 Student Development Programs in Higher Education. 3 A
Emerging conceptua models of student development Overv'ew of student personne and student affa rs pro grams n commun ty co eges, four-year co eges and un vers t es Observation on campuses.

656 The American College Student. (3) A
Selected theor es of human development w th app cat on to academic soc opsycho og ca earn ng tasks of postsecondary env ronmenta nf uences, includ ng facu ty expectat ons campus subcu tures

672 Marriage and Family Counseling I. 3 F
ntroduct on to marr age and fam y counse ng theor es Emphasis s on a systems commun cat on mode ut z ng co-counse ng

673 Marriage and Family Counseling II. (3) S
Advanced ana ysis and app cat on of systems commun cat on counse ng Focus on marita and sexual counse ng Pract cum recommended

681 Supervised Practice. 3 F, S
Superv sed experiences n schoo s or commun ty agen c es Prerequ s tes CED 680; nstructor approva

Special Courses: CED 294 494 498, 499, 500, 580, 583 584, 590 591, 592 593, 594, 598 599, 600 680 683 684, 690, 691, 692 693. See pages 43–44.

Counseling Psychology

The doctoral program n Counsel ng Psychology is ac credited by the Amencan Psycholog cal Associat on

CPY 613 Child Counseling. (3 N
App cat ons of counse ng theory n work ng w th ch dren *in c nics and e ementary schoo s. Integrated pract cum* ava ab e w th perm ss on of nstructor Prerequisite CED 577 or equ va ent.

622 Group Counseling. 3 F S, SS
Theor es and methodo og es used in group counse ing Prerequis tes· CED 567 577 or equ va ents

634 Organizational Development and Planned Change. 3 S
Organ zational/ nd v dua dynam cs theory, ana ys s tech n ques and consu tation/ntervention strateg es used n or gan zat ona development Field consu tat on projects Prerequ s tes CED 567, 577 or equ va ents.

644 Psychology of Careers. (3 S
Advanced career counse 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 SS
Eth cal, egal, and professiona ssues of concern to pract t oners and researche-s funct on ng n a var ety of sett ngs

666 Comparative Theories of Personality. (3 F
Comparative ana ys s of persona ty theor es n re ation to counse ng practices Prerequ s te CED 577 or equ va lent

667 Patterns of Behavior Disorders. (3 A
Et o ogy and treatment of a variety of psycho og ca prob ems part cular y those represented n DSM I R. Pre requ s te CED 577 or equ va ent

670 Behavioral Counseling. 3 N
Theory procedures and app cat ons of behav or mod fi cat on and therapy n work ng with ch dren, parents, and adu t cl ents n schoo c n c, and nst tut ona sett ngs. D dact c nstruct on ana ys s of nd v dua and group prob ems, and d rected exper ences Prerequ s te CED 577 or equ va ent

671 Multicultural Counseling. 3 A
Prov des awareness of the nf uence of soc ocu tural var ab es on human deve opment and exp ores mp cat ons for counse ng m nor ty popu at ons Prerequ site CED 577 or equ va ent

672 Human Diversity: Social Psychological Perspectives. 3 A
mp cat ons for psycho og ca pract ce of soc a psycho og ca and b o og ca factors n the deve opment of be haviora d fferences

674 Counseling Women. 3 F
Exp ores women s deve opment and ts mp cations for counse ng Sex sm n menta health, sex d fferences n d agnos s and psychopathology and women s part cu ar treatment needs

675 Counseling Interventions in Stress Management. (3 S
Theory, procedures, and app cat on of stress manage ment techn ques nc ud ng b ofeedback med tation, re axat'on, autogen c therapy v sual zat on and magery Prerequ s tes CED 577 or equ va ent, nstructor approva .

677 Advanced Counseling. 3 N
Advanced top cs n counse ng theory, research and prac t ce Prerequ s te CED 577 or equ va ent

679 History and Systems of Psychology. 3 A
Exam nat on of the deve opment and d fferent at on of the d sc p ne of psycho ogy from ts or g ns in ph losophy to the present

701 Science and Practice of Counseling Psychology. 3 A
D rected exper ences nvo v ng the ntegrat on of theory, research and pract ce n counse ng psycho ogy Pre requ s te: nstructor approva

702 Research Methods in Counseling Psychology. 3) A
The app cat on of exper menta and or quas exper menta methods to theory construction and treatment eva uat on in counse ing psycho ogy Prerequ s te COE 502 or equ va ent

Special Courses: CPY 600 690, 691, 692, 693, 700 780, 783 784 790, 791 792 799 See pages 43–44.

Educational Psychology

The doctora program n schoo psycho ogy a concentra tion w th n the degree n Educat ona Psycho ogy is ac credited by the Amer can Psycho og ca Associat on

EDP 301 Learning and Motivation in Education. *2 F, S*
Us ng a case format earn ng and mot vation pr nc p es are app ed to educat on contexts Educat on majors on y.

302 Assessment and Evaluation in Education. 1 F S
Us ng a case format, assessment and eva uat on pr n c p es are app ed to educat on contexts Educat on majors on y.

303 Human Development 3 F S
Se ected aspects of ch d and ado escent deve opment w th fespan mp at ons Emphas s on poss b t es for n f uence by teachers and parents For majors on y Pre requ s te CDE 232 or equ va ent

310 Educational Psychology. 1–6 F, S SS
Human behav or n educat ona s t at ons presented through nstruct ona modu es Students may re e ro for cred t to a tota of 6 hours *Sat sf es Genera Stud es Re qu rement· 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 nte ectua soc a , and emot ona deve opment w th pract ca mp ca t ons for teachers grades 5–9

454 Introduction to Statistical Data Analys s in Education. 3 F S, SS
The ro e of tat st cs n research Tabu ar and graph c data presentat on Frequency d str but ons descr pt ve n dexes and ntroduct on to tat st a ference. Prerequ s te MAT 117 *[Sat sf es Genera Stud es Requ rement N2]*

510 Essentials of Classroom Learning. 3 F S, SS
Theoret ca and emp r ca foundat ons of earn ng n the c assroom m eu Cr t ca exposure to research and method n nstruct ona psyc o ogy

513 Child Development. 3 F S SS
In depth exam nat on of prob em and ach evements ex per enced by ch dre grow ng up n a techno og ca soc ety Emphas s on d scover ng the ch d s perspect ve.

514 Psycho ogy of the Adolescent. 3 F, S SS
Cogn t ve phys ca and soc a deve opment of ado es cents n contemporary soc ety Impact of fam y schoo and work p ace on ado e cent deve opment Prerequ s te. PGS 100 or EDP 310 or equ va ent

530 Theoretical Issues and Research in Human Development. 3 F
Psycho og a theo es, research, and methods re evant to human deve opment emphas z ng the re at ons between ear y deve opment and ater performance

532 Psychology of Exceptionality. 3 S
Genera psycho g ca theory and exper menta research re evant to except ona ty, emphas z ng mp cat ons for educat ona programs wh ch ecogn ze un que earner character st cs F e d work

534 Principles of Behavior Mod fication. 3 F
Pr nc p es of co d t on ng as app ed to behav or mod f ca t on current research on the exper me ta ana ys s of be hav or n educat ona psycho ogy

540 Theoretical Views of Learning. 3 F S
C ass ca and cogn t ve theor es of earn ng p us recent or entat ons. ustrat ve exper menta and rat ona founda t ons mp cat ons fo educat ona pract ce

542 The Psychology of Learning and Instruction. 3 S
Cr t ca rev ew and eva uat on of research on learn ng var ab es re evant to acqu s t on and retent on of nstruct ona mater a s Laboratory exper ence

543 Psychological Research on Life-Span Development. 3 S
Cr t ca rev ew and eva uat on of contemporary research on cogn t ve 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 read ng process, des gns and procedures for nvest gat ng nstruct ona and non n struct ona var ab es re ated to read ng ach evement

550 Introduction to Measurement in Education. 3 F S
Nature and types of educat ona measures Cr t qu ng and se ect ng appropr ate measur ng dev ces Construct ng measur ng dev ces. Soc a controversies abo t tests

551 Expository Writing and Research Heuristics. 3 F
Week y wr t ng pract ce mak ng use of heur st c concepts and expos tory pr nc p es The constr ct on of rat ona es for research prob ems Log c and coherence rhetor c Wr t ng sty e appropr ate to expos t on

552 Basic Statistica Analysis in Education. 3 F S SS
Nature of educat ona data and stat st ca ana ys s Fre quency d str but ons and descr pt ve ndexes ntroduct on to hypothes s test ng ANOVA and regress on

554 Intermediate Stat stical Data Analysis in Education. 3 F S SS
Mu t p e regress on, ANOVA by mu t ple regress on, re peated measures and other des gns, covar ance ana ys s and ntroduct on to MANOVA Prerequ s te COE 502 or EDP 552, or pass ng grade on a qua fy ng exam

555 Multivariate Procedures in Data Analysis II. 3 S
App cat on of mu t var ate ana ys s of var ance factor ana ys s and mu t var ate categor ca ana ys's Prerequ s te EDP 554 or pass ng score on qua fy ng exam

556 Data Processing Techn ques in Measurement and Research. 3 S
Advancement of stat st ca de gn and measurement sk s through deve opment of data process ng techn ques and usage of spec a programs and data pro ess ng programs Prerequ s te EDP 554

560 Individual Intellectual Assessment. 1–6 F S
Exper ence n adm n ster ng and nterpret ng nd vidua tests Theoret ca bas s for ab ty test ng, eth ca cons d erat ons and d agnost c use of test resu ts n t a enro ment three hour m n mum Laboratory exper ence Pre requ s tes EDP 454 and adm ss on to a program n pro fess ona psycho ogy or nstructor approva .

562 Schoo Psychology: Theory and Practice. 3 F
Deve opment and present status of schoo psycho ogy· overv ew of assessment and ntervent on strateg es and profess ona ssues

563 Interventions in School Psychology. 3 F
Exam nat on of case based consultat on and consu tat on research re evant to schoo psycho ogy pract ce F e d ex per ence Prerequ s te schoo psycho ogy program or n structor approva

566 Diagnosis of Learning Difficulties. 3 S
C n ca d agnos s of earn ng difficu t es emphas z ng spe c f c academ c prob ems Use and nterpretat on of d ag nost c nstruments n pract ca schoo s tuat ons Prerequ s tes EDP 560 562 or equ va ents nstructor approva

567 School Psychological Services to Minority Students. 3 S
H stor ca perspect ves and major ssues n psycho og ca and academ c assessme t and ntervent ons w th m nor ty schoo h dren

651 Methods and Practices of Qualitative Research. 3 S
Advanced course for students fam ar w th theory and ex tant work Top cs nc ude data co ect on ana ys s, report ng and an extens ve f e dwork project Prerequ s te COE 503

754 Advanced Multivariate Analysis. (3) S
Multivariate experimental design, multivariate multiple comparison procedures, confidence intervals, covariance structure analysis and analysis of qualitative data. Prerequisite: EDP 554.

Special Courses: EDP 394, 494, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 680, 683, 684, 690, 691, 692, 693, 700, 780, 783, 784, 790, 791, 792, 799. (See pages 43–44.)

Educational Technology

EDT 405 Competency-Based Instruction. (3) F, S, SS
Students develop instructional objectives, select learning activities and design assessment procedures for competency-based instructional programs.

501 Foundations of Educational Technology. (3) F
Introduction to instructional development. An examination of accomplishments and problems in the field.

502 Design and Development of Instruction. (3) F, S
Design, development, and formative evaluation of objectives-based instructional materials.

503 Research Techniques for Instructional Development. (3) S
Procedures for analyzing the effects of alternative instructional practices.

504 Educational Evaluation. (3) S
Evaluation procedures in instruction and training.

584 Educational Technology Internship. (1–6) F, S, SS
Prerequisites: EDT 501, 502; instructor approval. Pre- or corequisite: IME 521.

780 Advanced Instructional Development. (1–3) S
Conducting and documenting selected instructional development activities. Prerequisites: EDT 502; instructor approval.

792 Advanced Instructional Research. (3) F
Design and execution of instructional research on selected topics. Prerequisites: EDT 503; instructor approval.

Special Courses: EDT 494, 498, 499, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 680, 683, 684, 690, 691, 692, 693, 780, 783, 784, 790, 791, 792, 799. (See pages 43–44.)

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 resources, technology, computer science, or construction. Every effort is made to carry on well rounded, well integrated programs which will not only give the student proficiency for a professional career but also will develop character, judgment, ideals, breadth of view, and appropriate cultural attitudes. Students are taught to recognize the fact that their professional efforts will cause change and that they must accept responsibility for the social consequences of those efforts.

Organization

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

School of Agribusiness and Environmental Resources

- Agribusiness
- Environmental Resources in Agriculture

School of Construction and Technology

- Department of Construction
- Department of Aeronautical Technology
  - Aeronautical Engineering Technology
  - Aeronautical Management Technology
- Department of Electronics and Computer Technology
  - Electronics Engineering Technology
- Department of Industrial Technology
  - Industrial Technology
- Department of Manufacturing Technology
  - Manufacturing Engineering Technology

School of Engineering

- Department of Chemical, Bio and Materials Engineering
  - Bioengineering
  - Chemical Engineering
  - Materials Science and Engineering
- Department of Civil Engineering
  - Civil Engineering
- Department of Computer Science
  - Computer Science
  - Computer Systems Engineering
- Department of Electrical and Computer Engineering
  - Electrical Engineering
- Department of Industrial and Management Systems Engineering
  - Industrial Engineering
  - Manufacturing Engineering
- Department of Mechanical and Aerospace Engineering
  - Aerospace Engineering
  - Energy Systems Engineering
  - Mechanical Engineering
- Engineering Special Programs
  - Engineering Mechanics
  - Engineering Synergy
  - Microelectronics Manufacturing Engineering
  - Nuclear Sciences
  - Pre-medical Engineering
  - Systems Engineering
- Engineering Interdisciplinary Programs
  - Business and Pre-Law
  - Geological Engineering
- Analysis and Systems
- Engineering Core
- Society, Values and Technology

Research Centers. The college is committed to becoming one of national prominence in research. In addition, it is the policy of the college to encourage exceptional upper division undergraduate students, as well as graduate students, to participate with faculty members in research activity. Most faculty members are conducting research on government or industry sponsored programs. Research activities include computer science and applications, computer integrated manufacturing, materials science, solar energy, thermosciences, transportation systems, signal processing, computer design, turbine design, aerodynamics, structures, structural dynamics, rotor dynamics, CAD CAM, solid state electronic devices, power systems, telecommunications, environmental, nuclear radiation biomedical, arid land agriculture, semiconductor materials and devices, biotechnology, microelectronics 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

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

Admission

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

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 students have the proper course prerequisites.

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

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 *nonresident* 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 page 29

Students admitted to the university by the GED (General Education Development) are required to take either the ACT or the SAT in order to be admitted to a professional program.

Preprofessional Program. For admission as a *preprofessional* student to one of the departments or schools of the college, students not admissible to a professional program within the college but who are otherwise admissible to Arizona State University may be admitted as a 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 preprofessional program. Students admitted into this classification will follow the freshman sophomore sequence of courses as required by their chosen major. Courses will be selected with the

assistance of an academic advisor. After completing a minimum of 30 semester hours of required or approved elective courses *with a cumulative GPA equivalent to that required of transfer students and corresponding to the chosen major*, students may apply for admission to the professional program. *International students must also submit a* TOEFL *score equivalent to that required for admission to the professional programs.* Students who are admitted as preprofessional students will not be permitted to register for 300 or 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 College. Students transferring into or between departments within the college or other colleges within the university must meet both the cumulative GPA requirement and the *Catalog* requirements of the new 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. Students who contemplate transferring into this college from other institutions whether community colleges or four year institutions, should study carefully the pertinent sections under this college pertaining to their particular program and, if possible, consult an advisor in this college prior to enrolling in that other institution. This will assure a smooth transition at the time of transfer. Transfer students may request admission to either 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" will be 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 will be calculated using all credits from ASU and from other colleges and universities.

** For international students see pages 29 .

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

Student Recruitment and Minority Relations. The assistant director of Student Recruitment and Minority Relations is available to assist prospective and newly admitted students with a variety of services related to academic and personal concerns. Advisement and assistance is provided in the procurement of financial aid and scholarships, particularly for top scholars.

Degrees

Majors. Programs leading to the B S. and B.S.E. degrees are offered by the College of Eng neering and Applied Sciences, with majors in the following subjects. Each major is administered by the aca demic department indicated.

	MAJOR FIELD	DEGREE	DEPARTMENT
	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
	Industria 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 Mater als Engineering
	Chemical Engineering	(B.S.E)	Chemical, Bio and Materials Engineering
	Civil Engineering	(B S.E	Civil Engineering
	Computer Science	(B.S.)	Computer Science
	Computer Systems Engineering	(B.S.E.)	Computer Science
	Electrical Engineering	B.S.E.)	Electrical and Computer Engineering
	Energy Systems Engineering	(B.S.E.)	Mechanical and Aerospace Engineering
***	Engineering Business and Pre law	(B S.)	Engineering Interdisciplinary Studies
*	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 Programs Engineering
*	Manufacturing Engineering	(B.S.E.)	ndustrial and Management Systems Engineering
	Materials Science and Engineering	(B S.E	Chemical, Bio and Materia s Engineering
	Mechanica Engineering	(B.S.E.)	Mechanical and Aerospace Engineering
*	Microelectronics Manufacturing Engineering	(B.S.E.)	Electrical and Computer 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 Spec al Programs are adm nistered by the department show above.
** These options under the Engineering Special Programs are administered by the Office of the Dean
*** These options under the Engineering Interdisc plinary Programs are administered by the Office of the Dean

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

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

Graduate Degrees

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

Master of 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 MAT are required. (GMAT 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 thesis is required.

Computer Science. This graduate program provides an opportunity for qualified students holding a baccalaureate degree in Computer Science or related fields to complete advanced studies with emphasis on research. 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.) This particular 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, as well as 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 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 1 This option is designed primarily for full time students. The M.S.E. degree option 1 is awarded upon successful completion of graduate course work, engineering projects and research endeavor resulting in a thesis (engineering report or research project). A final oral examination is required in defense of the thesis.

Option 2 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 2 is awarded upon successful completion of graduate course work. A final written comprehensive examination of the graduate course work taken for the degree and over the respective undergraduate prerequisites is required. Students selecting this option should check with their respective department for 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 ENG 101 and ENG 102, or ENG 105, but any student whose written or spoken English in any course is unsatisfactory may be required to take additional course work by the appropriate director or department chair. See statement on English proficiency, page 39.

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

Entry into Upper-Division Courses. Prior to enrolling in courses at the 300 level and above, all students in good academic standing must secure the approval of their advisor. Students who are not in good academic standing must secure the approval of their advisor and 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 will not normally be 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 will be 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 which facilitate the student's growth in ability to perceive significant relationships, to make intelligent value judgments, to express ideas with ease, clarity, and good taste, and to develop the qualities of character and personality requisite for a successful career. The development of moral, ethical, and social concepts, along with a sound professional attitude, is required. It is expected that the attainment of an interest and pleasure in the above pursuits will be an inspiration to continued study. Courses are selected with the aid of an advisor to provide planned sequences and to place emphasis on the interrelationships that exist among fields of knowledge.

Specific attention should be directed to the university General Studies requirements shown on pages 50–53. 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 page 314 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 54–80. 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 will be considered unsatisfactory progress and will result in the student being placed on provisional (probationary) status:

1. A deficiency of 15 grade points.
2. A semester or summer session with grade point average less than or equal to 1.50.
3. Two successive semesters with grade point average 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.
5. Students not meeting department standards will be placed on probation at the department's discretion.

Students on probation will be subject to disqualification (1) if they do not attain a 2.25 semester GPA and if their cumulative GPA is below 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. They may not participate in early registration.

Disqualification. During a semester on provi sional status, a student who fails to meet the re tention standards specified above will be disqualified. Students may request a review of their disqualification status by contacting the associate di rector of Student Academic Services in the Engi neering 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 aca demically by this college are not eligible to enroll in summer session courses in this college until the disqualification period has expired and they have been reinstated.

Reinstatement. The College of Engineering and Applied Sciences will not accept an applica tion for reinstatement until the disqualified stu dent 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 reinstate ment. Proof of ability to do satisfactory college work in the chosen discipline will be required, for example, completing pertinent courses in the dis cipline at a community college with better than average grades.

Student Responsibilities

Course Prerequisites. It is expected that stu dents will consult the *Schedule of Classes* and the *Catalog* with regard to course prerequisites. Students who register for courses without the desig nated prerequisites may be withdrawn without the student's consent at any time prior to the final ex amination. 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 will be no monetary reimbursement to the student. However, such withdrawal will be con sidered to be unrestricted as described on page 46 and will not count against the number of re stricted 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 as sist students in various matters. This office coor dinates the work of the College Standards Com mittee and administers the probation, disqualifica tion, and readmission processes for those students who are academically deficient.

Academic Honors. Students completing bac calaureate degree requirements will receive the appropriate honors designations on their diplomas consistent with the requirements specified by the university.

Students in the College of Engineering and Applied Sciences are encouraged to seek informa tion 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 So ciety, (6) Tau Alpha Pi National Honor Society, Engineering Technologies, (7) Tau Beta Pi Na tional Engineering Honor Society, and (8) Upsi lon Pi Epsilon National Computer Science Honor Society. Information on any of these or ganizations may be obtained from the respective department or school offices, or Student Aca demic Services.

Honors Program. The College of Engineering and Applied Sciences participates in The Univer sity Honors College program. The honors pro gram affords superior undergraduates opportuni ties for enhanced educational experiences. Stu dents participating in the honors program can ma jor 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 Hon ors College can be found on pages 91 93 of this *Catalog*.

Scholarships. Academic scholarships for con tinuing students in this college may be applied for by contacting the Student Academic Services Of fice or the various department or school offices. Other scholarsh ps may be available through the university Student Financial Assistance Office.

Cooperative Education. The co-op program is a study work plan of education which alter

nates periods of full time academic study with pe riods of full time employment in business, ndus try, and government directly related to a student's major. Students who choose this program idea ly complete 12 months of employment and graduate with both the academic background and practical experience gained from working with profession als in their chosen field. Besides the invaluable practical experience gained, co op can bridge the gap between theory and practice, validate career goals, increase self-confidence and provide pro fessional contacts.

A student is eligible to apply upon completion of 45 or more hours of course work in a selected engineering or applied sciences major. Certain positions may require completion of specific courses. Transfer students are required to com plete at least 12 hours at ASU before beginning work. All student applicants must have a mini mum cumulative grade point average of 2.50 and not be on academic probation.

To maintain continuous full time student status in the university, co op students must be enrolled in ASE 399, Co-op Work Experience, during each work session. The course is required to ob tain the co op education certificate upon gradu ation, but does not count toward graduation re quirements. Interested students should contact the coordinator of cooperative education in the Engi neering Center G Wing.

ASU 3+2 Programs. Students desiring to earn a baccalaureate degree from Grand Canyon College (Phoenix, Arizona) in Mathematics, Chemistry, or Physics, or from Southwestern Uni versity (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 College may also select a degree program in Construction. Such students will complete the first three years of study at their re spective 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 de gree requirements have been met, the baccalaure ate degree will be awarded by the student's re spective college or university and the appropr ate engineering or construction baccalaureate degree will be 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 College
3300 West Camelback Road
Phoenix, AZ 85017 1097

or

Provost and Dean of
The Brown College of Arts and Sciences
Southwestern University
Georgetown, TX 78626

or

Office of the Dean
College of Engineering and Applied Sciences
Arizona State University
Tempe, AZ 85287 5506

The Department of Construction also has 2+2 agreements with several selected out of state col- leges and universities For a listing and addi- tional information, contact the department chair.

ROTC Students. Students pursuing a commis sion through either the Air Force or Army ROTC programs will be required to take from 12 to 20 hours in the Department of Aerospace Studies or Department of Military Science To preclude ex cessive overloads, these students should plan on at east one additional semester to complete de gree requirements. ROTC students must also meet all other degree requirements of this Col lege.

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 A broad term describing the complete array of courses included in the study leading to a degree. Examples: engineering, technology, construction, agribusiness and envi ronmental resources

Major A specialized group of courses con tained within the program of study. Example: pro gram of study—engineering, major—Civil Engi neering. Example: program of study technol ogy; major Industrial Technology

Area of Emphasis (technical electives), Option or Concentration. 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 techni cal 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 counse of an advi sor Example: major Mechanical Engineering; area of emphasis thermosciences.

School of Agribusiness and Environmental Resources

, Director

PROFESSORS:
AG 281 BRADY
CHALQUEST GORDON, ST LES
ASSOCIATE PROFESSORS:
BROCK, EDWARDS, MADDY RACCACH,
SEPERICH, WHYSONG, WOOLVERTON
ASSISTANT PROFESSORS:
D AZ LOWE, W M LLER
PROFESSORS EMERITI:
BARRETT JUDD, LYTLE V M LLER MOODY
RASMUSSEN R CHARDSON,
ROBINSON, TAYSOM

Purpose

The School of Agr business and Env ironmental Resources provides academic programs directed toward agribusiness and the env ironmental as pects of agriculture Agribusiness is a dynamic industry which provides employment to about 23 percent of the U.S. abor force. Environmental resources emphasizes both the conserv ation of w ildland resources for the needs of future genera tions 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 w ide range of ob opportunities which exist in the agricultura industries and gov ernmental agencies. The academic programs are especially designed to meet the needs of the urban student who has had little or no previous agricul ture experience. An interest in plants, animals, or foods can be the starting point for career deve op ment in agricultural industries or natural resource management. The undergraduate programs also provide the necessary training for students prepar ing to enter graduate degree programs.

Organization

The academic programs are organized into two separate majors: Agribusiness and Environmental Resources in Agriculture. Options for specializa tion within these majors are as follows:

Agribusiness

C nc ntrati n	*Opti r*
Agribusiness ...	... Genera Agribusiness
	Inter natic nal Agribusiness
	Fi od ndustry

Pre Veterinary Medic ne

Environmental Resources in Agriculture

C n entrati r	*Opt r*
Natura Resource Management	.. Range Ec logy
	Wi dlife Hab tat Management

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

The NEW CAST Center carries out research and development leading to commercialization of bio techn ologies important to agribusiness As an in terdisciplinary center it draws on collaborators from the entire Arizona State U niversity faculty and both private firms and public agencies While it specia izes in new crops and products derived therefrom, it will act as a resource and manage programs develop ng new technologies and in ventions not directly related to agriculture

Degrees

Bachelor of Science (B.S.). The Schoo of Agri business and Environmental Resources offers the Bachelor of Science degree in Agribusiness and in Env ironmental Resources in Agricu ture.

Master of Science (M.S.). The School of Agri business and Env ironmental Resources offers the Master of Science degree in Agribusiness and in Env ironmental 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 de gree. Additional details for this degree are given in the *Graduate Catalog*.

Admission

See pages 28 34, 48 50, 269 270, and 274–275 for information regarding requirements for admis sion, transfer, retention, disqualification, and rein statement.

In addition, students who are beginning their initial college work in the School of Agribusiness and Environmenta Resources should present sec ondary school units in accordance with the mini mum university requirements. There are no sec ondary 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 grade point average of 2.00 is required. Forty percent of the semester hours required for graduation must be upper division. Also see special graduation requirements under the pre-veterinary medicine concentration described on page 280.

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 then 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 which affect agribusiness. Because of the United States' role in supplying commodity and food products to the world markets, international aspects of agribusiness development and trade are emphasized.

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, together with the option courses and elective courses to complete the graduation requirement of 126 semester hours. Prior to 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 or ENG 105 Advanced First Year Composition	6 (3)
General Studies	
*Literary 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	
MAT 117 College Algebra	3
ERA 350 Applied Quantitative Methods	3
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
† ECN 111 Macroeconomic Principles	3
Natural Sciences	
(8 semester hours minimum)	
† CHM 101 Introductory Chemistry	4
At least one additional course satisfying the Natural Sciences requirement*	4
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 54-80 for acceptable courses in these categories.

† Required for graduation.

Agribusiness and Environmental Resources in Agriculture Core

All students pursuing a B.S. degree in the school will complete the following general core courses:

			Semester Hour
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:

			Semester Hour
BIO	181, 182	General Biology	8
		or AGB 130 Plant Science 3 and AGB 150 Animal Science 3	
CHM	0	Introductory Chemistry	4
		or CHM 113 General Chemistry (4) and CHM 115 General Chemistry with Qualitative Analysis 5)	
* ECN	111	Macroeconomic Principles	3
* ERA	351	Applied Quantitative Methods	3
* MAT	117	College Algebra	3
		or MAT 210 Brief Calculus 3	
		A minimum of one computer course	3
		(Acceptable list: School of Agribusiness and Environmental Resources Office)	
		Total	24–27

* These courses are a part of the General Studies requirements.

Agribusiness

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

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

			Semester Hour
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

Agribusiness, as a 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 will 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 which exist in agribusiness. Many start career paths which will 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 which 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 which is extended to the global aspects of agriculture. Graduates in this area are particularly qualified to aid in the development of the world's agricultural potential to provide food and fiber to meet the expanding populations. Jobs exist in commercial industries and in government agencies United States, international and foreign. A language capability in addition to English is recommended.

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.

Pre-veterinary medicine is primarily designed to meet the entrance requirements of professional veterinary medical schools in the United States and Canada. Selection of this area will permit students to complete the pre-veterinary requirements for entrance to professional veterinary school. The curriculum permits the student to obtain some course work in agribusiness, especially as it relates to professional practice and industry. This background also provides an important alternative for the student who does not actually enter veterinary school. Completion of all requirements for a 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 will be eligible to receive the B.S. degree after the Registrar's Office receives a recommendation from the dean of the professional school and a transcript of credit indicating the student has completed a total of 126 semester hours with a cumulative grade point average 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.

Typical Curriculum for Agribusiness

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 Elective Courses			9
Humanities and Fine Arts Courses[1]			6
General Elective Courses			6
Total			33

Third Year

AGB	312	Agricultural 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

See pages 50–80 for requirements and approved list.

Environmental Resources in Agriculture

Natural resource management and conservation is the primary emphasis of the Environmental Resources in Agriculture degree. 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, as a 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 comprise 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 Behaviora Sciences Courses[1]			8
* Option Requirements			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			14
		Total	33

Fourth Year

ERA	490	Recent Advances in Environmental Resources	1
General Elective Courses			4
* Option Requirements			26
		Total	31

* *Option requirements as listed for individual programs*

See pages 50–80 for requirements and approved list.

AGRIBUSINESS

AGB 101 Food Chain. 2 F
Dependence of the quality quantity and cost of national food supplies on technology, marketing and world agriculture policies *[Satisfies General Studies Requirement G]*

130 Plant Science. 3 S
Plant growth and development in the rural and urban environment. Lecture, ab

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: AGB 150, or 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 trials 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 product on and management pr nc p es and the r ap p cat on to crop growth and deve opment Prerequ s tes AGB 130; or B O 181 182

312 Agricultural Marketing. 3 F
Market ng arrangements for agr cu tura products Pre requ s te AGB 342

332 Agribusiness Finance. 3 S
Agr bus ness nvestment management and f nanc a nst tut ons that serve agr cu ture Prerequ s tes AGB 342, ECN 111

335 Establishing an Agribusiness. 3 F
Estabi sh ng entrepreneursh p n agr cu ture nc ud ng e ga status f nanc ng p ann ng market ng and manage ment. Prerequ s te. un or stand ng

342 Agribusiness Management I. 4 S
Pr nc p es of management p ann ng organ z ng, ntegrat ng measur ng, and deve op ng peop e n agr bus ness or gan zat ons Lecture computer ab.

353 Wildlife and Domestic Animal Nutrition. 3 S
Feedstuffs feed ng standards, and the r app cat on n meet ng nutr t ona needs of an ma s produc ng food and f ber

364 Agribusiness Technology. 3) S
Techno og es of the three sectors of agr bus ness nput produ t on and commod ty process ng food manufactur ng food d str but on

365 Food Technology Laboratory. 1 F
Exper ments and procedures n process ng and packag ng foods Lab Co equ s te AGB 364

368 Food Processing. (3 F
An ntroduct on to processed food qua ty assurance sta t st ca samp ng and nspect on procedures Prerequ s tes. AGB 364 ERA 350

369 Food Analysis. 3 F
Process ng contro and sc ent f c nstrumentat on used n food qual ty assurance aborator es Lecture ab Pre requ s tes CHM 225 226

370 Companion Animals to Man. 3 N
Se ect on breed ng, hea th and care of pets. nc udes the r soc a and econom c mpact on urban v ng.

371 Pet Nutrition. 3 N
Rev ew and app cat on of nutr t on pr nc p es n feed ng man s compan on an ma s Prerequ s te B O 100 or CHM 101

390 Agricultural Accounting. 3 N
Bas c account ng app cat ons common y used by agr cu tura 'ndustr es nc ud ng tax and management nforma t on systems

402 Agricultural Cooperatives. 3 N
Organ zat on operat on and management of agr cu tura cooperat ves

404 Sales and Merchandising in Agribusiness. 3 N
The pr nc p es and techn ques of se ng and commod ty merchand s ng n the agr cu tura ndustr es Lecture ab

412 Agricultural Commodities. (3 F
Trad ng on futures markets Emphas s on the hedg ng practices w th gra ns and meats. Prerequ s te AGB 312 or one market ng or f nance course

413 Financial Commodities. 3 S
Trad ng on futures markets Emphas s on the hedg ng pract ces w th f nanc a and currency nstruments Pre requ s te: AGB 332 or FIN 300

414 Advanced Commodity Trading. 3 N
Advanced ana ys s of t ad ng techn ques w th emphas s on hedg ng n the futures markets Prerequ s te AGB 412 or 413

425 Food Safety. 3 S
Food hazards prevent on detect on assessment and neutra zat on Regu atory agency enf r ement programs are emphas zed Prerequ s te AGB 364

426 Food Chemistry. 4 S
The b ochem ca and chem ca nteract ons that cc r n raw and processed f ods Lecture ab P erequ s tes CHM 115 231

428 Comparative Nutrition. 3 N
Effects of n tr t o on an ma systems and metabo c func t ons Prerequ s tes AGB 305, CHM 231

433 Diseases of Domestic Anima s. 3 N
Contro and prevent on of nfe t o s and on nfect ous d s eases of domest c an ma s P erequ s te MIC 201 or 210

435 Animal Physiology I. 4 F
Contro and funct on of the nervous muscu ar ard ovas cu ar resp ratory and rena system of domest c an ma s Lectu e ab Cross sted as BME 435 Prerequ s tes BIO 181 CHM 113

439 Veterinary Practices. 3 F S
Observat on of and part c pat on n veter nary med c ne and surgery superv sed by oca veter nar ans Prerequ s te advanced pre veter nary student

440 Food Marketing. 3 S
Food process ng packag ng d str but on market re search new fo d research and deve opment and soc a mp cat ons Prerequ te AGB 312

443 Agribusiness Management II. 3 F
Pr nc p es of huma resource management w th emphas s on the spec a prob ems of agr bus ness systems Pre requ s te AGB 342

444 Agribusiness Analysis. 3 S
Ana ys s of agr bus ness f rm dec s ons n the eco og ca econom c soc a and po t ca env ronments Spec a em phas s on eth ca ssues urround ng food product on and consumpt on Prerequ s tes AGB 312 332 or equ va ents

450 International Agricultural Development. 3 F
Trans t on of develop ng countr es from subs ste ce to modern agr cu ture Techno ogy transfer and food m provement programs are emphas zed Prerequ s te AGB 312. *[Sat sf es Genera Stud es Requ rements SB, G]*

452 World Food Dynamics. 3 N
Trans t on and deve opment of raw agr cu tura c mmod t es nto nutr t ona food products Emphas s g ven to food expans on deve op ng countr es Prerequ s te AGB 302

453 World Agricultural Resources. 3 S
Wor d product o and consumpt on of agr cu tura prod ucts nternat ona re at onsh ps and agenc es concer ed w th wor d agr cu tura deve opment prob ems. Prerequ s te AGB 101

454 Internationa Agricultural Trade. 3 N
D mens ons ocat ons, m x methods, a d changes of nternat ona trade n agr cu tura products Prerequ s te AGB 312.

455 Agricultural Marketing Channels. 3 S
Operat ona tages of agr cu tura commod t es n norma d str but on systems and mp ementat on of market ng strateg es Prerequ s te AGB 312

458 International Agribusiness. 3) N
dent f cat on and ana ys s of methods prob ems and fu ture of internat ona agr business operations Emphas zes spec al prob ems assoc ated with nternat ona agr busi ness systems Prerequ s te: AGB 312 *[Sat sf es General Stud es Requ rements· SB, G]*

460 Agribusiness Management Systems. 4 S
The deve opment and use of dec s on support systems for agr bus ness management and market ng Lecture, ab Prerequ s tes AGB 332 342 ERA 350.

474 Agribusiness Policy and Government Regulations. (3 F
The development and mp ementat on of government food, drug pest c de, and farm po c es and regu at ons that affect the management of agr business. Prerequ s tes· AGB 312 342, 412

490 Recent Advances in Agribusiness. 1 F S
Reports and discussions of current top cs and prob ems assoc ated w th agr bus ness. May be repeated for cred t

505 Commodity Analysis. 3 N
Ana ys s of commodity markets Prerequ s te: 1 year of econom cs or market ng.

508 Advanced Agricultural Marketing. 3 F
Theory and a a ys s of market ng farm commod t es r sks and effect of future trading on cash pr ces

509 Advanced Agribusiness Marketing Channels. 3 S
Ana ys s of agr business market channe systems Formu at on of market ng strateg es

510 Advanced Agribusiness Management I. (3) F
Assessment and current problems n manag ng human and f nanc al resources n agribus ness. Case stud es and ana ysis of spec al agribus ness prob ems Prerequ s te. AGB 342

511 Advanced Agribusiness Management II. 3 S
Ana ys s of organ zat on behav or change and resource requ rements w thin agribusiness systems Prerequ s te AGB 342

512 Food Industry Management. (3 S
Operat ons and management of food process ng factories food distr but on centers and reta food hand ng f rms

516 International Agricultural Techniques. 3 N
Coord nation of product on and market ng techn ques to consumpt on object ves w th agr cu tural products n for eign countr es

518 World Agricultural Development. 3 N
Factors that nf uence product on, process ng, and market ing of agr cu tural products n deve op ng countries

520 Advanced Agribusiness Analysis I. 4 S
Vert ca ntegration and d fferent at on n food and agr cu tura ndustr es Lecture, rec tat on. Prerequ s tes AGB 508 510 532· or equ va ents

521 Agribusiness Coordination. 4 N
Organ zat ona a ternat ves for agr bus ness w th emphas s on cooperat ves and trading compan es. Lecture, rec ta t on Prerequisites AGB 508, 510 532, or equ va ents.

525 Advanced Agribusiness Management Systems. (3 N
Deve opment and use of dec s on s pport systems for ag ribus ness management dec s on making Prerequ s tes AGB 510, 532.

527 Agribusiness Research Methods. 3 N
The use of mode bu d ng, hypothes s test ng and emp ri cal ana ysis n so v ng agribus ness prob ems.

530 Advanced Agribusiness Policy. 3) N
Po cy mak ng h story, structure and process Prerequ s te AGB 508

532 Advanced Agribusiness Finance. (3) F
F nanc a management of agr bus ness f rms, agr business f nanc a ana ys s nvestment ana ys s agr cultura r sk management and ntroduct on to agricu tura financ a n termed ar es

535 Advanced Food Science. (3 N
Chem ca and phys ca nature of processed foods Em phas s on food product development Prerequ s te· AGB 364

536 Advanced Food Quality Instrumentation. 3 S
Food ana ys s us ng sens t ve laboratory nstrumentat on and methodo ogy Lectures lab Prerequ s tes AGB 369 426

Special Courses: AGB 484 492 493 494 498 499 500 580 584, 590 591, 592 593, 594 598, 599 See pages 43–44

ENVIRONMENTAL RESOURCES IN AGRICULTURE

ERA 301 Arboriculture. 3 S
The estab shment care and ma ntenance of ornamental trees and shrubs. Prerequ s te AGB 130

325 Soils. 3) F
Fundamenta propert es of so s and the r relat on to plant growth and the nutr t on of man and an ma s Re at on of so s to env ronmenta qua ty Prerequ s te CHM 101 or 113 or equ va ent

326 Soils Laboratory. 1 F
Se ected exerc ses to broaden the background and under stand ng of bas c so pr nc ples Lab. Corequ s te ERA 325

332 Agricultural Chemicals. 3 N
Compos t on, propert es and use of agricu tural commer c a fert zers and pest c des and the r effects on so , a r and water qua ty

333 Water Resources Management. 3 S
Sources, the r development and conservation n ar d re g ons for agr cu tura natura resources and urban uses. Prerequ s te. CHM 101 or 113

346 Natural Resource Conservation. (3 S
A g oba perspect ve on the conservat on of w dland and agr cu tura resources Deve opment/resource conserva t on nterre at onsh ps *[Satisfies Genera Studies Re qu rement· G]*

350 Applied Quantitative Methods. 3 F
Stat st ca methods w th app cat ons n natural resource management and the agr cultura sciences Use of d g ta computer Prerequ s te MAT 117 or equ va ent. *[Satisfies General Stud es Requirement. N2]*

360 Range Ecosystem Management. (4 F
The nterre at ons of vegetat on so is and graz ng an ma s Eva uat on and s mu at on of graz ng an ma mpact Lecture, rec tat on Prerequ s tes BIO 320 ERA 346; or equ va ents

365 Watershed Management. (3) N
Hydro og c, phys ca b o og ca and ecolog ca princ p es appl ed to watershed management Impact of ecosystem man pu at ons on water y e d and qua ty 1 weekend fie d trip. Prerequ s tes. ERA 325 346

370 Forest Silvics and Management. 3) N
S v cu tura pr nc p es under ying the pract ce of forestry Growth of trees and stands, forest s te eva uat on ma n pu at on of stand to d rect success on and forest meas urements Lecture ab Prerequ s tes B O 320 ERA 346 350

380 Landscape Plants. 3 F
P ant cu ture and use n urban agr cu ture Prerequ s te AGB 130

381 Plant Propagation. 3 S
Pr nc p es and sk s n propagat ng andscape trees and shrubs by sem na and vegetat ve means nc ud ng fru t p ants Lecture, ab Prerequ s tes AGB 13 B O 182

382 Turf Management. 3 N
Se ect on, estab shment and ma ntenance of turf grasse for awn park and sports areas Lecture ab Prerequ s te AGB 130

386 Indoor Plants. 3 S
Se ect on and care of conta ner grown house p ants

402 Range Habitat Inventory. 4 S
Vegetat on samp ng and nventory as re ated to an ma hab tat re at ons Lecture ab 1 weekend f e d tr p Pre requ s tes ERA 350 360

407 Range Plants and Habitats. 4 F
The d str but on eco og ca character st cs dent f cat on of key p ants, and va ues of hab tats on western range ands Laboratory emphas s on grass dent f cat on Lecture ab Prerequ s te BOT 370 or equ va ent.

410 Wildlife Habitat Relations. 3 N
Interact ons among an ma popu at ons and the r hab tat Systems s mu at on of popu at on dynam cs as nf uenced by compet t on and management strateg es Lecture 1 weekend fie d tr p Prerequ s te ERA 360

420 Range Habitat Improvements. 3 S
Current pract ces n brush and weed contro , revegetat o burn ng water deve opments fenc ng and graz ng as too s for range mprovement Lecture, 1 weekend f e d tr p Prerequ s te: ERA 360.

425 Soil Classificat'on and Management. 3) N
Pr nc p es of so genes s, morpho ogy and c ass f cat on Management and conservat on pract ces w l be pre sented. Prerequ s te. ERA 325.

430 Landscaping Principles. 3 N
P ann ng and p ant ng for max mum beauty and ut ty, n c ud ng energy conservat on Prerequ s te ERA 380 or equ va ent.

438 Greenhouse Nursery Management 3 F
Operat on and management of greenhouses and nurser es Prerequ s tes AGB 130 ERA 325 380 381

440 Crop Growth and Development. 3 F
Env ronmenta factors affect ng the adaptat on, d str bu t on growth and deve opment of crops Prerequ s tes: BIO 182 CHM 231 ERA 381

446 Soil Fertility. 3 S
Ab ty of so s to reta n and supp y p ant nutr ents Reac t ons of fert zers n so s Prerequ s tes ERA 325, 326

448 Soil Ecology. 3 N
So s v ewed n an ecosystem context so p ant re at on sh ps nutr ent budgets, and ab ot c factors that nf uence so processes Prerequ s tes: B O 320· ERA 325 326 or nstructor approva

450 Horticultural Plant Problems. 3 F
dent f cat on and contro of b ot c and ab ot c factors wh ch cause common prob ems to hort cu tura p ants Prerequ s tes ZOL 354, a p ant patho ogy course

452 Soil, Water and Irrigation. 3 N
Water measurement conveyance and conservat on w th emphas s on crop product on and so p ant water re a t ons Prerequ s te ERA 325

460 Applied Systems Ecology. 3 N
The systems approach app ed to ana ys s and manage ment of natura resource ecosystems. Use of s mu at on mode s. Prerequ s tes ERA 350 or equ va ent; one course n eco ogy

470 Land Reclamation. 3 N
Prob ems of reestab sh ng vegetat on on d sturbed s tes Spec a revegetat on techn ques, surface mod f cat ons and government regu at ons 1 weekend f e d tr p Pre requ s tes: ERA 446, 407 420 448 or nstructor approva

475 Wildlife and Range Animal Management. 3 N
Pr nc ples and techn ques for management of domest c and nondomest c an ma s us ng range and ecosystems Emphas s on pract ca app cat ons of management Weekend f e d tr ps Prerequ s te nstructor approva

480 Natural Resource Planning. 3 N
Pr nc p es and techn ques of p an ng for management and c nservat on of natura ecosystems Use of opt m za t on mode s and dec s on theory Preparat on of manage ment p an Lectures 1 weekend f e d tr p. Prerequ s tes ERA 402 sen or stand ng

490 Recent Advances in Environmental Resources. 1 N
Current terature and s gn f cant deve opments nvo v ng env ronmenta resources May be repeated for cred t

540 Plant Responses to Environmental Stresses. 3 N
React on of p ants to env ronmenta stresses, herb vores f re pest c des mechan ca treatments aer a po utants and so amendments 1 weekend f e d tr p Prerequ s tes BOT 360; ERA 420 or nstructor approva

548 Plants, Soils and Environmental Qua ity. 3 N
Effects of a r qua ty on p ants and so s and the r ro e n remov ng contam ants from the atmosphere Prerequ s te ERA 325

550 Vegetation Dynamics. 3 N
Success on concept and its use n s te eva uat on Hab tat type concept Herb vore as an eco og ca process Pre requ s tes BOT 420 ERA 364 or nstructor approva .

560 Systems Ecology. 3 N
Quant tat ve descr pt o and mathematica mode ng of ecosystem structure and funct on. Techn ques for model construct on and s mu at on Lecture, ab Prerequ s tes 6 hours n eco og ca stud es computer programm ng ERA 350 or equ va ent

581 Plant Tissue and Cell Culture. 3 F
Ascept c c ona propagat on of p ants v a so ated ce s t ssues and organs Lectures ab Prerequ s tes. BOT 360, ERA 381 or 440

Special Courses: ERA 484 492 493 494 498 499 500 580 584, 590 591 592, 593 594 598, 599 See pages 43–44

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 the industrial, commercial, educational, and government activity.

The Construction program and its options provide a well integrated program which will give the student proficiency for a professional construction career. In addition to technical skills, it develops ideals, judgment, character and breadth of view important to success in the industry.

The technology programs provide the opportunity to earn a degree in a technological field which 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. A student will be educated to render practical decisions with safety and economy in mind; to install and operate technical systems; develop or improve a product; to 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 268 Each curriculum includes some elective courses which 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, or 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, Master of Technology M.Tech.) is offered by each of the four departments in technology in accordance with the details given on page 273 See the *Graduate Catalog* for complete details.

Admission

See pages 28 34, 48 50, 269 270, 274–275 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 3 / units in mathematics, including geometry, advanced algebra, and trigonometry. Students having omissions or deficiencies in subject matter preparation will be required to complete additional university credit course work which will not be applied toward a Construction degree These may include MAT 118 Precalculus Algebra and Trigonometry and PHY 101 Introduction to Physics. Vocational and craft oriented courses taught at community colleges will not be 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, II, and geometry). High school chemistry and physics are recommended Students without the required math background must take appropriate deficiency courses prior to entry, or immediately upon enrollment at ASU Associate degree transfer students are expected to have completed college algebra and trigonometry

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 will be 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 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 will be 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 College and South western University. See page 276 for details

Cooperative Education. The co op program includes one or more periods of employment within the degree curriculum, the employment necessarily relating to a student's major. A student who chooses this program will graduate with both the academic background and practical experience gained from working with professionals in his or her chosen field.

Complete information on eligibility requirements are given on pages 275 276 under special programs—cooperative education.

Construction

PROFESSOR:
ROUNDS
ASSOCIATE PROFESSORS:
BADGER (COB 268), BURTON, MULL GAN, WEBER
ASSISTANT PROFESSOR:
SHING
PROFESSORS EMERITI:
HASTINGS, M CHELS, PETERMAN SELLECK, WARD WOOD NG

Purpose. Construction careers are so broadly diversified that no single curriculum will prepare 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 which distinguish modern day constructors, advisory groups representing leading associations of contractors and builders provide counsel in curriculum development Construction has a common core of engineering science, management and behavioral courses on which students may build defined 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
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 shall complete the following basic requirements prior to registering for advanced courses:

1. All first semester first year courses and the university English requirement (see page 39) must be completed by the time the student has accumulated 48 semester hours of program requirements.
2. All second semester, first year courses must be completed by the time the student has completed 64 semester hours of program requirements. Transfer students will be given a one semester waiver.

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

Construction—B.S.

Students in all options will be 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 differences in credits will be 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 (6 semester hours)			*Semester Hours*
ENG	101, 102	First Year Composition ..... or ENG 105 Advanced First Year Composition	6

General Studies Requirements
(36 semester hours

*Literary and Critical Inquiry**
(6 semester hours minimum)

COM	225	Public Speaking	3
TCE	400	Technical Communications	3

Numera
6 semester hours minimum)

MAT	270	Calculus with Analytic Geometry I ..... or MAT 260 (3 *and* MAT 261 (3)	4
ECE	106	Introduction to Computer Aided Engineering	3

Human ties and Fine Arts
*Social and Behavioral Sciences**
(semester hours minimum)
At least one course must be of 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
One course must be an approved Architecture APH*) course	
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 50–80 for requirements and 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	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 with Lab			4
		Total Common to All Options	45

Primary 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	244	Construction Graphics	2
CON	273	Electrical Construction Fundamentals	4
CON	331	Construction Safety	2
CON	345	Mechanical Systems	3
CON	374	Systems Management for Construction	2
CON	424	Structural Design	3
CON	453	Construction Labor Management	3
CON	463	Foundations and Concrete Structures	3
BLW	306	Business Law	3
		Total Primary Core Required	34

Secondary Core for the General Development Option

			Semester Hour
ACC	212	Introductory Managerial Accounting	3
APH	314	History of Western Architecture	3
COM	222	Argumentation	3
CON	483	Advanced Building Estimating	3
FIN	300	Fundamentals of Finance	3
FIN	361	Managerial Finance	3
BLW	306	Business Law	3
GPH	111	Introduction to Physical Geography	4
PUP	301	Introduction to Urban Planning	3
REA	251	Real Estate Principles	3
		Total Secondary Core Required	31

Secondary Core for the Military Option

			Semester Hours
CEE	310	Testing of Materials for Construction	3
CEE	450	Soil Mechanics in Construction	3
CON	244	Construction Graphics	2
CON	273	Electrical Construction Fundamentals	4
CON	331	Construction Safety	2
CON	344	Route Surveying	3
CON	345	Mechanical Systems	3
CON	424	Structural Design	3
CON	463	Foundation and Concrete Structures	3
CON	472	Land Development Feasibility	2
CON	482	Cost Engineering	2
		Total Secondary Core Required	30

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

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			
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
Humanities and Fine Arts Elective			3
		Total	17
Second Semester			
APH Elective			2
CON	252	Construction Equipment	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	17
Third Semester			
CON	221	Applied Engineering Mechanics Statics	3
CON	243	Introduction to Construction Materials and Specifications	3
CON	244	Construction Graphics	2
COM	225	Public Speaking	3
ECE	106	Introduction to Computer Aided Engineering	3
STP	226	Elements of Statistics	3
		Total	17
Fourth Semester			
ACC	211	Introductory Financial Accounting	3
CON	251	Microcomputer Applications for Constructors	3
CON	273	Electrical Construction Fundamentals	4
CON	323	Strength of Materials	3
Basic Science Elective			4
		Total	7

[1] See pages 50–80 for requirements and 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
CON	472	Land Development Feasibility	2
CON	483	Advanced Building Estimating	3
REA	251	Real Estate Principles	3
BLW	411	Real Estate Law	3
Approved Technical Elective			2
Total			13

Option in General Development

The general development option prepares the student to participate in the development of land and buildings. Courses will 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
CON	472	Land Development Feasibility	2
CON	484	Internship	6
CON	494	ST Construction Process	3
BLW	411	Real Estate Law	3
Approved Technical Elective			2
Total			16

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
CON	344	Route Surveying	3
CON	482	Cost Engineering	2
CON	486	Heavy Construction Estimating	3
BLW	307	Business Law	3
Approved Technical Elective			2
Total			13

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
Total	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 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 problem solving tool for the constructor Characteristics of microcomputer hardware and operating systems Use of spreadsheets, statistical packages database management and software Prerequisites ECE 106 STP 226

252 Construction Equipment. 2 F S
Character st cs, apab t es m tat ons and emp oyment of genera bu d ng and heavy construct on equ pment F eet operat ons ma ntenance programs F e d tr ps Pre requ s te sophomore stand ng

273 Electrical Construction Fundamentals. 4 F S
C rcu ts and mach nery Power transm s on a d d str bu t on w th empha s on secondary d str but on systems Measurements and nstrumentat on F e d tr ps Lecture ab Prerequ tes MAT 270, PHY 112 114

323 Strength of Materials. 3 F S
Ana ys s of strength and g d ty of structura members n res st ng app ed forces Stre s stra n shear moment de f ect ons comb ned stresses, connect ons moment d str but on Both US and S un ts of measurement Prerequ s te CON 221

331 Construction Safety. 2 F S
Protect ve equ pment and dev ces, nspect on procedures and record keep g OSHA requ rements for construct on Hazard ana ys s and ab ty a s gnment Econom cs of acc dent protect on F e d tr ps

341 Surveying. 3 F S
Theory and f e d work n co st uct on and and surveys. Lecture ab. Prerequ s te MAT 118

344 Route Surveying. 3 F
S mp e compound and t ans t on curves reconna s sance, pre m nary, and ocat on surveys Ca cu at on of earthwork D mens ona contro for construct on pro ects Lecture ab Prerequ s te CON 341

345 Mechanical Systems. 3 F S
Heat ng and coo ng systems for bu d ngs San tary and water p p ng ayout and s mp e des g Computer a ded ca cu at ons F e d tr ps ecture ab Prerequ s tes CON 243 251 PHY 111, 113 Corequ s te CEE 340

366 Construction Methods. 3 F S
Ana ys s of construct on projects for the determ nat on of the most appropr ate and eco om 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

374 Systems Management for Construction. 2 F S
Organ zat on and management theory app ed to the con struct on process Conceptua f undat ons Industry env ronment processes and management Leadersh p func t ons Prerequ s te: jun or stand ng or nstructor approva

383 Construction Estimating. 3 F S
Methods and techn ques used n est mat ng constru t on costs Standard approach to quant ty surveys empha s zed Pract ce n take offs cost ng and f na b d prepara t on M crocomputer usage for semester project Lecture project workshop Pre equ s tes CON 243 244 251 con struct on ma r or nstructor approva

389 Construction Cost Accounting and Control. 3 F S
Nature of construct on cost Deprec at on and tax theory, var ab e equ pment costs Cash f ow theory nvestment mode s prof tab ty and ana ys s Computer app cat ons Fund ng sources and arrangements Bu der s nsurance Prerequ s tes ACC 211 CON 251 or equ va ent CON 383 *[Sat sf es Genera Stud es Requ rement N3]*

424 Structural Design. 3 F S
Econom c use of stee , re nforced concrete, and wood n 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 des gn pro ects F e d tr ps Prerequ s te CON 323

453 Construction Labor Management. 3 F, S
Labor and management h story, un on and open shop or gan zat on of bu d ng and construct on workers app cab e aws and government regu at ons goa s, econom c power, jun d ct ona d sputes and gr evance procedures Lecture, ab *Prerequ s tes CON 374 ECN 112 [Satsf es Gen era Stud es Requ rement H]*

455 Construction Office Methods. 3 S
Adm n strat ve systems and procedures for the construc t on company off ce nc ud ng methods mprovement and work s mp f cat on off ce ayout bus ness forms and de s gn office manua s Prerequ s te CON 389

463 Foundations and Concrete Structures. 3 F S
Subsurface construct on theory and pract ce for founda t ons of bu d ngs and eng neered fac t es Concrete form des gn for foundat ons and structura frames Underp n n ng, p g dry and wet excavat ng, dewater ng 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 est mat ng construct on costs before des gn has *been n t ated Cost est mat ng for arge pro ects* Ana ys s and organ zat on of e ectr ca est mate Prerequ s te CON 383

472 Land Development Feasibi ity. 2 S
Econom c ocat on theory Ana ys s of the prof tab ty of and deve opments. M crocomputer app cat ons n the ana ys s process Fie d tr ps Prerequ s tes CON 251 383 389

477 Residential Construction. 3 F
Study of des gn concerns construct on mater a and con tract adm n strat on prob ems re ated to res dent a con str ct on. *Owner and contractor re at onsh p F e d tr ps* Prerequ s te jun or stand ng or nstructor approva

482 Cost Engineering. 2 S
The t me va ue of money Compar son of a ternat ve de prec at on methods and mpact on taxes, rep acement and break even ana ys s Construct on f nanc ng and ana ys s Prerequ s te CON 389

483 Advanced Building Estimating. 3 F S
Concepts of pr c ng and markup deve opment of h stor c costs, fe cyc e cost ng change order and conceptua est mat ng, emphas z ng m crocomputer methods Prerequ s tes CON 251 383

486 Heavy Construction Estimating. 3 F S
Methods ana ys s and cost est mat on for construct on of h ghways br dges tunne s, dams and other eng neering works F e d tr ps Prerequ s tes: CON 344 383 or n *structor approva*

495 Construction Planning and Scheduling. 3 F, S
Various network methods of project schedu ng, such as AOA, AON Pert bar chart ng ne of ba ance and VPM tech ques M crocomputers used for schedu ng, re source a ocat on and t me cost ana ys s Prerequ s tes· CON 251, 383 389 construct on major or nstructor approva *[Sat sf es Genera Stud es Requ rement N3]*

496 Construction Contract Administration. 3 F S
Case stud es Effects of organ zat on on construct on con tract operat ons Essent a s of construct on aw Pr me contracts subcontracts jo nt venture and consort um agreements and change orders Documentat on C a ms arb trat on and t gat on Qua ty contro requ rements Bond ng, nsurance ndemn f cat on procedures Eth ca pract ce cens ng code etc F eld tr ps Prerequ s tes. sen or stand ng CON 374 TCE 400 or nstructor ap prova

531 Economics of the Construction Industries. (3 F
The econom c env ronment of construct on w th emphas s on un que aspects cr t ca rev ew of econom c l terature dea ng w th the construct on ndustr es Prerequ s tes. CON 496; ECN 500 or nstructor approva

551 Facilities Operation and Maintenance. 3 S
Ana ys s of ma ntena ce work Structure of the ma'nte nance work and organ zat on Contract ma ntenance and force account econom cs Ma ntenance contro and super v s on of operat ons F e d tr ps Prerequ s tes CON 389 495 or nstructor approva

577 Construction Systems Engineering. 3 F
Systems theory as app ed to the construct on process A ternates for structur ng nformat on f ows and the contro of projects Prerequ s te IEE 476 or equ va ent

Special Courses: CON 294 394, 484, 492 493 494 498, 499 580, 583 590 591 592, 593 594 598. See pages 43–44.

Departments of Technology

Degree Requirements—B.S.

All baccalaureate degree programs in the depart ments of technology require completion of the university English proficiency requirement, a General Studies component and a technology core component. The engineering technology pro grams also require completion of an engineering technology core in addition to the technology core of the chosen major and option. All pro grams require a minimum of 132 semester hours.

The specific course requirements for the Eng lish proficiency, General Studies, technology core and the engineering technology core are listed be low. Refer to the individual majors or options for their additional required courses

			Semester Hours
English Proficiency			
† ENG	101, 102	First Year Composition ..... or ENG 105 Advanced First Year Composition (3)	6

General Studies

*Litera s and Criti al Inquir s**
(6 semester h urs m nimum)
One course to be chosen from university approved list Course w l be sophomore level and include a series of formal, graded written *or sp ken* assignments in composing critical discourse 3
; TCE 400 Technical Communications. 3

Numera s
6 semester hours minimum
MAT 118 Precalculus Algebra and Trigonometry 3
ECE 106 Introduction to Computer Aided Engineering 3

Humanities and Fine Arts
*Soc a and Behav r al Sc en es**
15 semester hours min mum)
At east one c ourse must be of upper di vi sion level two ourses must be f n same depart ment, and two dep rtmen ts n m re must be represented n t tal sel tion
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 S en es
(8 semester hours minimum
; PHY 111 Genera Physics 3
† PHY 112 Genera Physics 3
† PHY 113 General Physi s Laboratory 1
† PHY 114 General Physics Laboratory .. 1

Total Genera Studies. 35

NOTE: One course in the area of g obal awareness* and one course n histor cal awareness* *must* appear in the fina list of courses offered in the student's graduation program of study. These can be ncluded in the humanit es and fine arts/ social and behavioral sciences course selec tions See list of acceptable courses

* See pages 50–80 for requiremer ts and 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	01	Introductory Chemistry ..... or CHM 113 General Chemistry 4) or CHM 114 General Chemistry for Engineers (4	4
ECE	105	Introduction to Languages of Eng neer ng	3
MAT	260	Technica Calculus I ..... or STP 420 Introductory Applied Statistics 3	3
TCE	100	Structured Problem Solv ng w th BASIC	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	20

Engineering Technology Core

The following courses comprise 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 100 Structured Problem Solving with BASIC. (3) F, S, SS
Methods of defining, organizing, developing ideas and solutions to problems using computer and structured BASIC language as a tool. Corequisite: MAT 118.

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. Prerequisite: TCE 100.

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]*

Special Courses: TCE 294, 394, 492, 493, 484, 494, 498, 591. (See pages 43–44.)

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 211. 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 second laws of thermodynamics, properties of pure substances, applications to heat engines and special systems. Fundamentals of conduction, radiation, and convection. Prerequisites: MAT 261; PHY 112, 114.

Special Courses: ETC 294, 394, 492, 493, 484, 494, 498, 591. (See pages 43–44.)

Aeronautical Technology

PROFESSOR:
MATTHEWS (TCB 206)
ASSOCIATE PROFESSORS:
LATIGO PEARCE REED ROPER, SALMIRS
ASSISTANT PROFESSORS:
CARLSEN GESELL
INSTRUCTOR:
ROGERS
PROFESSORS EMERITI:
COX, SCHOEN THOMASON

The Department of Aeronautical Technology of fers 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 aero space industry in productive, professional em ployment or, alternatively, for graduate study. The curricula emphasize the recognized prin ciples underlying the application of technical knowledge as well as current technology, prepar ing the graduate to adapt to the rapid and contin ual changes in aerospace technology

Aeronautical Engineering Technology—B.S.

The Aeronautical Engineering Technology cur riculum is designed to prepare the technologist for technical support of engineering activities throughout the aerospace field. Areas of responsi bility include the application of applied engineer ing practice related to fixed wing aircraft and aerospace vehicle design, helicopter applications, internal combustion engines, combustion proc esses, turbomachinery, systems analysis, com- puter modeling, quality assurance and non destructive testing and low speed wind tunnel ap plications.

Advisor approved alternates for transfer credit for listed courses may vary from the total required semester hours indicated Such variances shall not reduce the minimum of 132 semester hours re quired for the degree.

Aeronautical Engineering Technology students are required to complete the technology core, the engineering technology core, and the fo lowing courses as part of their General Studies under humanities social sciences·

			Semeste Hours
ECN	111	Macroeconomic Principles	3
One Upper division Humanit es and F ne Arts			.3

In the technology core see page 291 , the fol lowing course is required:

			Sem ester Hou
MAT	260	Technica Calculus I	. . 3

In the engineering technology core (see page 292), the following courses are required

			Semeste Hours
ETC	313	Applied Engineering Mechanics Materia s	3
ETC	340	Applied Thermodynamics and Heat Transfer	3
MAT	262	Technical Calculus III . . . . . or AET 472 Applied Linear Analysis 3	3

The following courses are required in both op tions AET 280, 281, 287, 288, 300, 310, 320, 321, 409, 414, 487; ETC 312, IEE 300; MET 432.

The following courses are also required for the option listed:

Aeronautical technology AET 415, 417, 490, elective hours, 3.

Helicopter technology AET 360, 461, 462, 463, 464

Suggested Course Pattern for Freshmen

First Semester			*Semester Hour*
CHM	101	Introductory Chemistry	4
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
MAT	260	Technical Ca cu us I	3
PHY	111	General Physics	3
PHY	113	Genera Physics Laboratory	1

CE	231	Engineering Materials and Processing	3
		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 is prepared with 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 today's airspace. This career option leads to development, administration, and enforcement of safety regulations including airworthiness and operational standards in civil aviation. It 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 prior to enrollment at the university.

Flight instruction costs are not included in university tuition

Aircraft flight management students are required to complete the following courses as part of their General Studies under humanities/social sciences.

			Semester Hours
One Upper division Humanities and Fine Arts			3
ECN	11	Macroeconomic Principles	3
PGS	100	Introduction to Psychology	3
COM	100	Introduction to Human Communication	3

In the technology core (see page 291), the following course is required:

			Semester Hours
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, 394, 408, 410, 444, 489, GPH 212; IST 452, MGT 301, 311.

Suggested Course Pattern for Freshmen

			Semester Hours
First Semester			
AET	182	Private Pilot Ground School	3
CHM	101	Introductory Chemistry	4
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
		Total	16
Second Semester			
AET	183	Private Pilot Certificate	1
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
GPH	212	Introduction to Meteorology I	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 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, will prepare 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 the following courses as part of their General Studies under humanities social sciences:

			Semester Hours
Humanities and Fine Arts (must be upper division selected from two different departments)			6
ECN	111	Macroeconomic Principles	3
ECN	112	Microeconomic Principles	3
SOC	301	Principles of Sociology	3

In the technology core (see page 291), the following course is required.

			Semester Hours
MAT	260	Technical Calculus I	3

In addition, the following listed courses are required: AET 101, 201, 280, 281, 287, 288, 308, 342, 408, 410, 444, 489, COM 110, 210, 410; IEE 300, 431, IST 452; MGT 301, 311, 352, 423; PGS 100, 315; POS 310; two elective hours.

Suggested Course Pattern for Freshmen

First Semester			*Semester Hours*
AET	101	Introduction to Aeronautics	3
ENG	101	First Year Composition	3
TCE	100	Structured Problem Solving with BASIC	3
MAT	118	Precalculus Algebra and Trigonometry	3
PGS	100	Introduction to Psychology	3
		Total	15
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 101 Introduction to Aeronautics. 3 F
Evolution of aviation. Aircraft types and uses. Principles of flight. Technical development of equipment/systems. Air space use.

182 Private Pilot Ground School. 3 F, S, SS
Ground school leading to FAA Private Pilot Certification. Student may begin flight training when concurrently enrolled in AET 294. 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 FR operations. Departures and arrivals. Airport conditions and emergencies.

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 101 or 182.

222 Instrument Pilot Ground School. 3 F, S
Ground school leading to the FAA Instrument Pilot Rating. Ten hours ground training required. Prerequisite: Private Pilot Certificate. Prerequisite or corequisite: AET 220.

280 Aerospace Structures and Materials. 3) F, SS
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, SS
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 AET majors. Prerequisites: AET 222 passed FAA written.

287 Aircraft and Aerospace Powerplants. 3 F, S, SS
Theory of internal combustion engines, components, performance analysis, engine accessories, systems and environmental control. Lecture, lab. Prerequisites: PHY 111, 113; or instructor approval.

288 Gas Turbine and Turbomachinery. 3 F, S, SS
Development and theory of gas turbine engines. Thrust and performance analysis. Engine components, systems, aerodynamic problem applications and environmental control. Lecture, lab. Prerequisites: PHY 111, 113; or instructor approval.

300 Aircraft Design I. 3 F, S, SS
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
A r commerce re ated to the transportat on system H s tonica deve opment of a r transportat on regs the regu a tors and the regu atory c mate w th n the Nationa A r space System Prerequ s te AET 101 or equ va ent *[Sat sf es Genera Stud es Requ rement G]*

310 Instrumentation. 2 F
Measurement system responses and the character st cs of exper mental data Methods of co ect ng and ana yz ng data Prerequ sites MAT 261, TCE 201

314 Commercial Pilot Ground School. 3 S
Ground schoo ead ng to Commerc a P ot cert f cat on Ten hours ground tra ner requ red Prerequ s te Pr vate P ot Cert f cate Pre or corequ s tes AET 220, 222

320 Applied Aerodynamics I. (3 F
ntroduct on to potent a and v scous f ows and the r re a t onsh p to a rcraft ft and drag. Prerequ s tes: AET 300 ECE 106 MAT 262

321 Applied Aerodynamics II. 3 S
Wind tunne and f ght test theory measurements and ana ys s A rcraft stab ty and contro Lecture ab Pre requ s te AET 320

342 Aviation Law Regulations. 3 F, S
Study wh ch encompasses the f e d of av ation w th n the context of the U S Common Law system Pub c aw, ad m n strat ve ru e mak ng sovere gnty enforcement, and case aw ana ys s Prerequis te AET 101 or 182 or equ va ents.

360 Introduction to Helicopter Technology. 3 S
Introduct on to the work ng funct ons of modern rotary wing 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 89
Advanced D R theory appl cat on of VLF, NS, Loran pressure pattern gr d nav gat on Corequ site AET 222 or nstructor approva

383 Commercial Pilot Certificate and Instrument Rating. 2 F S SS
F ght tra n ng for the FAA Unrestr cted Commerc a P ot Cert f cate Sat sfactory comp etion of FAA Cert ficate Rat ng requ red Prerequ s tes AET 222 314 passed FAA written, fly 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 f cate 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 required for course comp et on Prerequ sites AET 385, passed FAA wr tten

387 Multi-Engine Ground School. 1 F
Ground schoo preparat on 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 tra n ng for the FAA Mu t Eng ne Rat ng FAA rat ng requ red for course comp et on Corequ s te AET 387.

392 Flight Instructor Instrument Ground School. 2 S
Ground schoo preparat on for FAA nstrument F ght In structor Rat ng Prerequ s te· AET 386 or nstructor ap prova

393 Flight Instructor Instrument Rating. (1) F S, SS
F ght training for the FAA CF . CF I Cert f cate requ red for course comp et on Prerequ s tes AET 386, 392 passed FAA wr tten

394 Multi-Engine Land, Airplane Flight Instructor Rating. 1 F S SS
Norma and emergency f ght operat ons Instruct on tech n ques and procedures assoc ated w th ght mu t -eng ne and a rp ane Prerequ s tes AET 386 389

408 National Airspace System. 2 S
A rway fac t es Operat ons and commun cat ons a r route traff c contro centers and f ght serv ce stat ons Nav gat on a ds a rport env ronment cert f cat on and se cur ty Prerequ s te AET 201 or 222

409 Nondestructive Testing and Quality Assurance. 3 F, S SS
Purpose of nspect on and qua ty assurance Theory ap p cat on of nondestruct ve nspect on methods Appl ca t on of pert nent standards, spec f cations and codes Lec ture ab Prerequ s tes AET 280 or TCE 230 TCE 400, sen or stand ng in techno ogy or nstructor approva

410 Aviation Safety. 2 F
Av at on acc dent prevent on 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
Development and eva uation of ev dence ana ys s, and recommendat ons for prevent ve pract ces Prerequ's te jun or stand ng

414 Applied High Speed Aerodynamics. 3 F
Bas c concepts of compress b e f u d mechanics nc ud'ng nterna and externa f ows Prerequ s tes. ETC 340 MAT 262

415 Propulsion. 3 S
Pr nc p es thrust performance cycles, combustion sys tems mechan ca , mater a , and other des gn cons dera t ons ram jets rockets and advanced propulsion systems. Prerequ s te AET 414

417 Aerospace Systems Design. 3 F
Ana ys s and des gn of rockets m ss es and sate tes Therma des gn of aerospace systems ntroduct on to or b ta mechan cs Computer s mu ations and appl cat ons Prerequ s tes AET 322 ETC 313, MAT 262

444 Airport Management and Planning. 3) S
Career or entat on nto adm n strat on and management of modern pub c airports to nc ude an overv ew of p ann ng fund ng and development of a rport fac l t es. Prerequ site AET 308 or instructor approva

461 Applied Helicopter Aerodynamics and Performance Measurements. (3 F
Hover ng theory vert ca f ght, b ade mot on and rotor contro Aerodynam cs of forward f ght stab ty Prerequ s tes AET 322 360

462 Aerodynamics of Wind Tunnel Models. 3 S
He copter mode types des gn cons derations, propu s on oads surfaces mount ngs nstrumentat on Prerequ s tes. AET 321 461

463 Aircraft/Helicopter Handling Qualities. 3 F
FAR s M LSPEC s human resources, ana yt ca tech n ques s mu ator and f ght test techn ques W nd tunne data acquisit on and ana ysis Prerequ s te AET 461.

464 Flow Modeling Validation. 3 S
F ow mode concepts f ow mode s in a rp ane and he cop ter des gn Test requ rements, data ana ys s, error ana y s s. Prerequ s te AET 462

472 Applied Linear Analysis. 3) N
L near a gebra d fferent a equations and computer meth ods app ed to prob ems n engineer ng techno ogy Pre requ s tes· ECE 106; MAT 262 *[Satisf es Genera Stud es Requ rement· N1]*

484 Aeronautical Internship. 1 3) F, S SS
Work experience ass gnment at a rports or w'th aerospace ndustry commensurate w th student's program Spec a projects gu dance by ndustry w th un vers ty superv s on Prerequ s tes adv sor approval un or stand ng

487 Aircraft Design II. 3 F S
Bas c aerodynam cs and a rplane performance ana ys s methods app ed to pract ca des gn project Prerequ s te AET 322

489 Airline Administration. 2 S
Adm n strat ve organ zat ons econom cs of a r ne adm n strat on, operat ona structure relat onsh p with federa government agenc es Prerequ s te. AET 308 or nstructor approva

490 Mathematical Modeling of Aerospace Systems. 2 S
Methods of ana yzing and opt m z ng aerospace systems us ng bas c stat st cs and we l known numer ca methods w th emphas s on computer s mu at on. Prerequ s te· MAT 261 *[Satisfies Genera Studies Requ rement· N2]*

Special Courses: AET 294, 484 492 493 494 498 499 500 580 583 584, 590 591 592, 593 594, 598
See pages 43–44.

Electronics and Computer Technology

PROFESSORS:
McHENRY (TC 301A), MAISEL
ASSOCIATE PROFESSORS:
FORDEMWALT, McBRIEN, MUNUKUTLA, STRAWN, WOOD YOUNG
ASSISTANT PROFESSORS:
BAXTER, EDWARDS, KIL AN PETERSON
VISITING ASSISTANT PROFESSOR:
SADDLER

Purpose. Electronics engineering technology is a technological field of specialization which requires the application of scientific and engineer ing knowledge and methods combined with tech nical skills in support of electrical electronic engi neering activities It lies in the occupational spec trum 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 engi neering technologists and electronics engineering technicians

The electronics engineering technologist is ap plications oriented building upon a background of applied mathematics including the concepts and applications of calculus. Utilizing applied sci ence and state of the art technology, the electron ics techno ogist is able to: produce practical, workable, and safe results quickly and economi cally, install and operate technical systems, con figure hardware for unique applications from proven concepts, develop and produce products, service machines and systems, manage construc tion and production processes, and provide cus tomer support to technical products and systems

Degrees. The Department of Electronics and Computer Technology offers the Bachelor of Sci ence degree with a major in Electronics Engineer ing Technology (B.S./EET . Four options are available:

Computer Systems
Electronic Systems
Microelectronics
Telecommunications

The *computer systems* option combines applied electronics and computer hardware software con cepts and applications It has been formulated to meet the needs of persons who wish to engage in digital and computer systems applications as a ca reer focus

The *electronic systems* option is aimed at pre paring persons for careers in instrumentation, control and power systems applications. This op tion 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 re maining seven hours will be approved technical electives The ECT department has had a concen tration 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 will 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 inte grated 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 microelectron ics manufacturing with immediately applicable knowledge as well as to develop a strong founda tion of electronic fundamentals and methods. Stu dents should be interested in the design, fabrica tion 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 offer unique and challenging opportunities. Graduates of this program option will 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 provides orientation to the entire spectrum of telecommunications activities from the basics of radio and television to the applications of satellites in modern communications applications.

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 consisting of core areas and the option specialty area, and General Studies consisting of courses selected to meet the university's 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 90 semester hours of course work, which includes the technology core (20 hours), engineering technology core (19 hours), electronics engineering technology core (28 hours), and an option (23 hours). The General Studies* portion of the B.S./EET curriculum has been carefully structured to meet the specific requirements of the university as well as 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 291, 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

* See pages 50–80 specific General Studies requirements and the approved course list.

The following courses are required as part of the technology core.

			Semester Hours
CHM	113	General Chemistry UET only	4
TCE	250	Digital Systems and Microprocessors	3

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	3
		or ETC 340 Applied Thermodynamics and Heat Transfer 3 (UET only)	
ETC	331	Semiconductor Materials Science Devices	3

Electronics Engineering Technology Core Requirements:

			Semester Hours
CSC	183	Applied Problem Solving with FORTRAN	3
CET	350	Digital Logic Principles	4
CET	354	Microcomputer Principles	4
EET	208	Electric Circuits	3
EET	301	Electric Networks I	3
EET	310	Electronic Circuits	4
EET	372	Communication Systems	3
EE	396	Professional Orientation*	1
ET	415	Electronics Fabrication Principles	3
		Total	28

* Students must register for 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 register for EET 396 the prior spring semester.

Electronics Engineering Technology Options

Computer systems Required courses: CET 452, 456, 457, 473; plus eight hours of *approved* technical electives.

Electronic systems Required courses. EET 300, 406, 430, 460; plus eight hours of *approved* technical electives

Microelectronics Required courses CHM 116, UET 416, 418, 432; plus nine hours of *approved* technical electives.

Telecommunications systems Required courses: CET 473; EET 304, 470, 478; plus eight hours of *approved* technical electives.

Electronics Engineering Technology Program of Study

Typical First- and Second-Year Sequence

Freshman Year

First Semester			Semester Hours
CHM	101	Introductory Chemistry or CHM 113 General Chemistry (UET only	4
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of 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			
ECE	106	Introduction to Computer Aided Engineering	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. Applications 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 CET 350 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 Computer solutions Prerequisite EET 301

406 Control System Technology. 4 S
Control system components, analysis of feedback control systems stability, performance application With lab and computer simulations techniques Prerequisite EET 401; or EET 301 and MAT 262

410 Linear Electronic Circuits. (4 F
Frequency response and feedback des gn of mu t stage e ectron c c rcu ts and systems L near ntegrated c r cu try SPICE ana ys s Lecture ab Prerequ s tes: EET 301, 310

420 Operational Amplifier Theory and Application. 4 A
D fferent a and operat ona amp f er c rcuitry feedback conf gurat ons op amp errors and compensation, near and non near circu try App cations Lecture ab. Pre requ s tes EET 301 310

422 Electronic Switching Circuits. 4 S
Ana ys s and des gn of e ectron c c rcu ts operat ng n a sw tch ng mode Waveshap ng t m ng log c SP CE analys s Lecture, ab Prerequ s tes CET 350 EET 301 310

430 Instrumentation Systems. 4 F
Measurement pr nc p es and nstrumentat on techn ques S gna and error ana ys s Lecture ab Prerequ s tes CET 350 EET 301 310

440 Electrical Power Systems Technology. 3 S
E ectr ca power systems ana ys s transm ss on, d str bu t on, nstrumentat on protect on and re ated system com ponents. Prerequ s te EET 307

460 Power Electronics. 4 S
Analys s of c rcu ts for contro and convers on of e ectr ca power and energy Lecture ab Prerequ s tes CET 350 EET 301 310.

470 Communication Circuits. 4 S
Ana ysis and des gn of pass ve and act ve commun cat on c rcu ts Coup ng networks f lters mpedance match ng Modu at on and demodu at on techn ques Computer so lut ons Lecture ab Prerequ s tes EET 372 MAT 262

478 Communication Transmission System Design. (4 S
S gna propagat on, transm ss on Antenna pr nc p es and app cat ons Cab e TV and other commun cat on trans m ss on system des gn Lecture ab Prerequis tes EET 404, 372; MAT 262

482 Industrial Practice: Internship Coop. (1–4 F S SS
Spec a y ass gned or approved act v t es n e ectron c n dustr es or nst tut ons Report requ red Max mum of 10 cred ts Prerequ s te majors on y enro ed at jun or sen or eve

490 Electronics Project. 1–4 F, S SS
nd v dua or sma group projects in app ied e ectronics w th emphas s on aboratory pract ce or hardware so u t ons to pract ca prob ems Prerequ s te· nstructor ap prova

501 Digital Signal Processing and Application I. 3 A
Fundamenta s and app cat on of d screte s gna s and sys tems app cat on of DFT and FFT des gn of recurs ve fi ters using computer techn ques Prerequ s tes EET 401 or nstructor approva MAT 262

502 Digital Signal Processing and Applications II. (3 S
Design and app cat on of nonrecurs ve d screte f ters convo ut on w th FFT, power spectrum ana ys s, random s gnals Prerequ s te EET 501

506 System Dynamics and Control. 3 S
T me frequency and transform doma n ana ys s of phys ca systems Transfer funct on ana ys s of feedback con trol systems performance and stab ty Compensation Prerequis tes EET 301, EET 501 or MAT 262

510 Linear Integrated Circuits and Applications. 3 F
Ana ys s des gn and app cat ons of near ntegrated cir cu ts and systems Prerequ s tes CET 350 EET 301 310

522 Digital Integrated Circuits and Applications. 3 S
Ana ys s, des gn and app cat ons of ntegrated c rcu ts and systems. Prerequ s tes· CET 350. EET 301, 310.

530 Electronic Test Systems and Applications. 3) F
Analys s des gn and appl cat on of e ectron c test equ p· ment test systems, spec f cat ons, documentat on Pre requ s tes CET 354; EET 301, 310

540 Electrical Power Systems. 3 S
E ectr ca power system ana ys s, transm ss on d str bu t on nstrumentat on protect on and re ated system com ponents Prerequ s tes: EET 301 ETC 307

560 Industrial Electronics and Applications. (3 A
Ana ys s, des gn and app cat on of spec a e ectron c de v ces and systems to ndustr a contro power, communi cat ons and processes Prerequ s tes CET 350 EET 301, 310

574 Communication Circuits and Appl cations. 3 S
Ana ys s and des gn of m crowave c rcu ts us ng s para· meters and computer a ded des gn Match ng networks coup ers f lters and amp f ers Prerequ s tes EET 304 372

576 Modern Telecommunication Systems. (3 S
App ed ana ys s and des gn of sate te, and, and f ber op t c systems App cat ons of coherent system design and compensat on Four er and Lap ace analys s Prerequ s tes· EET 372 MAT 262 or nstructor approva

578 Communication Transmission Systems. (3 S
E ectromagnet c s gna propagation and transm ss on, an tenna pr nc p es and app cat on Cab e TV and other commun cat on transm ss on systems Prerequ s tes EET 304 372 MAT 262

Special Courses: EET 294 484, 492 493 494, 498 499 580, 584 590, 591 592 593, 594 598, 599 See pages 43–44.)

COMPUTER ENGINEERING TECHNOLOGY

CET 350 Digital Logic Principles. 4 F S
Comb nationa og c analys s and des gn and sequent a c rcu t ana ysis and des gn w th aboratory Lecture ab. Prerequ s tes ECE 106; TCE 250

354 Microcomputer Principles. (4 F, S
M crocomputer organ zat on, pr nc p es, and assembly lan guage programm ng w th aboratory Prerequ s te TCE 250

408 Digital Control and Simulation. (3 F
D g tal systems ana ys s, contro techn ques and com puter s mu at on 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 us ng system des gn tech n ques and comp ex MS LS dev ces w th aboratory Pre requ s tes· CET 350· CSC 183.

456 Minicomputer Systems and Programming. (3) S
Assemb y anguage programm ng nput output and off ne d agnost cs Ut ty 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 n and or m crocomputer hardware and software Spec a purpose contro ers nterface des gn Lecture, ab. Prerequ s tes CET 350, 354, CSC 183 EET 310

473 Digital Data Communication Systems. 4) F
S gna s d stortion, no se error detect on correct on. Transm ss on and systems des gn Interface techn ques and standards. D g ta hardware Appl cat ons w th ab Prerequ s tes CET 350 EET 372

485 Digital Testing Techniques. 3 S
Hardware software aspects of d g ta test ng techno ogy, systems board, and og c test ng and equ pment Lec ture ab Prerequ s tes CET 350, 354 CSC 183, EET 310

486 Electronics Computer Aided Design. 3 F
CAD CAM for e ectron cs manufactur ng Pr nted c rcuit ayout, documentat on schemat c p ott ng Prerequ s tes CSC 183 EET 310· TCE 250

508 Computer Process Control Technology. 3 F
Process computer control hardware software Samp ed data contro systems process mode ng m croprocessor control techn ques computer a ded des gn, s mu at on Process app cat ons Prerequ sites CET 354; EET 401 or 406

552 Digital Systems and Applications. 3) S
Ana ys s des gn and app cat ons of d g'ta networks and systems Prerequ s tes CET 350 354 CSC 183.

556 Computer Software Technology. 3 S
Assemb y anguage programm ng techn ques and opera t ons, operat ng system character st cs systems software app cat ons Prerequ s te CET 354

557 Microcomputers and Applications. (3) F
Appl cat ons of sma computer systems, m n and m cro computer hardware and software Prerequ s tes CET 354, CSC 100 or 183 EET 310

Special Courses: CET 294 484 492, 493 494 498, 499 580 584 591 592 593, 594 598 599 (See pages 43–44

MICROELECTRONICS ENGINEERING TECHNOLOGY

UET 415 Electronics Fabrication Principles. 3) F, S
E ectron c equ pment des gn and fabr cat on pr nc p es and pract ce Comp et on of electron cs hardware des gn proj ect and report Lecture ab W th ab fee. Prerequ s te sen or stand ng

416 Monolithic Integrated Circuit Technology. (3 F
Process ng and fabr cat on of mono th c b po ar and MOS ntegrated c rcu ts Lecture ab Prerequ s te. ETC 331

418 Hybrid Integrated Circuit Technology. 4) S
Layout fabr cat on des gn and manufacture of th n and th ck f m hybr d c rcu ts Lecture ab Prerequ s tes EET 310; ETC 331

432 Semiconductor Packaging and Heat Transfer. 3) S
Packag ng theory and techn ques hermetic and p ast c assemb y therma management, e ectr cal charactenst cs and re ab ty Prerequ s tes. ETC 331, 340, or equiva ent

437 Integrated Circuit Testing. 3 F
Pr nc p es techn ques and strateg es emp oyed n wafer evel and f na product testing both destruct ve and non destruct ve Prerequ s te UET 416

513 Microelectronics Technology. (3) A
Spec al processes techn ques and advances in mono th c, and hybr d techno ogy. Emphas s on manufactur ng pract ce and product app cat on for LSI and VLS Pre requ s te nstructor approva

516 IC Technology and Applications. 3) F
Advanced process ng and fabr cat on technology of mono th c ntegrated c rcu ts Lecture ab. Prerequ site UET 416

518 Hybrid IC Technology and Applications. 3) S
Theory, process ng, fabr cat on and manufactur ng of hy br d m croe ectron cs dev ces and products App cat ons Prerequ s te ETC 331 or equ va ent or nstructor ap prova

Special Courses: UET 294, 484 492 493, 494 498, 499, 580 584, 590 591, 592 593, 594 598, 599 (See pages 43–44

Industrial Technology

PROFESSOR:
(TC 201E)

ASSOCIATE PROFESSORS:
BOWERS, DAHL HIRATA HOROWITZ, LAWLER, MATSON, SCHILDGEN

ASSISTANT PROFESSOR:
GAFFORD

PROFESSORS EMERITI:
AUTORE BROWN, BURDETTE, BURK, KEITH, KIGIN, LITTRELL, PARD N PRUST ROE, ROOK, STADMILLER WATKINS, WILCOX

Purpose. The purpose of industrial technol ogy is to provide students with a broad technical and managerial background in a variety of disci-plines related to industry

Typically the programs are applications ori ented to include functional knowledge and under-standing of materials and production processes, industrial management and human relations, problem solving, the physical sciences, mathe matics, computer science, and current technologi cal skills.

Degrees. The Department of Industrial Tech nology offers four options leading to a Bachelor of Science degree. The four options are:

Graphic Communications
Industrial Management
Industrial Technology Education
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 Hour
ITC	200	Impact of Communications Technology on Society	3
ITC	202	Design and Enterprise	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 Hour
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
IST	446	Management Dynamics	3
IST	455	Industrial Sales and Demand	3
IST	491	Introduction to Labor Concerns	3
		Total	27

Areas of Emphasis (Technical Electives)
31 semester hours

After selecting the area of emphasis which 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
TCE	100	Structured Problem Solving with BASIC	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

See pages 50–80 for requirements and 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 are also scheduled at facilities where the demand is sufficient to justify a class.

Prior to 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	412	Industrial Laws Contracts and Regulations	3
IST	446	Management Dynamics	3
IST	451	Materials Control	3
IST	452	Industrial Management	3
IST	453	Safety Management	3
IST	461	Production Supervision Principles	3
IST	470	Project Management	3
IST	491	Introduction to Labor Concerns	3
PGS	430	Industrial Psychology	3
		Total	27

Areas of Emphasis (Technical Electives 31 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)

			Semester Hours
First Semester			
CHM	101	Introductory Chemistry	4
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
PGS	100	Introduction to Psychology	3
PHY	111	General Physics	3
PHY	113	General Physics Laboratory	1
Area of Emphasis Elective			3
		Total	16

Option in Industrial Technology Education

Students in industrial technology education combine technology courses, professional education, and General Studies to prepare for educational careers. Concentration in a variety of technical fields is available.

Industrial/Technology Education Core

To achieve its objective, the industrial technology education option requires the following courses:

			Semester Hours
ITE	412	Occupational Analysis and Course Development	3
ITE	421	Production Technology	3
ITE	446	Instructional Aids and Materials	3
ITE	480	Teaching Industrial and Vocational Subjects	3
ITE	485	Teaching Internship	4
ITE	491	Organization and Management of Co-Op Programs	3
		Total	19

Areas of Emphasis (Technical Electives)
30 semester hours

After selecting the area of emphasis, courses are to be selected with an advisor that relate to the following areas of emphasis.

Electronic communications Required: EET 307, TCE 201, plus an additional 13 hours of *approved* technical electives.

Manufacturing Required: TCE 230; MET 231; plus an additional 13 hours of *approved* technical electives.

Visual communications Required: ECE 105, 106; GRC 135; ICG 212, 312; plus an additional four hours of *approved* technical electives.

Technical teacher education. The objective of technical teacher education is the preparation of technical educators for the postsecondary level. A technical area of emphasis is required. Internship and prior industrial experience, approved by the advisor, are considered a means of gaining technical expertise in an industrial situation.

Typical Freshman Year
Course Pattern
(Faculty Advisor Approval Required)

First Semester			Semester Hours
CHM	101	Introductory Chemistry	4
ENG	101	First Year Composition	3
ITC	200	Impact of Communications Technology on Society	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
		Total	16
Second Semester			
ECE	105	Introduction to Languages of Engineering	3
ENG	102	First Year Composition	3
MAT	260	Technical Calculus I	3
PGS	100	Introduction to Psychology	3
Technical Elective			3
		Total	15

Option in Interactive Computer Graphics (ICG)

The purpose of the interactive computer graphics (ICG) option is to prepare students to enter the diverse field of computer graphics. The ICG option provides a blend of technological, managerial and applications knowledge and related skills. Graduates are qualified as applications technologists and professionals who are immediately productive and who have the breadth of educational experiences to advance into positions of leadership. The ICG courses are industry responsive and maintain a high level of technical applicability in the software, hardware, and computer graphics systems used.

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 Assisted Graphics	3
ICG	314	The CIM Database	3
ICG	412	Computer Graphics Modeling	3
ICG	417	Computer Graphics Systems	3
IST	446	Management Dynamics	3
IST	455	Industrial Sales and Demand	3
IST	461	Product on Supervision Principles	3
		Total	27

Areas of Emphasis (Technical Electives)
31 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)

First Semester			Semester Hours
CHM	101	Introductory Chemistry	4
ENG	101	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	100	Structured Problem Solving with BASIC	3
Humanities and Fine Arts Elective			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

[1] See pages 50–80 for requirements and 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 no ogy Act v t es nc ude research ng eva uat ng find ngs and present'ng arguments n support of pos t ons Pre requ s te: ENG 102 105 or 108 *[Satisfies General Stud es Requ rement· L1]*

202 Design and Enterprise. 3 F, S
App cat on concepts of des gn, creat v ty problem so v ng, research development organizat ons, and production as used n the work ng environment of techno ogy. Prerequ s te TC 200

343 Occupational Safety. 3 F
Acc dent prevention acc dent factors methods of record ng and reporting, ana ys s psycho og ca aspects att tudes recent eg s at on safety consc ousness and ab ty Prerequ s te jun or status

444 Industrial Organization. 3) S
Industr al organ zat on concepts Top cs relate to ndus tr al re at ons governmenta regu at ons, organ zat onal structure abor re at ons human factors and current in dustna pract ces F e d tr ps. Prerequ s te jun or status.

Special Courses: TC 294, 394, 484 492 493, 494, 498 591 (See pages 43–44

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 ss on and production of mu t p e images for consumer ut zation Lecture ab F e d trips

136 History of Printing in the Western World. (3 N
H stor ca perspect ve of technolog ca deve opments n pr nt ng and soc a 'mpacts on Western c vi zation 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. n troduct on to photocompos t on systems Lecture ab

331 Quality Assurance for the Reproduction Processes. 3 N
nstrumentation and methodo og es for matena s test ng and qual ty control n the major reproduct on processes F e d tr ps

332 Film Assembly and Platemaking. 3 N
Str pp ng negat ves and pos t ves; ne halftone, duo tone fu co or contact ng f ats onto various types of mage car r ers Fie d tr ps. Lecture lab Prerequ s te GRC 135

333 Sheet-Web Press Technology. (3 F
Funct on of the offset print ng equ pment L thograph c dy nam cs of both sheet fed and web systems. Lecture ab. Prerequisite GRC 332 or nstructor approva

334 Photo-Mechanical Reproductions. 3) F
Theory and product on of ne work, ha ftones contact work and spec a effects for the graph c arts ndustry Lec ture ab

335 Printing and Finishing Techniques. 3 F
Analys s of major pr nt ng processes of f exography screen process and re ief production b ndery and f n sh ng procedures Prerequ s te GRC 135

336 Color Separation. 3) S
Methods of produc ng separat on negat ves and pos t ves Prerequ s te GRC 334

337 Production Management. (3 N
P ann ng and contro ng work f ow of graph c arts prod ucts. F e d trips Prerequisite GRC 135.

339 Estimating and Cost Analysis. 3) N
Management re at onsh p between f nanc a product on and sa es departments n pr nt ng ndustr es ana ys s of equ pment, labor and mater a costs use of paper and standard pr c ng cata ogs. Prerequ s te. GRC 135.

433 Production Techniques. 3) N
Systemat c product on p ann ng exper ence Lecture ab Prerequ s tes GRC 333, 334

435 Plant Management. 3 N
Concepts, pract ces and processes used by the commer c a pr nt ng p ant manager re at ng to the operat on of the p ant Prerequ s te GRC 135 or nstructor approva

436 Gravure Technology. 3) N
In-depth study of the market prof e and product on se quences re ated to the gravure method of print ng Pre requ s te GRC 336

437 Advanced Color Reproduction. 3 F
Sc entif c ana ys s for the eng neering of co or reproduc t on systems used n the graph c arts ndustry. F e d trips Prerequ s te: GRC 336

438 Graphic Arts Techniques and Processes. 3 F, S, SS
Survey of production sequences and prof e of the pr nt ng and pub sh ng ndustry Lecture, ab Prerequ s te jun or stand ng

439 Electronic Imaging for Publications. 3 N
ntroduct on and n depth nvest gat on nto e ectron c pub sh ng systems used n pr nt ng and pub sh ng ndustry for transm ss on and generation of copy

537 Current Issues in Quality Assurance. 3 N
Directed group study of se ected ssues re at ng to qua ty assurance in the pr nt ng and pub sh ng ndustry

Special Courses: GRC 484, 492 493 494, 498, 499, 500, 580, 584, 590, 591 592 593 594 598 See page 43–44.

INDUSTRIAL MANAGEMENT

IST 402 Industrial Laws, Contracts and Regulations. (3) N
Rev ew of c ty state county, and federal aws that affect ndustr a and construct on operat ons, mater a s supp es and acqu s t on procedures

445 Industrial Internship. (1 10 F S, SS
Work experience assignment n ndustry commensurate w th student s program. Spec a zed nstruct on by ndustry with un versity superv s on Prerequis tes adv sor ap prova · jun or sen or status 2 50 GPA

446 Management Dynamics. 3) S
Elements of human re at ons tra n ng and the conse quences of superv sory behav oral patterns n effect ve y deal ng w th emp oyees

451 Materials Control. 3 F
Act v t es of materia hand ng nc ud ng purchas ng re ce v ng, warehousing traff c, p ant ayout, nventory and product on contro and sh pp ng re at ng to techn ca pro cedures

452 Industrial Management. 3 S
Supervisory princ p es as app ed to ndustria and govern menta agenc es Superv sor-emp oyee re at ons, group mora e, eadersh p techn ques po cy nterpretat on and tra n ng Prerequ s te: IST 446

453 Safety Management. 3 S
Contro ng phys ca cond t ons env ronmenta control personal protect on contro s cost ana ys s systems safety ana ys s aux ary funct ons Prerequ s te· ITC 343

454 Occupational Hygiene. 3 F S
Fundamenta concepts and pr nc p es of ndustr a hyg ene and occupat ona env ronmenta hea th. Inc udes OSHA and EPA aws regu at ons standards chem ca and physica hazards a r samp ng equ pment and contro measurers.

455 Industrial Sales and Demand. 3 F S
Customer and sa es strateg es for ndustr a organ zat ons nclud ng current practice and future p ann ng Prerequ s tes: ECN 111 adv sor and nstructor approva ; jun or stand ng.

461 Production Supervision Principles. 3 N
Introduct on to superv sory princ p es as appl ed to produc t on of goods and serv ces. Prerequ s te ECN 111

470 Project Management. 3 S
P ann ng, organ zat on coordinat ng and contro ng staff and project groups to accomp sh the project ob ect ve

480 Organizational Effectiveness. 3 N
Human aspects of superv sory behav or n the ndustr al sett ng and how they nf uence eff c ency, mora e and or gan zat ona pract ce

491 Introduction to Labor Concerns. 3) N
Introduct on to abor re at ons, organ zat on of abor un ons and federations co ective barga n ng, gr evances and ar b trat on, and app cable abor eg slat on.

542 Global Management Philosophies. 3 S
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 potentia app cat on n the Un ted States

549 Research Techniques and Applications. 3 F S
Selection of research prob ems, ana ys s of terature nd v dua nvestigat ons prepar ng reports, proposa wr t ng

550 Industrial Training. 3) F
Tra n ng techniques and earn ng processes P ann ng deve op ng and evaluat ng tra n ng programs n ndustry and governmenta agenc es Prerequisite adv sor ap proval.

598 Special Topics. 1 2 F, S
Spec al top cs courses, nc ud ng the fo ow ng wh ch are regu arly offered are open to qua f ed students.
(a) Princ p es of Hazardous Materia s and Waste Management
(b) Regu atory Framework for Tox c and Hazardous Substances
(c Princ p es of Tox cology
(d) Techno ogies for Storage, Treatment and D sposa of Hazardous Mater als
e) Quant tat ve Analys s and Pract ca Laboratory Techn ques
f) ndustria Hyg ene
g) A r Po ut on and Tox c Chem ca s
h Groundwater Hydro ogy Mon tor ng Protect on and C ean up
Emergency Preparedness Response and P ann ng for Hazardous Mater a s
Risk Assessment for Hazardous Mater a s
k Fate of Tox c Substances n the Env ronment

Special Courses: ST 484 492, 493 494 498, 499 500 580 583, 584 590 591, 592 593, 594 598, 599, 600 680, 683, 684 690 691 692 693 700 780, 783 784 790 791 792 799 See pages 43–44

INTERACTIVE COMPUTER GRAPHICS

ICG 212 Design Documentation. 3 A
Us ng m crocomputer based graph cs systems for product des gn and documentat on Geometr c shape ana ys s and descr pt on Documentat on techn ques and stan dards D mens on ng F e d tr ps ecture ab Prerequ s te ECE 106

310 Computer Graphics Fundamentals. 3 A
Computer mage creat on transformat on and man pu a t on Current techn ques for database generat on. Con cepts of app cat ons software deve opment Hands on exper ence F e d tr ps Lecture, ab Prerequ s te. pro gramm ng background he pfu but not necessary *[Sat s f es Genera Stud es Requ rement: N3]*

312 Computer-Assisted Graphics. 3 A
Us ng computer a ded des gn and draft ng app cat on soft ware for advanced geometr c construct on System and workstat on conf gurat on and product v ty Mode ng ap p cat ons F eld tr ps Lecture, ab Prerequ s te CG 212 *[Sat sf es Genera Stud es Requ rement. N3]*

313 Technical Illustration and Presentation Graphics. 3 A
P ctor a draw ng, shades and shadows and mu t med a render ng techn ques. Lecture ab Prerequ s te CG 212

314 The CIM Database. 3 A
Prepar ng the product def n t on database for computer n tegrated manufactur ng Documentat on and process re qu rements systems and standards. Prec s on d mens on ng F e d tr ps Lecture lab Prerequ s te ICG 212, TCE 230 or equ va ent

412 Computer Graphics Modeling. 3 A
Estab sh ng and man pu at ng 3D comp ter mode s Ap p cat ons nc ud ng so ds mode ng concepts des gn ana ys s dynam c s mu at on, and database nterchange F e d tr ps Lecture ab Prerequ s te ICG 312 *[Sat sfies Genera Stud es Requ rement. N3]*

413 MicroCadd Applications. 3 A
Student se ected modu es arch tectura construct on, c v ut ty, e ectron c draw ng, mechan ca manufacturing, an mat on computer graph cs, and others Fie d trips Lecture ab Prerequ s te CG 212

417 Computer Graphics Systems. 3 A
P ann ng mp ement ng, manag ng computer graph cs systems App cat ons, needs assessment ana ys s of components, system ergonom cs, nterfac ng, ma nte· nance and human resources management F e d tr ps Lecture ab Prerequ s te nstructor approval

517 Graphics Systems Development. 3 N
Research and development n computer graph cs sys tems App ed project management deve opment eva u at on and mp ementat on F e d tr ps Lecture ab Pre requ s tes CG 212 312 and 412 or equ vale ts or n structor approva

Special Courses: ICG 484, 492, 493, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599, 780, 783, 784, 790, 791, 792, 799. (See pages 43–44.)

INDUSTRIAL TECHNOLOGY EDUCATION

ITE 361 Industrial Projects Design. (2) N
Design and development of projects for the classroom. Lecture, lab. Prerequisite: instructor approval.

402 Occupational Analysis and Course Development. (3) A
Selecting instruction units through task analysis techniques; industrial and vocational course and training program development. Prerequisite: senior standing.

405 Improving Instruction in Industrial Education. (3) N
Methods, evaluation, and instructional improvement in industrial education. Prerequisite: senior standing.

421 Production Technology. (3) A
The use of modern production techniques including robotics, CAD/CAM, and team problem solving. Lecture, lab. Prerequisites: MET 346, 416.

446 Instructional Aids and Materials. (3) N
Selection, preparation, construction, and methods of use in industrial and vocational education. Prerequisite: instructor approval.

461 Hot Metal Techniques. (3) N
Properties of metals; sand and investment casting; pattern making. Field trips. Lecture, lab. Prerequisite: TCE 230.

465 General Power Transmission. (3) A
Classroom and laboratory in the application of various types of control systems and logic systems used in controlling and managing processes.

470 Improving Instruction in Prevocational Education. (3) N
Methods, evaluation and instructional improvement in prevocational education. Prerequisite: ITE 402.

471 Power Transmission. (3) N
Models of classical machines and their rational equivalents (pulleys, gears, wedges). Group design and problem solving in the application of general physical properties of machines. Prerequisite: ITE 465.

478 Power Systems and Analysis. (3) A
Hydraulics, pneumatics, energy sources for delivering power to devices. Internal combustion, electric, hydraulic and pneumatic motors will be used in laboratory applications. Prerequisite: ITE 465.

480 Teaching Industrial and Vocational Subjects. (3) N
Teaching techniques, philosophy, organization, planning, evaluation of teaching efficiency. Prerequisite: junior standing.

485 Teaching Internship. (1–8) N
Classroom, laboratory, and training procedures in postsecondary institutions, industry or governmental agencies. Prerequisites: ITE 402, 480, senior standing and departmental approval.

491 Organization and Management of Cooperative Programs. (3) N
Workstudy programs for industrial and vocational occupations in high schools and community colleges. Developing and coordinating programs. Instructional materials. Prerequisite: junior standing.

513 Experimental Activities. (3) N
Investigation and solution of technical problems in the student's area of specialization involving material design and analysis.

540 Evaluation in Industrial and Vocational Education. (3) N
Evaluative factors such as attitudes, behavioral factors, skills, technical information; instrument construction; evaluation of program effectiveness.

541 Vocational Education for Special Needs. (3) N
Organizing and administering vocational programs to meet special needs of youth and adults in schools, agencies, and industry.

542 History and Philosophy of Industrial and Vocational Education. (3) N
Evolution of modern programs, current concepts, future trends.

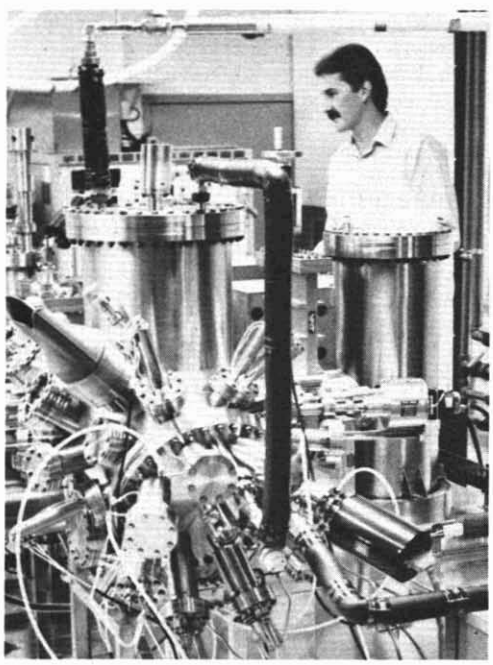
544 Industrial Processes in Special Education. (3) N
Emphasis on task analysis in development of manipulative activities for special needs learners.

545 Legal Aspects of Occupational Education. (3) N
Interpretation of federal and state acts, regulations, and responsibilities related to vocational education programs.

546 Postsecondary Occupational Education. (3) N
Trends, community surveys, needs, curricula, instruction, evaluation of occupational programs, financing, emphasis on industrial occupational education at the postsecondary level.

548 Administration of Industrial and Vocational Education. (3) N
Improving instruction, fund and material control, student personnel problems, curricular patterns.

Special Courses: ITE 484, 492, 493, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599, 780, 783, 784, 790, 791, 792, 799. (See pages 43–44.)



Manufacturing Technology

ASSOCIATE PROFESSORS:
KELLEY TC 201H KIS ELEWSK SCHM DT
ASSISTANT PROFESSORS:
LAMERAND PALMGREN, PELT ER SHELLER
LECTURER:
KR NGS
PROFESSORS EMERITI:
AUTORE CAVALL ERE, MINTER

Increased technological complexity and sophist 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 Engineering Technology
- Manufacturing Engineering Technology
- Mechanical Engineering Technology
- Robotic and Automation Engineering Technology
- Welding Engineering Technology

Manufacturing Engineering Technology—B.S.

The program wi appeal to persons interested in developing a career in the field of manufacturing with a primary focus on practice oriented applica tions of existing or state of the art manufacturing 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 will be required to develop an area of specialization

Degree Requirements

	Semester Hours
Technology Core	16
Engineering Technology Core	13
General Studies requirements	46
University English requirements	6
Manufacturing Engineering Technology Core	16
Selected option	35
Total Semester Hours Required	32

The following courses are required as part of the technology core:

			Semester Hours
CHM	114	General Chemistry for Engineers	4
MAT	260	Technica Calculus I	3
TCE	230	Engineering Materials and Processing	3

The following courses are required as a part of the engineering technology core:

			Semester Hours
ETC	313	Applied Engineeri g Mechanics: Materials	3
ETC	325	Electrical Power Source Analysis	4
E C	340	Applied Thermodynamics and Heat Transfer	3

Manufacturing Engineering Technology Core

			Semester Hours
MET	231	Manufacturing Processes	3
ME	300	App ied Metallurgy	3
MET	302	Welding Survey	4
ME	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 proven to be a powerful tool for increasing pro ductivity in manufacturing. This impact will be greater in the future as the full potential of com puters is integrated into the manufacturing fac tory Computer integrated manufacturing engi neering technology is concerned with the coordi nation of computer information and computer im p ementation in manufacturing.

Required courses ICG 314; MET 303, 341, 345, 416, 443, 448, 451, 453; plus seven hours *approved* technical electives.

Option in Manufacturing Engineering Technology

This option is designed to prepare technologists with both conceptua and practical applications of processes, materials, and products related to met alworking industries. Accordingly, this concentra tion is intended to prepare students to meet the re sponsibilities in planning the processes of produc tion, developing the tools and machines, and inte grating the facilities of production or manufactur ing.

Required courses· AET 409, MET 303, 341, 344, 345, 346, 416, 442, 444; plus seven hours *approved* technical electives

Option in Mechanical Engineering Technology

The primary objective of the mechanical engi neering technology option is to prepare the stu dent 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 will obtain a well rounded academic background in the General Studies, basic sciences, mechanics and thermal sciences

Required courses AET 310; ETC 312; MET 331, 432, 433, 434, 436, 438, plus seven 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 Robotic and automation technology will address the field of automating manufacturing processes

Required courses MET 303, 341, 345, 346, 416, 444, 451, 452, 453; plus seven hours *ap proved* technical electives.

Option in Welding Engineering Technology

This option is des gned primarily to prepare indi viduals for technical positions in industries utiliz ing 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 individ ual 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 ro bots in robotic welding applications Also, a laser is available for investigating the area of high en ergy welding processes.

Graduates of this program have the capability to function in a variety of technical positions re lated 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 evalu ation and technical sales.

The industries where graduates may find em ployment are· aerospace, automotive, heavy ma chinery, heavy fabrication, and energy produc tion.

Required courses AET 409; MET 321, 322, 341, 344, 346, 420, 421, 425, plus seven hours of *approved* technical electives.

First Two-Year Typical Curriculum for Manufacturing Engineering Technology

Freshman Year

			Semester Hour
First Semester			
CHM	114	General Chemistry for Engineers	4
ENG	01	First Year Composition	3
MAT	118	Precalculus Algebra and Trigonometry	3
TCE	00	Structured Problem Solving with BASIC	3
General Studies Elective (HU or SB)[1]			3
		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 Princ ples	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			3
Total		. ...	16

See pages 50–80 for requirements and approved list

MANUFACTURING TECHNOLOGY

MET 110 Welding Survey. 3 N
Oxy acety ene arc braz ng, res stance and gas tungsten arc we d ng procedures for ferrous and nonferro s meta s Lecture ab

116 Aeronautical Welding. 2 F
Oxy acetylene and tungsten gas tungsten arc we d ng procedures and braz ng techn ques u ed for a rcraft structures. Lecture ab

231 Manufacturing Processes. 3 F
Meta remova processes emphas z ng dr ng, m ng and lathe processes nc ud ng tool b t gr nd ng Emphas s on product on speeds and feeds Lecture, ab Prerequ s tes: ECE 106 TCE 230

300 Applied Metallurgy. 3) F
Pr nc p es of meta urgy emphas z ng concepts most rele vant to typ ca manufactur ng requ rements factors affect ng properties and eva uat on methods, meta ography ex periences Lecture, ab. Prerequ site TCE 230 or instruc tor approva

302 Welding Survey. 4 F
Theory and app cat on of ndustr a we d ng processes; n troductory we ding meta urgy and we dment des gn· SMAW GTAW GMAW, Oxy acety ene, braz ng experi ences Lecture, lab Prerequ's te upper c ass stand ng

303 Machine Control Systems. 3) N
Theory and app cat on of e ectromechan ca , hydrau c pneumat c f u d c and e ectr ca contro systems for manufactur ng Lecture ab Prerequ s tes MAT 260 TCE 201 or PHY 112

321 Engineering Evaluation of Welding Processes. 3 N
Theory and appl cat on of the arc we d ng pr cesses and oxy fue cutt ng f xturing procedures safety, codes and exper menta techn ques are covered. Lecture ab Pre requisites· MET 302 PHY 112

322 Engineering Evaluation of Nontraditional Welding Processes. 3 N
Theory and app cat ons of EBW, LBW so d state bond ng, braz ng and so dering Lecture ab Prerequ s tes MET 302 PHY 112

331 Design for Manufacturing I. 3) S
ntroduct on to des gn of mach nes and structures w th emphasis on ayout des gn draw ng Basics of gears, cams, fasteners, springs bear ng nkages cy ndrica f ts f at pattern development and surface f n sh requ rements emphas zed. Prerequ s te· ETC 313.

341 Manufacturing Analysis. 3 S
Introduct on to the organ zat ona and funct ona requ re ments for effect ve product on Inc udes wr t ng product on operation p ans Prerequ site MET 231.

343 Material Processes. (4 S
ndustr a process ng as app ed to ow med um and h gh vo ume manufactur ng. Bas c and secondary process ng fasten ng and o n ng coat ng qua ty contro . Lecture ab.

344 Casting and Forming Processes. 3 S
Ana ys s of var ous form ng processes to determ ne load requ rements necessary for a part cu ar meta form ng op erat on Th s nformat on s used to se ect equ pment and des gn tooling Meta cast ng processes and des gn of ca t ngs ntroduct on to powder meta urgy Prerequ s tes: ETC 313 MET 300, or nstructor approva

345 Advanced Manufacturing Processes. 4 S
Meta emova processes emphas z ng m ng gr nd ng turret and tracer athe and cutter sharpen ng Appl cat on of mach nab ty theory to pract ce Product on feeds speeds and too wear measurement. Lecture ab. Pre requ's tes MET 231 300 or nstructor approva .

346 Numerical Control Point to Point and Continuous Path Programming. 3 N
Methods of programm ng set up and operat on of numeri cal contro mach ne emphas z ng athe and m systems. Lecture, ab Prerequ s te MET 231.

354 Mechanics of Materials. 4 F
Vectors, force systems, fr ct on equ ibr um centro ds and moment of ner a Concepts of stress stra n and stress ana ys s app es to beams, co umns and comb ned oad ng Nonmajors on y Prerequ s tes MAT 118 PHY 111

401 Statistical Process Control. 3 S
ntroduct on to stat st ca qua ty contro methods as ap pl ed to to erances, process contro samp ng and re ab ty Prerequ s te MAT 118

407 Aerospace Materials. 2 N
Mater a s used for aircraft powerp ants and a rframes· em phas s on cr ter a for se ect on n terms of mechan ca propert es and manufactur ng processes Prerequ s te TCE 230 or equ va ent

416 Applied Computer Integrated Manufacturing. 3 F, S
Techn ques and pract ces of Computer ntegrated Manu facturi ng w th an emphas s on Computer Aided Des gn and Computer A ded Manufactur ng Prerequ s te. MET 346 or nstructor approva . *[Sat sf es Genera Stud es Re qu rement N3]*

420 Welding Meta lurgy. (4 N
Meta urg ca princ ples app ed to structura and al oy stee and a um num we dments aboratory emphas s on we d· ng exper ments meta ography and mechanica test ng Lecture lab Prerequ s tes· CHM 114· MET 300, 302

421 Welding Metallurgy. 3 N
Meta urg ca pr nc p es as app ed to sta n ess stee super a oy t tan um and other refractory metal we dments and braze o nts Prerequ s tes CHM 114 MET 300

425 Welding Codes. (2 N
Fam ar zat on w th and app cat on of the var ous codes standards spec f cat ons app cab e to we dments Pre requ s te MET 302 or equ va ent

432 Applied Thermodynamics and Heat Transfer. 3) F S
Thermodynam cs of m xtures Combust on process Ap p cat ons of thermodynam cs to power and refr gerat on cyc es Heat transfer steady state conduct on convect on and rad at on Prerequ s te 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.

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.

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.

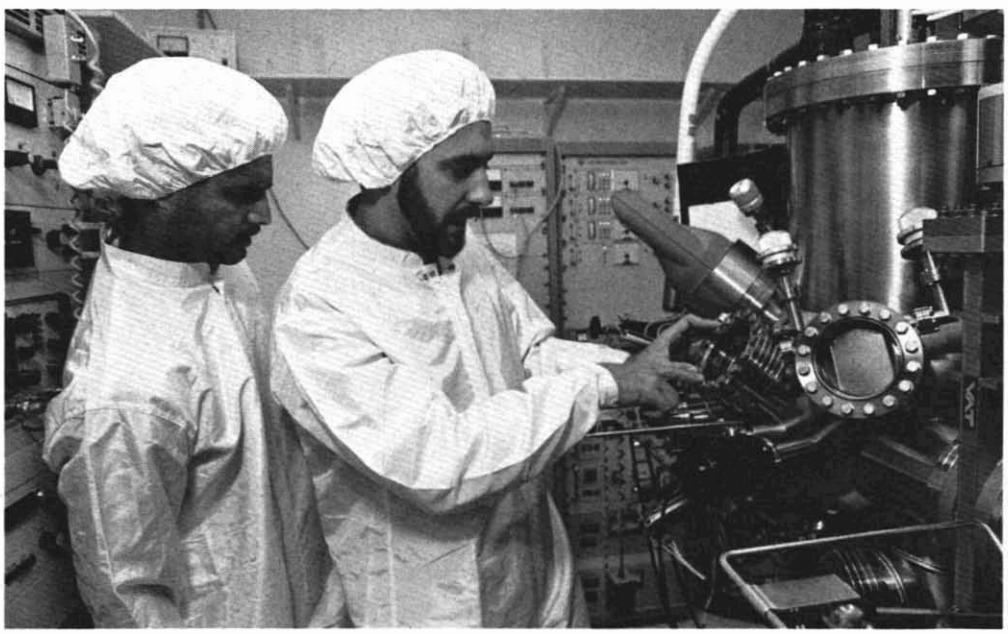
453 Robotic Applications. (3) S
Lab course utilizing robots and other automated manufacturing equipment to produce a part. Students are required to program robots, as well as interface the robots with other equipment. Prerequisite: MET 303 or ETC 325 or instructor approval.

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.

Special Courses: MET 484, 492, 493, 494, 498, 499, 500, 580, 584, 590, 591, 592, 593, 594, 598. (See pages 43–44.)



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 will serve our society well as a truly liberal education. Society's needs in the decades ahead call for engineering contributions on a scale not previously experienced. The well-being of our civilization as we know it may well depend upon how effectively this resource is developed.

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

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

Admission

See pages 28–34, 48–50, 269–270, and 274–275 for information regarding requirements for admission, transfer, retention, disqualification, and reinstatement.

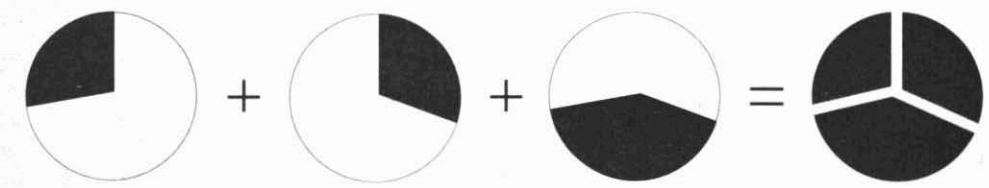
In addition, college students who are beginning their initial college work in the School of Engineering should present certain secondary school units in addition to the minimum university requirements. A total of three units is required in mathematics. Included must be: college algebra, geometry, and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

Students who have omissions or deficiencies in subject matter preparation may be required to complete additional university credit course work which may not be applied toward an engineering degree. One or more of the courses—CHM 113 General Chemistry, ENG 101 First-Year Composition,* MAT 118 Precalculus Algebra and Trigonometry, PHY 111, 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 312 and 313.

* See statement on placement examinations for proficiency—English, page 39.



General Studies
37 sem. hrs.

Engineering Core
44 sem. hrs.

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

BSE Degree
133 sem hrs.

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 50–53). In addition, there are requirements in the areas of historical awareness and global awareness. These courses comprise approximately 28 percent of the degree program.

The engineering core is a specific and organized body of knowledge that will serve as a foundation to engineering and for further specialized studies in a particular engineering major. These courses comprise approximately 33 percent 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, Civil Engineering, etc.), and 2) those offered as special and interdisciplinary studies (for example, nuclear sciences, pre-medical engineering, etc.). 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."

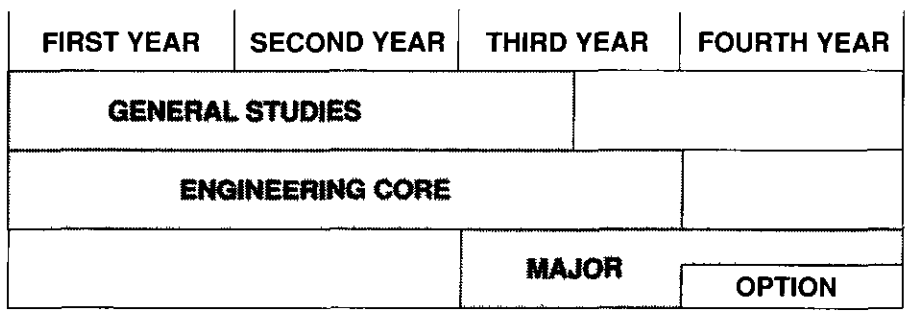
Majors and areas of emphasis are offered by the six engineering departments: Chemical, Bio- and Materials Engineering (CHE), Civil Engineering (CEE), Computer Science (CSC), Electrical and Computer Engineering (EEE), Industrial and Management Systems Engineering (IEE), and Mechanical and Aerospace Engineering (MAE). 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 359–366).

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

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

Typical Freshman Year

			Semester Hours
First Semester			
CHM	114	General Chemistry for Engineers[1] or CHM 116 General Chemistry 4)	4
ECE	105	Introduction to Languages of Engineering	3
MAT	290	Calculus I[3]	5
General Studies Electives (HL or SB)[4] or ENG 101 First Year Composition 3)			6
		Total	18
Second Semester			
ECE	106	Introduction to Computer Aided Engineering	3
ENG	102	First Year Composition or ENG 105 Advanced First Year Composition (3[5]	3



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

[1] Chemical Engineering, Bioengineering, Materials Science and Engineering, and Premedical engineering students will take CHM 113.

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 prior to enrollment in MAT 106, 117, 270, or 290.

[4] See pages 50–80.

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, i.e., in chemistry, English, mathematics, or 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 years or longer.

Degree Requirements

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

1. *Competency in oral and written communication* in the English language, which is considered to be essential for the engineering graduate. Although the requirement of specific course work may serve as a foundation for such competency, the development of communication skills should be demonstrated by student work in engineering courses As a minimum and in addition to the 133 semester hour course requirements, all students must satisfy the university English proficiency requirements see page 39)
2. *General Studies* 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* in engineering and related subjects that further develop the foundation for engineering and provide the base for specialized studies in a particular engineering discipline.
4. *Major studies* that provide a depth of understanding for a more definitive body of knowledge appropriate to a particular aspect of societal concern. These studies include technical elective course work in an area of emphasis that may be selected by the student 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 university approved list that is designated as L1 and HU or L1 and SB (see pages 54–80 for General Studies list) 3

† ECE 400 Engineering Communications ... 3

Numeracy

(6 semester hours minimum)

† MAT 290 Calculus I 5
or MAT 270 Calculus with Analytic Geometry I (4)

† 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 same department and two departments or more must be represented in total selection)

(16 hours may be required if L1 course is not also an HU or SB)

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 50–80 for specific requirements and 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)	
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	3
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	220	Computer Organization and Assembly Language Programming (4)	
EEE	221	Digital Computer Fundamentals (4)	
IEE	463	Computer Aided Manufacturing and Control (3)	
MAE	405	Microcomputer Aided Processes for MAE 3)	
Total Required Minimum Engineering Core			44

Subject to department approval. If PHY 321 is selected, PHY 322 must also be completed.

[2] Courses to be selected 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
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 grade point average of 2.00, in addition to having *a grade point average of at least 2.00 for the* 52 semester hours of required courses in the major field

Professional Accreditation

The undergraduate program majors Bioengineering, Chemical Engineering, Civil Engineering, Computer Systems Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, Engineering Specia Programs and Engineering Interdisciplinary Programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET)

ANALYSIS AND SYSTEMS

ASE 100 College Adjustment and Survival. 2 F S
Explorat on of career goa s and majors Emphas s on or ga zat on and deve opment of study sk s nc ud ng t me management stress management and use of the brary

399 Cooperative Work Experience. 1 F, S SS
Usua y nvolves two 6 month work per ods w th ndustr a f rms or *government agenc es a ternated w th fu t me se* mester and summer sess ons stud es Not open to students from other co eges on campus Prerequ s tes. at east 45 hours comp eted n major area w th m n mum 2 50 GPA instructor approva

485 Engineering Statistics. 3 F S SS
Stat st ca methods app ed to eng neer ng prob ems Est mat on tests of hypotheses regress on corre at on ana y s s of variance and nonparametr c stat st cs Prerequ s te ECE 383. *[Sat sf es Genera Stud es Requ rement N2]*

490 Project in Design and Development. 2 3 F S SS
Ind v dua project n creat ve des gn and synthes s Pre requ s te sen or stand ng.

496 Professional Seminar. 0 F S
Topics of nterest to students n the eng neer ng spec a and nterd sc p nary stud es

500 Research Methods: Engineering Statistics. 3 F S SS
Stat stica methods app ed to eng neer ng prob ems Est mat on, tests of hypotheses regress on, corre at on ana y sis of variance and nonparametr c stat st cs Open on y to students w thout prev ous cred t ASE 485 Prerequ s te ECE 383 or 500

582 Linear Algebra in Engineering. 3 F
Development and so ut on of systems of near a gebra c equat ons App cat ons from mechan ca structura and e ectr ca f e ds of eng neer ng Prerequ s te MAT 242 or equ va ent.

586 Partial Differential Equations n Engineering. 3 S
Deve opment and so ut on of part al d fferent a equat ons n eng neer ng. Appl cat ons n so d mechan cs v brat ons heat transfer Prerequ s tes ECE 386 MAT 242 274

Special Courses: ASE 294 394 484, 492, 493 494 498, 499 591 (See pages 43–44.

ENGINEERING CORE

ECE 105 Introduction to Languages of Engineering. 3 F S SS
Computer programm ng us ng C and FORTRAN 77 free hand draw ng v ua zat on and computer graph cs Lec ture rec tat on ab Prerequ s tes a gebra CSC 181 or BAS C programm g exper ence.

106 Introduction to Computer-Aided Engineering. 3 F S
Computer a ded ana ys s and des gn computer graph cs mode ng optim zat on and graph c documentat on Lec ture rec tat on, ab Prerequ s tes ECE 105 1 year h gh schoo phys cs or corequ s te of PHY 105 PHY 112 or 131 *[Sat sf es Genera Stud es Requ rement N3]*

107 Freehand Drawing and V sualization. 1 F, S SS
Representat ona draw ng from d rect observat on to ass st v sua zat on, spat a awareness and per ept on Tech n ques nc ude contour, gesture and va ue draw ng Media nc ude penc and computer graph cs 3 hours ab

210 Engineering Mechanics I. Statics. 3 F S SS
Force systems resu tants equ br um d str buted forces, area moments f u d stat cs nterna stresses, fr ct on en ergy cr ter on for equ br um and stab ty Lecture rec ta t on Prerequ s tes ECE 106 MAT 271 or 290, PHY 121, 122

301 Electrical Networks I. 4 F S SS
ntroduct on to e ectr ca networks Component mode s, trans ent and steady state ana ys s Lecture rec tat on ab Prerequ s tes· ECE 106 MAT 274· PHY 131 132

312 Engineering Mechanics II: Dynamics. 3 F S SS
K nemat cs and k net cs of part c es trans at ng and rotat *ng coord nate systems, r g d body k nemat cs dynam cs* f systems of part c es and r g d bod es energy and mo mentum pr nc p es Lecture rec tat on Prerequ s te· ECE 210

313 Introduction to Deformable Solids. 3 F S SS
Equ br um stra n d sp acement re at ons, stress stra n temperature re at ons App cat ons to force transm ss on and deformat ons n ax a tors ona and bend ng of bars Comb ned oad ngs Lecture, rec tat on Prerequ s tes. *ECE 210 MAT 274*

333 Electrical Instrumentat on. 3 F S SS
Survey of e ectron cs as app ed to nstrumentat on meas urements D odes trans stors bas c trans stor amp f ers op amps d g ta og c gates as app ed to e ectr ca and e e t on c nstruments E ectr ca sensors transducers Lecture ab. Prerequ s te ECE 301

334 Electronic Devices and Instrumentation. 4 F S, SS
App cat on of e ectr c network theory to sem conductor d screte and ntegrated c rcu ts E ectronic dev ce and c r cu t app cat ons aboratory c rcu t de gn test ng and ver f cat on Lecture rec tat on ab Prerequ s te ECE 301

340 Thermodynamics. 3 F S, SS
Work, heat and energy transformat ons, re at onsh ps be tween propert es aws, concepts and modes of ana ys s common to a app cat ons of thermodynam cs n eng *neer ng* Lecture rec tat on Prerequ s 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 re at on to properties App cat on to eng neer ng prob ems Lecture Prerequ s tes CHM 114 or 116 PHY 121

351 Engineering Materials. 3 F S
Structure and behav or of c v eng neer ng mater a s Laboratory nvest gat ons and test cr ter a Lecture, lab Prerequ s te: ECE 313

352 Properties of Electronic Materials. (3 F S, SS
ntroduct on of Schrod nger wave equat on, treatment of potent al barr er prob ems n wave mechan cs hydrogen atom and the per od c tab e, bonds of crysta s free e ec tron mode the band theory of so ds, sem conductors, n troduction of sem conductor dev ces, superconductor d e ectr c and magnet c propert es of e ectron c mater als Prerequ s tes ECE 333 or 334 MAT 274.

383 Probability and Statistics for Engineers. 2 F, S SS
Probab ty, random var ab es d screte and continuous d s tr but ons, descr pt ve stat st cs and samp ng d str but ons Prerequ s te MAT 272 or MAT 291 *[Sat sfies Genera Stud es Requ rement: N2]*

384 Numerical Analysis for Engineers I. 2 F, S
Numer ca so ut on of a gebra c and transcendenta equa t ons and systems of near equat ons Numer ca ntegra t on Curve f tt ng Error bounds and error propagat on Emphas s on use of d g ta computer Prerequ s tes. ECE 105, MAT 272 or 291

385 Numerical Analysis for Engineers II. 2 S
Cont nuat on of ECE 384 Numer ca so ut on of part a d f ferent a equat ons and m xed equation systems Introduc t on to exper menta des gn and opt m zat on techn ques Prerequ s te. ECE 384.

386 Partial Differential Equations for Engineers. 2 F S
Boundary value problems separat on of vanab es, Four er ser es as app ed to n t'a boundary va ue prob ems Pre requ s te MAT 274

400 Engineering Communications. (3 F S, SS
P ann ng and prepar ng eng neer ng pub cat ons and ora presentat ons, based on d rected brary research related to current engineer ng top cs Prerequ s te sen or stand ng n an eng neer ng f e d and comp et'on of f rst year Eng sh requ rements p us sophomore cr t ca wr t ng course *[Sat sf es Genera Stud es Requirement L2]*

500 Research Methods: Probability and Statistics for Engineers. 2 F, S SS
Probab ty, random var ab es, d screte and cont nuous d s tr but ons descr pt ve stat st cs and samp ng d str but ons Open on y to students w thout prev ous credit for ECE 383. Prerequ s te MAT 272 or MAT 291

Special Courses: ECE 294 394, 484 494 498 499, 591 See pages 43–44

SOCIETY, VALUES AND TECHNOLOGY

STE 201 Technology and Social Change. 2 A
Techno ogy as related to soc a change contemporary m pact of technology on soc ety Cross sted as HPS 201. *[Sat sf es General Stud es Requ rement HU]*

310 Man and Machine. 2 A
Re at on of man to mach ne exam ned n h stor ca , po t ca and soc a terms Compar sons w th a ook at art f c a ntel gence stud es Cross sted as HPS 321 *[Sat sf es General Stud es Requirements. HU H]*

311 Science and Technology in History. 3 F, S
Development and app cat on of sc ent f c th nk ng from anc ent t mes through the 17th century Cross l sted as HPS 322 *[Sat sf es General Studies Requ rements HU, H]*

312 Science and Technology in History. 3) F S
Development and app cat on of sc entif c th nk ng from the 18th century to the present Cross listed as HPS 323 *[Sat sf es General Stud es Requ rements. HU H]*

402 Technology, Society and Human Values. 3 A
Va ues wh ch mot vate mank nd to create technology Ar eas of conf ct and reso ut on between bas c human va ues and techno ogy. Read ng and d scuss on w th v s t ng lec turers Cross sted as HPS 402. Prerequ s te jun or stand ng or above *[Sat sfies Genera Stud es Requ re ment. HU]*

Special Courses: STE 394, 484 492, 493, 494 498 499 591 See pages 43–44

Chemical, Bio and Materials Engineering

Joseph D. Henry, Ph.D., Chair
(COB B-210L)

Historically, materials have had a tremendous impact on the advancement of civilization as re flected in the words "stone," "bronze," "iron," and "paper" attached to the various ages in the devel opment of society. Until recently an arbitrary distinction was made between chemically reactive materials and relatively inert solid phase materi als. As our technological know how advances, we recognize that the fundamental principles, the mo lecular 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 sys tems 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 sci entists and engineers dealing with the engineered materials be comprehensive, covering all aspects of the materials world.

Similarly, the human body and other living sys tems 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 trans fer and other familiar principles. Therefore, it is appropriate that chemical, bio and materials engi neers work together in both education and re search.

Students aspiring to be engineers in either the chemical, bioengineering or materials areas must prepare to solve a wide variety of problems utiliz ing chemistry, physics, mathematics, life sciences and engineering sciences. As professionals in in dustry they will apply these fundamentals to crea tively develop, economically design, and produc tively operate systems, constituent equipment, and specialized analytical facilities.

The department offers three B.S.E. degrees: one in Chemical Engineering, one in Bioengineering, and one in Materials Science and Engineering. A B.S.E. degree program in Premedical Engineering is also available at ASU; it is described separately on pages 363-365.

Chemical Engineering—B.S.E.

PROFESSORS:
BERMAN, DORSON, GUILBEAU, HENRY, KUESTER, SATER, ZWEBEL
ASSOCIATE PROFESSORS:
BECKMAN, BELLAMY, CALE, TORREST
ASSISTANT PROFESSORS:
BEZANSON, BURROWS, RAUPP
PROFESSORS EMERITI:
REISER, SHAW

Chemical engineers are generally concerned with chemical change. They design and operate processes which 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, drugs and health care industries, where they practice in a wide variety of occupations, like 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 HL and SB type courses (see page 314, General Studies, for special requirements since CHE 351 and 352 must be taken to satisfy literacy and critical inquiry elective.

Engineering Science 44
CHE 461, CHM 116, 331, 441, 442, ECE 105, 210, 301, 313, 333, 384, 385; MAT 291 or 271 and 272 or 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 freshmen 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 emphasis 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 on attending medical 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 will not be counted toward the Chemical Engineering bachelor's degree.

Biochemical. Students wishing to prepare for a career in biotechnology, pharmaceuticals, fermentation, food processing, and other areas within biochemical engineering should select from.

Chemical-content elective: CHM 361, 461.

Technical electives: CHE 475, 476, 477, AGB 425, 426.

Environmental Students interested in the management of hazardous wastes and air and water pollution should select from:

Chemical content elective: CHM 361, 461, 481; CEE 361.

Technical electives: CHE 494 (Pollution Topics), 533, 553; CEE 362, 561, 563, 564; EEE 461

Materials. Students interested in the development and production of new materials such as ceramics, polymers, semiconductors, composites, superconductors, and alloys should select from

Chemical content elective. CHM 438, 453, 471; CHE 458.

Technical electives: BME 318; ECE 350, 352; MSE 431, 470, 471, 472.

Semiconductor processing Students who are interested in the development and manufacturing of semiconductor and other electronic devices should select from

Chemical content elective: CHE 458

Technical electives ECE 352; MSE 472; EEE 435, 436.

Process engineering. The engineering core and required chemical engineering courses serve as a suitable background for students intending to enter the traditional petrochemical and chemical process industries. Students can build on this background by selecting courses with the approval of their advisor. Examples:

Energy conversion and conservation. CHE 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

			Semester Hours
First Semester			
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 Lab	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 Laboratory	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)			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	Professiona Seminar	0
ECE	333	Electrical Instrumentation	3
ECE	400	Engineering Communications	3
Technical Elective			6
General Studies Elective (HU or SB [1]			3
		Tota	18

Degree Requirements 133 semester hours plus English proficiency.

[1] See pages 50–80 for requirements and approved list.

Bioengineering—B.S.E.

PROFESSORS:
CHEN, DORSON GUILBEAU
ASSOCIATE PROFESSORS:
KEARFOTT TOWE
ASSISTANT PROFESSOR:
W NTERS

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 ASU *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 which have been selected to meet all university requirements and ABET accreditation requirements:

			Semester Hour
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	3
		or CHM 331 General Organic Chemistry (3)	
BME	413	Physiological Instrumentation	3
BME	417	Biomedical Engineering Design	3
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			16
		Total	51

Bioengineering Areas of Emphasis

Students interested in a career in bioengineering may elect to emphasize either biochemical, bioelectrical, 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: ECE 333, 340, 350 and CHE 461. Technical electives must include: CHM 331, 332, 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, 352 and EEE 221 ECE 312 is not required in the engineering core. Technical electives must include: BME 414, ECE 334; EEE 302 and 303 Remaining technical electives will be selected from BME 412, 419, 520, or 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 contro and the study of human motion. The following courses are required in the engineering core ECE 340, 350, 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, 352 and EEE 221. ECE 312 is not required in the engineering core. Technical electives will include: BME/EEE 461, 465 and PHY 361 Remaining technical electives will be 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: ECE 313, 333; CHE 461; CHM 441, 442. Technical electives must include CHE 311, 312, 342; ECE 312 and BME 419.

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	10	First Year Composition	3
MAT	29	Calculus I	5
		Total	18

Second Semester

BME	496	Professional Seminar	0
CHM	16	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	2 4	Elementary Differential Equations	3
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab I	1
General Studies Elective HU or SB			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			3
General Studies Elective HU or SB)			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	490	Biomedical Engineering Project	2
BME	496	Professional Seminar	0
MAE	405	Microcomputer Aided Processes for MAE or CHE 461 Process Control 3 or CSC 220 Computer Organization and Assembly Language Programming 4) or EEE 222 Digital Computer Fundamentals (4 or IEE 463 Computer Aided Manufacturing and Control (3	3
Technical Electives			6
		Total	17

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			3
Technical Elective			4
		Total	18

Graduation requirements 133 semester hours plus English proficiency

See pages 50–80 for requirements and approved list of courses

[3] See page 314, General Studies for special requirements and selection of L1 elective.

Except biosystems and biomechanics areas of emphasis.

[4] For biomechanics area of emphasis only

Materials Science and Engineering—B.S.E.

PROFESSORS:
CARPENTER, JACOBSON, STANLEY, WAGNER
ASSOCIATE PROFESSORS:
HENDRICKSON, J. NDAL, KRAUSE
ASSISTANT PROFESSORS:
DEY, SH. N

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 page 314 for School of Engineering requirements.

Engineering core . . . 44
CHM 116, 441; CSC 220 or IEE 463 or MAE 405 or ECE 333; ECE 105, 210 (or PHY 321), 301, 312 (or PHY 322), 313, 350, 353 or 394 or 486), MAT 242, 274, 29 or 271, 272; PHY 361

Major 52
CHE 311, 312, 351, CHM 113, MAE 351; MSE 355, 420, 430, 431, 440, 450, 470, 472, 490

In addition, nine 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	4

MSE	496	Professional Seminar	0
General Studies Elective		HU or SB	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	3
		or PHY 321 Newtonian Mechanics	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	3
PHY	132	University Physics Lab II	1
		Total	17

Second Semester

CHE	312	Introduction to Thermodynamics	3
ECE	301	Electrical Networks I	4
ECE	312	Engineering Mechanics I: Dynamics	3
		or PHY 322 Analytical Mechanics	3
ECE	313	Introduction to Deformable Solids	3
ECE	351	Structure and Properties of Materials	3
MSE	496	Professional Seminar	0
Literacy and Critical Inquiry Elective			3
		Total	19

Third Year

First Semester

CHM	441	General Physical Chemistry	3
CSC	220	Computer Organization and Assembly Language Programming	4
		or IEE 463 Computer Aided Manufacturing and Control 3 or MAE 405 Microcomputer Aided Processes for MAE 3, or ECE 333 Electrical Instrumentation 3	
MAT	242	Elementary Linear Algebra	3
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	19 or 17

Second Semester

ECE	383	Probability and Statistics for Engineers	2
		or ECE 384 Numerical Analysis for Engineers I (2), or ECE 386 Partial Differential Equations for Engineers (2)	
MAE	351	Manufacturing Processes Survey	3
MSE	420	Physical Metallurgy	4
MSE	496	Professional Seminar	0
Technical Elective			3
General Studies Elective		HU or SB	6
		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	496	Professional Seminar	0
Technical Elective			3
General Studies Elective (HU or SB)			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 Material Science	3
MSE	496	Professional Seminar	0
MSE	490	Capstone Design Project	3
Technical Elective			3
		Total	18

Degree requirements: 133 semester hours plus English requirements

See pages 80–80 for requirements and approved list

[1] See page 314 General Studies for specific requirements and selection of 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 app cat on of transport phenomena to mass transfer and the des gn of mass transfer equ pment Prerequ s te CHE 332 Pre or corequ tes CHE 342 442

342 Appl ed Chemical Thermodynamics 3 F S
Energy re at ons and equ br um convers o s 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 dev ces Prerequ s te CHM 116. Corequ s tes CHE 311 CHM 335 *[Sat sf es Genera Stud es Requ re ment L1 f taken w th CHE 352]*

352 Transport Laboratories. 2 S
The demon trat on of transport phenomena pr nc p es w th exper ments n f u d f ow heat and mass transfer. Pre requ s te CHE 331 *[Sat sf es Genera Stud es Req re ment L1 f taken w th CHE 351]*

411 Biomedical Engineering I. 3 F
Rev ew of d agnost and pro thet c methods us ng eng neer ng methodo ogy. ntroduct on to transport, metabo c and autoregu atory processe n the human b dy Cro s sted as BME 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 a and pu monary f u d me chan cs app cat on of mathemat ca mode ng Cross sted as BME 412 Prerequ s te: nstructor approva .

413 Physiological Instrumentation. 3 S
Prob ems concepts and techn ques of b omed ca nstru me tat on n stat c and dynamic env ronments Cross sted as BME 413 Prerequ s tes BME 435 or AGB 435 ECE 333 or 334 *[Sat sf es Genera Stud es Requ rement L2]*

432 Principles of Chemical Engineering Design. 3 F
S z ng of un t operat ons equ pment such as fract onators str ppers, absorbers and extractors w th app cat ons to comp ex ndustr a processes Prerequ s tes CHE 333 342

442 Chemical Reactor Design. 3 F S
App cat on f k net cs to chem ca reactor des gn Pre requ s te CHE 342. Pre or corequ s te CHE 333.

451 Chemical Engineering Laboratory. 2 F
Operat on, cont o and des gn of exper menta and ndus tr a process equ pment ndependent research p o ects 6 hours ab Prerequ s tes CHE 333 352.

458 Semiconductor Material Processing. 3 N
ntroduct on to the process ng and character zat on of e ectron c mater a s for sem conductor app cat ons Pre requ s tes CHE 333 342

461 Process Control. 3 F
Process dynam cs nstrumentat on and feedback app ed to automat c process contro Lecture ab Prerequ s te ECE 301 *[Sat sf es Genera Stud es Requ rement N3]*

462 Process Design. 3 S
App cat on of econom c pr nc ples to opt m ze eq pment se ect on and des gn deve opment and des gn of process systems Prerequ s tes CHE 432, 442

475 Biochemical Engineering. 3 N
App cat on of chem ca e g neer ng methods mass trans fer thermodynam cs transport phenomena to ndustr a b otechno ogy Prerequ s tes CHE 332 342 Pre or corequ s tes CHE 333 442

476 Bioreaction Engineering. 3 N
Pr nc p es of ana ys s and des gn of reactors for process ng w th ce and other b o og ca y act ve mater a s app cat ons of react on eng eer ng n b otechno ogy Pre requ s tes CHE 342 ECE 385 Pre or corequ s tes CHE 333 442

477 Bioseparat on Processes. 3 N
Pr nc p es of separat on of b o og ca y act ve chem ca s the app cat on sca eup and des gn of separat on proc esses n b otechno ogy Prerequ tes CHE 332 333 475 CHM 361

490 Chemical Engineering Projects. 1 5 F S, SS
nd v dua projects n chem ca eng neer ng operat o s and des gn Prerequ s te structor approva

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 re pons b t es Lectures, f e d tr ps

501 Introduction to Transport Phenomena. 3 F, S
Transport phenomena w th emphas s on f u d systems Prerequ s te trans t on student w th nstructor approva

502 Introduction to Energy Transport. 3 F S
Cont nuat on of tran port pr nc p es w th emphas s on en ergy transport stat onary and f u d systems Prerequ s te trans t on student w th nstructor approva

503 Introduction to Mass Transport. 3 F S
T e app cat on of transport phenomena to mass transfer and the des gn of mass transfer equ pment Prerequ s te trans t on student w th nstructor approva

504 Introduction to 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 te trans t student w th nstructor approva

505 Introduction to Chemical Reactor Design. 3 F, S
App cat on of k net cs to chem ca reactor des gn Pre requ s te trans t o student w th nstructor approva

515 Biomedical Transport Processes. 3 N
Pr nc p es of momentum heat and mass transport w th ap p cat ons to med ca and b o og ca systems and med ca dev ce des gn Cross sted a BME 515 Prerequ s te n structor approva

517 Prosthetic and Diagnostic Engineering. 3 N
Cr ter a for mechan ca rep acement or ass stance of or gan funct ons d agnost c methods equ pment and usage ex st ng methodo ogy and future requ rements nc ud ng deta ed des gns Cross sted as BME 517 Prerequ s te nstructor approva

518 Introduction to Biomateria s. 3 F
Top cs nc ude structure property re at onsh ps for syn thet c and natura b omateria s, b ocompat b ty and uses of mater a s to rep ace body parts. Cross l sted as BME 518 Prerequ s te ECE 313 or n tru tor approva

527 Advanced Applied Mathematical Analysis in Chemical Eng'neering. 3 F
Formu at on and so ut on of comp ex mathemat ca re a t onsh ps resu t ng from the descr pt on of phys ca prob ems n mass energy a d mome tum transfer and chem ca k net cs

528 Process Optimization Techn'ques. 3 S
Method for opt m z ng eng neer ng processes Exper men ta des gn and ana ys s near and non near regress on methods, c ass ca , search and dynam c programm ng a gor thms

533 Transport Processes I. 3 F
Un f ed treatment of mome tum heat and mass t ansfer from mo ecu ar t eory and ont n m p nts of v ew Con t nuum equat ons of m cr scop c and macroscop c sys tems mu t component and mu t phase systems Cross sted a BME 533

534 Transport Processes II. 3 S
Cont nuat on of CHE BME 533 emphas z ng mass t ans fer Cross sted as BME 534 Prerequ s te CHE 533 o BME 533

535 Turbulent Mix ng. 3 N
Turbu ence and m x ng n m t component systems w t w thout chem ca react ons Computat ona mode s app ed to chem a processes Prerequ s te CHE 533

536 Convective Mass Transfer. 3 N
Turbu ent f ow for mu t component sy tems nc d ng chem ca react on w th app cat ons n separat ons and a r po ut on Prerequ s te CHE 533 or MAE 571

543 Thermodynamics of Chemical Systems. 3 F
C ass ca and stat st ca thermodynam cs of on dea phys ochem a systems and processe pred ct on of opt mum operat ng c nd t ons C oss sted as BME 543

544 Chemical Reactor Engineer ng. 3 S
React on rates thermodynam c and transport pr nc p es app ed to the de gn and operat on of c em a reactors Cross sted as BME 544 Prerequ s te CHE BME 543

548 Topics in Catalysis. 3 N
Eng neer ng cata ys emp as zes adsorpt on k net cs character zat on d ffu ona cons derat ons and react r des gn Other top cs mechan m surface ana yses and e ect on c structure

553 Air and Water Qua ity Control 3 N
Or g ns of po utants env ronmenta nteract ons and con cerns Phys ca and chem ca processes nc ud ng d sper on part c e mechan cs f trat on samp ng sed me ta t on, coagu at on f tat on ab orpt on Contro techno ogy

554 New Energy Technology 3 N
Gas f cat on quefact on pyro ys s a d c mbust n pr c e se for a wa te and other raw mater a s n s tu pr cesses for coa o ha e and geotherma energy En v ronmenta q a ty ssue

556 Separat on Processes. 3 N
Top cs n b ary mu t con ponent eparat on rate gov erned a d equ brat on proce ses mass transfer cr ter a energy requ reme ts separat ng agents and dev ces staged operat ons

558 Electronic Materia s. 3 N
P ocess ng and character zat n of e ectron c mater a s fo sem onductor type use Thermodynam cs and tran port phenomena pha e equ br a and structure mass transfer d ffus on and therma propert es

561 Advanced Process Control. 3 S
Dynam c proce s representat ear opt ma ont o opt ma state reconstruct on parameter and state est ma t on techn que for c nt nuou and d crete t me systems

562 Chemical Systems Engineering. 3 N
Process dynan c ystems ana ys s computer app ca t ons process contro

563 Chem'cal Engineering Design. 3 N
Computat ona methods the de gn of chem ca p ants and processes

Special Courses: CHE 484 492 493 494 498 499 580 584 590 591 592 593 594 598 599 792 799
See pages 43–44

BIOENGINEERING

BME 318 Biomaterials. 3 A
Mater a propert es of natura and art f c a b omater a s T ssue and b ood b ocompat b ty Uses of mater a s to re p ace 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 ma ors 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 agnost c and prosthet c methods us ng eng neer ng methodo ogy nt oduct o 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 u d me han cs app cat on of mathemat ca mode ng Cross sted as CHE 412 Prerequ s te nstructor approva

413 Physio ogical Instrumentation. 3 F
Prob ems concepts and techn ques of b omed ca nstru mentat on n stat c and dynam c env ronments Cross sted as CHE 413 Prerequ s tes BME 435 or AGB 435 ECE 333 or 334 *[Sat sf es Genera Stud es Requ rement L2]*

414 Biomedical Instrumentation. 3 F
E ectr ca phys ca and mechan ca pr nc p es govern ng the operat on of modern b omed ca nstrumentat on n c ud ng b osen ors EEG ECG recorders u trason c mag ng d agnost c dev ces Prerequ s tes ECE 334, MAT 274

415 Biomedical Transport Processes. 4 A
Pr nc p es of momentum heat and mass transfer w th ap p cat ons to med ca and b o og ca systems and med ca dev ce des gn Prerequ s tes MAT 274· PHY 131

416 Biomechan cs. 3 S
Mechan ca propert es of bone musc e and soft t ssues Stat c and dynam c ana ys s of human movement tasks such as ocomot on Prerequ s te ECE 313 Corequ s te ECE 312

417 Biomedical Engineering Design. 3 A
Techn ca regu atory econom c ega soc a and eth ca aspects of med ca dev ce systems eng neering des gn Prerequ s te sen or stand ng n B oeng neer ng or nstruc tor approva

419 Biocontrol Systems. 3 F
App cat o of near and non near contro systems tech n ques toward ana ys s of neuromuscu oske eta , card o va cu ar therma and mass transfer systems of body Pre requ s tes ECE 301 MAT 274

435 Animal Physiology I 4 F
Contro a d funct on of the nervous muscu ar card ovas cu ar resp ratory and rena ystems of domest c an ma s Lecture ab Cross sted as AGB 435 Prerequ s tes. BIO 181 CHM 113

436 Animal Physiology II. 3 N
Contro and funct on of the endocrine d gest ve and repro duct ve systems of domest c an ma s Pr nc p es of adap tat on of an ma s to the r env ronment Prerequ s te: BME 435 or ZOL 360

437 An mal Physiology Laboratory. 1 N
Se ected phys o og ca 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, sh e d ng and meas urement techn ques for cosmogen c terrestr a and a thropogen c rad at on on z ng and non on z ng rad at on theory ALARA concept Emphas s on nstrumentat on detectors and env ronmenta mon tor ng Lecture ab. Cross sted as EEE 461 and NUC 461 Prerequ s te ECE 301.

465 Clin'cal Nuclear Engineering I. 3 N
Fundamenta s of c n ca nuc ear eng neer ng and med ca hea th phys cs pract ce. Rad at on b o ogy dos metry and sh e d ng for rad otheraphy and d agnost c procedures Cross sted as EEE 465 and NUC 465 Prerequ s te n structor approva

490 Biomed cal Engineering Projects. 1 5 F S SS
nd v dua projects n med ca systems or med ca dev ce des gn and deve opment

496 Profess onal Seminar. 0 F S
Profess ona and eth ca aspects w th a d scuss on of emp oyment opportun t es and respons b t es Lecture f e d tr ps

511 Biomedical Engineering. 3 A
D agnost c and prosthet c methods us ng eng neer ng methodo ogy Transport metabo c and autoregu atory processes n the body

512 Biomedical Engineering II. 3 A
E ectrophys o ogy and nerve pac ng app cat ons ntroduc t on to b omechan cs and jo nt/ mb rep acement, techno ogy card ovascu ar and pu monary f u d mechanics mathemat ca mode ng

513 Physiological Instrumentation I. 3 A
Prob ems concepts and techn ques of b omed ca nstru mentat on n stat c and dynam c env ronments.

514 Biomedical Instrumentation. 3 F
E ectr ca phys ca and mechan ca pr nc p es govern ng the operat on of modern b omed ca nstrumentat on. Pre requ s tes ECE 334 MAT 274

515 Biomedical Transport Processes. 3 N
Pr nc p es of momentum heat and mass transport w th ap p cat ons to med ca and b o og ca systems and med ca dev ce des gn Cross sted as CHE 515. Prerequ s te n structor approva

516 Topics n Biomechanics. 3 S
Mechan ca propert es of bone muscle and soft t ssues Stat c and dynam c ana ys s of human movement tasks nc ud ng n depth project Prerequ s tes ECE 312 313, or nstructor approva

517 Prosthetic and Diagnostic Engineering. 3 N
Cr ter a for mechan ca rep acement or ass stance of or gan fu ct ons d agnost c methods equ pment and usage ex st ng methodology and future requ rements, nc ud ng deta ed des gns Cross sted as CHE 517 Prerequ s te nstructor approva

518 Introduction to Biomaterials. 3 F
Top cs nc ude structure property re at onsh ps for syn thet c and natura b omater a s b ocompat b ty and uses of mater a s to rep ace body parts. Cross sted as CHE 518. Prerequ s te ECE 313 or instructor approva

519 Topics in Biocontrol Systems. 3 F
L near and non near contro systems ana ys s of neu romusculoske eta card ovascu ar, thermal and mass transfer systems of body nc ud ng n depth pro ect Pre requ s te MAT 274

520 Bioelectric Phenomena. 3 N
Study of the or g propagat on and nteract ons of b o e ectr c ty in v ng th ngs vo ume conductor prob em, mathemat ca ana ys s of b e ectr c nteract ons, ses med ca d agnost cs

521 Neuromuscular Control Systems. 3 S
Overv ew of ensor motor bra n struct res. App cat on of non near adapt ve, opt ma and superv sory contro the ory to eye head hand coord nat on ocom t on

522 Biosensor Design and Application. 3 A
Theory and pr nc p es of b osensor des gn and app cat on n med c ne and b o ogy Pr nc p es of measurements w th b osensors Prerequ s te nstructor approva .

532 Prosthet'c and Rehabilitation Engineering. 3 A
Ana ys s and cr t ca assessment of des gn and contro strateg es for state of the art med ca dev ces used n e hab tat on eng neer ng Prerequ s tes ECE 312 313 BME 435 BME 416 or PED 610 CoreqU s te BME 419

533 Transport Processes I. 3 F
Un f ed treatment of momentum heat and mass t an fer from mo ecu ar theory and cont nuum po nts of v ew Con t nuum eq at ons of m croscop c and macroscop c sys tems mu t component and mu t phase systems Cross sted as CHE 533

534 Transport Processes II. 3 S
Cont nuat on of BME CHE 533 emphas z ng mass trans fer Cross sted as CHE 534 Pre equ s te BME/CHE 533

543 Thermodynamics of Chemical Systems. 3 F
C ass ca and stat st ca thermodynam cs of non dea phys ochem ca systems and proces es pred ct on of opt mum operat ng cond t ons Cro s sted as CHE 543

544 Chem cal Reactor Engineering. 3 S
React on rates thermodynam cs and transport pr nc p es app ed to the des gn and operat on of chem ca reactors Cross sted as CHE 544 Prerequ s te BME/CHE 543.

566 Medical Imaging Instrumentation. 3 N
Des gn and ana ys s of mag ng systems and nuc ear de v ces for med ca d agnos s therapy and research Labo ratory exper ments us ng d agno t c rad o ogy f uoros copy u trasound and CAT scann ng Lecture, ab Cross sted as EEE 566 a d NUC 566 Prerequ s te BME/EEE/ NUC 465 or nstructor appr va

567 Radiation Sh'elding and Transport. 3 F
Sh e d ng for rad at on therapy d agnost c radio ogy cyc o trons and nuc ear reactors Monte Car o and emp r cal computat ona methods regu at ons, des gn prob ems Cross sted as EEE 567 and NUC 567

568 Medical Tomography. 3 S
CT SPECT PET. MR Three d mens ona *n v vo* meas urements nstrument des gn phys olog ca mode ng c n ca protoco s reconstruct on a gor thms quant tat on ssues Cross sted as EEE 568 a d NUC 568

569 Radiochemistry and Rad'opharmaceutical Production. 3 N
Advanced pr nc p es of cyc otron des gn targetry opera t on and ut zat on Nove synthes s tracer preparation qua ty contro b od str but on stud es Cross sted as EEE 569 and NUC 569

Special Courses· BME 294 394 484 492 493, 494, 498, 499 584, 590 591 592, 593 594, 598 599 792 799 See pages 43–44

MATERIALS SCIENCE AND ENGINEERING

MSE 355 Introduction to Metallurgy. 3 S
E ements of the structure of meta s and a oys measure ment of mechan ca properties and opt ca meta ography F e d tr ps Lecture ab Prerequ s te CHM 114 or 116

420 Physical Metal urgy. 4 F
Cry ta structure and defects Phase d agrams meta o graphy so d f cat on and ca t ng deformat on and annea ng Lecture ab Prerequ s te ECE 350

430 Thermodynamics of Materia s. 3 N
Pr nc p es of stat t ca mechan cs stat st ca thermody nam cs of s ng e crysta s so ut ons phase eq br m free energy of react ons free e ectron theory thermody nam cs of defects Prerequ s te CHE 312 or ECE 340

431 Corrosion and Corrosion Control. 3 S
ntroduct on to corros on mechan sms and methods of pre vent ng corros on Top cs e ectrochem stry po ar zat on corros on rates x dat on coat ngs cathod c protect on Prerequ s te ECE 350

440 Mechanical Properties of Sol ds. 3 S
Effe ts of env onmenta and m crostructura var ab es of mechan ca propert es p ast c deformat on fat gue creep br tt e fracture nter a fr t on Prerequ s te ECE 350

441 Analysis of Material Failures. 3 S
dent f cat on of types f fa ures Ana yt ca techn ques Fractography SEM nondestruct ve nspect on meta o graphy Mechan a and e ectron c comp nents. Prerequ s te ECE 350

450 X-Ray and Electron Diffraction. 3 F
Fundamenta s of X ray d ffract on tra sm 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 oure cence 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 c mpos te systems Prerequ s te ECE 350

471 Introduction to Ceramics. 3 F
Pr nc p es of st ucture, property re at ons n ceram c mate r a s Process ng techn ques App cat ons n mechan ca e ectron c and supe conduct ng systems Prerequ s te ECE 350

472 Integrated Circuit Materials Science. 3 N
Pr nc p e of mater a s sc ence app ed to sem conductor proces ng and fabr cat on n meta s ceram cs po ymers and sem conductors

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 character zat on Prerequ s tes CHE 351 ECE 350

480 Manufacturing Engineer ng. 3 F
Ana ys s and opt m zat on of manufactur ng processes Prerequ s te ECE 350

482 Materials Engineering Design. 3 F S
Pr nc p es of the des gn process Feas b ty and opt m za t on. Manufactur ng processes mater a s se ect on fa ure ana ys s and econom cs Prerequ s tes ECE 313, 350

490 Capstone Design Project. 1 3) F, S
For sma g oups n fundamenta or app ed aspects of en g neer ng mater a s emphas s on exper menta 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 t es Lectures f e 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 Open on y to trans t on student w th nstructor approva

511 Corrosion and Corrosion Control. 3 S
ntroduct on to corros on mechan sms and methods of pre vent ng corros on Top cs e ectrochem stry, po arizat on, corros on rates ox dat on coat ngs cathod c protect on. Open on y to trans t on students w th nstructor approva

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 ography Mechan ca and e ectron c components Open on y to trans t 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 po ymers Des gn propert es and behav or of f ber po ymer compos te systems Open on y to trans t on students 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 annea ng Lecture ab Open on y to trans t on student with n structor approva

515 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 Open on y to trans t o student w th n structor approva

520 Theory of Crystalline Solids. 3 F
An sotrop c propert es of crysta s tensor treatment of e as t c, magnet c e ectr c and therma propert es, crysta ogra phy of Martens t c transformat ons

521 Defects in Crystalline Solids. 3 S
Introduct on to the geometry, interact on and equ brium between d s ocations and po nt defects. Re at ons be tween defects and propert es w be d scussed Prerequ site ECE 350 or nstructor approva

530 Metallurgical Thermodynamics and Kinetics. 3) S
Thermodynam cs of a oy systems d ffu on n sol ds, k net cs of prec p tat on and phase transformat ons n sol ds Prerequ s 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 rre vers b 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 the ory, des gn and app cat ons Cross sted as MAE 537 Prerequ s te MAE 581

540 Fracture, Fatigue and Creep. 3 F
Re at onsh p between m crostructure and fracture fat gue and creep propert es of mater a s Env ronmenta effects recent deve opments Current theor es and exper menta resu ts Prerequ s te MSE 440 or equ va ent

549 Manufacturing Analysis. 3) S
Ana ys s and opt m zat on of manufactur ng processes Prerequ s te MSE 480

550 Advanced Materials Characterizat on. 3 N
Ana yt ca nstrumentat on for characterizat on of mater a s; SEM, S MS, Auger ana yt ca TEM and other ad vanced research tech ques

556 Electron M croscopy 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 corequ s te MSE 559 or SEM 559

558 Electron Microscopy I. 3 F
M croana ysis of the structure and compos t on of mater a s us ng mages d ffract on and X ray and energy loss spectroscopy Know edge of e ementary crysta ography rec proca att ce 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
M croana ys s of the structure and compos t on of mater a s us ng mages, d ffract on and X ray and energy oss spectroscopy Knowledge of e ementary crysta ography rec proca att ce stereograph c projections and comp ex var ab es requ red Cross sted as SEM 559 Prerequ s te. nstructor approva

560 Strengthen ng Mechan sms. 3 S
Deformat on of crysta ne mater a s Propert es of d s oca t ons Theor es of stra n harden ng so d so ut on prec 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 p tat on react ons, shear d sp ac ve react ons, order d sorder transformat on

562 Ion Implantation. 3 S
Inc udes defect product on and annea ng Genera zed treatment nc ud ng on mp antat on, neutron rrad at on damage and the nteract on of other nc dent beams Pre requ s te MSE 450.

570 Polymer Structure and Properties. 3 F
Re at onsh ps between structure and propert es of syn thet c po ymers g ass trans t on, mo ecu ar re axat ons crysta ne state v scoe ast c ty, morpho og ca character zat on process ng

571 Ceram cs. 3 A
nc udes ceram c process ng cast ng, mo d ng f r ng s n ter ng, crysta defects mechan ca e ectron c and phys ca propert es w be ncluded. Prerequ s tes MSE 521 561

572 Semiconductor Phase Diagrams. 3 A
Ana ys s of b nary and ternary phase d agrams and appl cat on to sem conductor growth and vapor and qu d 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 an sotrophy, magnetastrict on Study of commerc a magnet c mater a s Prerequ s te MSE 520 or equ va ent

Special Courses: MSE 484, 492, 493, 494 498 499 500 584, 590 591, 592 593 594 598 599 600 690, 691 692 693, 791, 792 799 See pages 43–44

Civil Engineering

PROFESSORS:
EC G 136A , BETZ
W HOUSTON, KLOCK, LUNDGREN,
MATTHIAS O BANNON, RUFF,
S NGHAL, TUMA

ASSOCIATE PROFESSORS:
DUFFY H NKS, MAMLOUK
RADWAN, UPCHURCH

ASSISTANT PROFESSORS:
FAFIT S, S. HOUSTON KREAMER,
RAJAN ZAN EWSKI

PROFESSORS EMERITI:
BLACKBURN, BORGO P AN

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 ef ficient 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 main tenance of many types of buildings for govern ment, commerce and industry for example, high rise office towers, factories, schools, air ports, tunnels and subway systems, dams, canals, and water purification and environmental protec tion facilities such as so id waste and wastewater treatment systems. C vil engineers are concerned with the impact of their project 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 com pleted one year of h gh school chem stry and one year of high school physics with grades of "B" or better in each subject. Students who do not meet these requirements will take CHM 113 116 in lieu of CHM 114 and PHY 111 113 s required as a prerequisite to PHY 121 122. For international students, an official TOEFL score of 550 is re quired.

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 will be 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	
CEE	321	Structural Analysis	3
CEE	322	Steel Structures	3
CEE	325	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	Capstone in Civil Engineering Practice	
IEE	300	Economic Analysis for Engineers	2
MAE	371	Fluid Mechanics	3
		Total	34

Civil Engineering Designated Design Electives (minimum of 2 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

(minimum 12 hours required)

A maximum 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	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			3
		Total	5

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	322	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			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	37	Fluid Mechanics	3
Literacy and Critical Inquiry Elective[2]			3
Humanities and Fine Arts Elective			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			3
		Total	18

[1] See pages 50–80 for requirements and approved list

[2] See page 314, General Studies, for special requirements and selection of 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 (page 195).

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

CIVIL ENGINEERING

CEE 296 Introduction to Civil Engineering. 1 F S
Introduction to the profession Description of areas of specialization Degree requirements academic standing and advising procedures Introduction to faculties Prerequisite freshman standing

310 Testing of Materials for Construction. 3 F S
Structural and behavioral characteristics engineering properties measurements and application of construction materials Lecture laboratory Not open to engineering students Prerequisite CON 323

321 Structural Analysis. 3 F S
Statically determinate and indeterminate structures by classical and matrix methods trusses beams and frames 2 Lecture 2 hour recitation Prerequisite: ECE 313

322 Steel Structures. 3 F S
Behavior of structural components and systems Design of steel members and connections Part a design of a steel building system Lecture, recitation Prerequisites CEE 321 completion of engineering core except ECE 400 Minimum core grade requirements satisfied

323 Concrete Structures. 3 F, S
Behavior of concrete structure design of reinforced and prestressed concrete members including footings Part a design of concrete building system Lecture recitation Prerequisites CEE 321, completion of engineering core except ECE 400 . Minimum core grade requirements satisfied.

340 Hydraulics and Hydrology. 3 F S
Application of hydraulic engineering principles to flow of liquids in pipe systems and open channels hydrostatics characteristics of pumps and turbines Introduction to hydrology Not open to engineering students Lecture laboratory Prerequisite CON 221

341 Hydraulic Engineering. 4 F S
Fundamental principles and methods of fluid mechanics forming analytical basis for water resources engineering. Flow in conduits and open channels Introduction to hydrology Lecture, laboratory Prerequisites MAE 371 completion of engineering core except ECE 400 Minimum core grade requirements satisfied

351 Soil Mechanics. 4 F S
Index properties and engineering characteristics of soils. Compaction, permeability and seepage, compressibility and settlement and shear strength Lecture, laboratory Prerequ

s te CEE 321 comp et on of eng neer ng core except ECE 400 M n mum core grade requ rements sat sf ed

361 Environmental Eng neering. 3 F S
Natura env ronment water resources hydro og c cyc e chem stry of natura waters qua ty requ rements and wa ter treatment water d str but o systems Corequ s te CEE 341

362 Environmental Engineering. 3 F S
Natura env ronment the carbon cyc e a d b ochem stry of wastes pr nc p es of waste treatment dra nage systems Prerequ s te CEE 361

371 Introduction to Urban Planning. 3 N
Theoret ca and pract ca aspects of c ty p ann ng nte re at onsh ps among phys ca p ann ng env ronment gov ernment and soc ety Not acceptab e as a techn ca e ec t ve for CEE students *[Sat sf es Genera Stud es Requ re ment L1]*

372 Transportation Engineer ng. 4 F S
H ghway ra water and a r tran portat on Operat ona character st cs and traff c contro dev ces of each transport mode mpact on urban form Pre equ s te same as CEE 322.

400 Microcomputer Applications in Civi Engineer ng. 3 F S
Deve opment of m crocomputer teracy n c v eng neer ng app cat ons. Pre equ tes 3 f the fo ow ng CEE courses· 321 341 351, 361, 3 2 ECE 106 *[Sat sf es General Stud es Requ rement. N3]*

412 Pavement Analysis and Design. 3 F
Des gn of f ex b e and r g d pavements for h ghways and a rports Surface, base subgrade courses Cost ana ys s and pavement se ect on Prerequ s tes CEE 351 ECE 351

423 Structural Design. 3 F
Ana ys s and des gn of tructura sy tems Lect re ab Prerequ s tes CEE 322 323

432 Matr x and Computer Applications in Structural Eng neering. 3 S
Matr x and computer app cat ons to structura eng neer ng and structura mechan cs St ffness and f ex b ty methods f n te e ements d fferences Prerequ s te· CEE 321

441 Water Resources Eng neering. 3 S
App cat on of the pr nc p es of hydrau cs and hydro ogy t the eng neer ng of water resources projects des gn and operat on of water resources systems, water qua ty Pre requ s te CEE 341

450 Soil Mechanics in Construction. 3 F, S
So mechan cs as app ed to the construct on f e d foun dat ons h ghways reta n ng wa s and s ope stab ty Re at onsh p between so character st cs and geo og c forma t ons Not open to eng neer ng students Lecture ab Pre requ s te CON 323

452 Foundations. 3 F S
App cat o s of so mechan cs to foundat on ystems bear g capac ty atera earth pressure s ope stab ty Prerequ s te CEE 351

466 Sanitary Systems Design. 3 F
Capac ty, p ann ng and des gn of water supp y domest c and storm dra nage and so d waste systems Prerequ s te· CEE 361 or 362

471 Planning and Design of Urban Systems 3 F
For students n c ty p ann ng urban systems c v eng neer ng and re ated areas work ng as nterd sc p nary p ann ng and des gn teams Effect of econom c base, em p oyment and popu at on on urban and use requ rements Locat on and requ red capac ty of urban systems to serve urban and uses Lecture ab Prerequ s te se or stand ng.

475 Highway Geometric Design. 3 S
Des gn of the v s b e e ements of the roadway Fundamen ta des gn contro s w th app cat on to rura roads at grade ntersect ons, freeways and nterchanges Lecture rec ta t on Prerequ s te· CEE 372

496 Topics in Civ l Engineer ng Practice. 1 F S
Profess ona eng neer ng pract ce. Interv ew ng and résumé wr t ng profess ona reg strat on requ rements cont nu ng educat on graduate study f nanc a p ann ng and emp oyment Prerequ s te sen or stand ng

512 Pavement Performance and Management. 3 S
Pavement management systems nc ud ng data co ect on eva uat on opt m zat on econom c ana ys s and computer app cat on for h ghway and a rport des gn Prerequ s te CEE 412

514 Bituminous Materials and Mixture. 3 F
Types of b tum nous mater a s used n pavement m xtures C em ca compos t on and phys ca propert es des rab e aggregate character st cs, opt mum aspha t contents Lec ture ab Prereq s te ECE 351

515 Design and Behavior of Portland Cement Concrete Mixtures. 3 S
Propert es of cements and aggregates M x des gn for strength and durab ty requ rements Fa ures caused by chem ca react on weather ng and oad ng Prerequ s te ECE 351

521 Stress Analysis. 3 F
Advanced top cs n the ana yt ca determ nat on of stress and stra n Prerequ s te CEE 321.

524 Advanced Steel Structures. 3 S
Strength propert e of stee and the r effects on structura behav or E ast c des gn of stee structures P ast c ana y s s and de gn of beams frames and bents P ast c de f ect ons P ast c des gn requ rements. Mu t st ry bu d ngs Prerequ s te CEE 322

526 Finite Element Methods in Civil Engineering. 3 F
F n te e ement formu at on for so ut ons of structura ge otech ca and hydrau c prob ems Prerequ s te CEE 432

527 Advanced Concrete Structures. 3 F
E ast c u t mate strength and y e d ne theory Def ect on tors on shr nkage and p ast c f ow Prestressed concrete spec a systems Prerequ s te CEE 323

528 Stabi ity of Structures. 3 F
E ast c and ne ast c buck ng of ro ed and co d formed co umns and beams Stab ty of p ates, r g d frames and trusses. Prerequ s tes CEE 322 nstructor approva

529 Complex Structures. 3 S
C ass ca and numer ca nvest gat ons of near and non n ear structures composed of f at and curved surfaces and near or curv near e ements Prerequ s te nstructor ap prova

531 Theory of Structures. 3 F
Genera theorems re at ng to e ast c ystems def ect on of trusses and beams stat ca y ndeterm nate trusses beams, r ngs arches and frames by cons stent deforma t on east work and e ast c enter hor zonta y curved members n bend ng and tors on Prerequ s te CEE 21

533 App ied Optimal Des gn. 3 S
L near and non near programm ng Prob em formu at on Des gn sens t v ty ana ys s FEM based opt ma des gn of structura and mechan ca systems Prerequ s te gradu ate stand ng or nstructor approva

536 Dynamics of Structures. 3 S
Structures and structura members sub ected to dynam c oad ngs respo se spectra theory emphas z ng earth quake app cat ons nvest gat ons of the response of mu

t degree of freedom structures matr x methods of ana y sis Lecture rec tat on Prerequ s tes CEE 321, nstructor approva

537 Topics in Structural Engineering. 1 3 F S
Advanced top cs nc ud ng w nd eng neer ng earthquake eng neer ng probab st c concepts opt m zat on and be hav or of structura systems Prerequ s te nstructor ap prova

540 Groundwater Hydrology. 3 F
Phys ca propert es of aqu fers groundwater exp orat on we construct on and pump ng subsurface f ow mode ng and subs dence groundwater po ut on and water r ghts Prerequ s te CEE 341 or nstruct r approva

541 Surface Water Hydrology. 3 S
Hydro og c cyc e and mechan sms nc ud ng prec p tat on, evaporat on and transp rat on, hydrograph ana ys s f ood rout ng stat st ca methods n hydro ogy hydro og c de s gn Prerequ s te CEE 341 or nstructor approva .

542 Water Resources Systems Planning. 2 F 89
Ph osophy of water resources p ann ng, econom c, soc a and eng neer ng nteract on ntroduct on t the theory and app cat on of quant tat ve p ann ng methodo og es n water resources p ann ng Guest ecturers and case stud es Prerequ s te nstructor approva

543 Water Resources Systems I. 3 S 90
Theory and app cat on of quant tat ve p ann ng methodo o g es for the design and operat on of water resources sys tems c ass projects us ng computer, case stud es Core qu s te CEE 542 or nstructor approva

544 Water Resources Systems II. 3 F 90
Advanced computer or ented workshop n the app cat on of quant tat ve p ann ng techn ques to the des gn and op erat on of water resources system Prerequ s te CEE 543

545 Foundations of Hydraulic Engineering. 2 S 91
Rev ew of ncompress b e f u d dynam cs. F ow n p pes and channe s unsteady and var ed f ows wave mot on Prerequ s te CEE 341

546 Free Surface Hydraulics. 2 F 89
Deriva on of one d mens ona equat ons used n open channe f ow ana ys s computat ons for un form and nonun form f ows unsteady f ow f ood rout ng Mathemat ca and phys ca mode s Prerequ s te CEE 341

547 Principles of River Engineering. 2 S 90
Uses of r vers study of watershed and channe processes Sed ment sources y e d and contro hydro og c ana ys s Case stud es Prerequ s te CEE 341 or nstructor ap prova

548 Sedimentation Engineering. 2 F 90
ntroduct on to the transportat on of granu ar sed mentary mater a s by mov ng f u ds Degradat on aggregat on and oca scour n a uv a channe s Mathemat ca and phys ca mode s Prerequ s te CEE 547 or nstructor approva

550 Soil Behavior. 3 S
Phys co chem ca aspects of so behav or stab zati n of so s eng neer ng propert es of so s Lecture. Prerequ s te CEE 351

551 Advanced Soil Mechanics Laboratory. 3 F
Oedometer tr ax a stat c a d cyc c back pressure satu rated and unsaturated samp es pore pressure measure ments, resonant co umn automat c data acqu s t on n s tu test ng Lecture abs Prerequ site CEE 351

552 Geological Engineering. 3 S
Geolog ca nvest gat ons for eng neer ng purposes case h stor es geo og c structure, weather ng remote sens ng, geophys cs, a r photo nterpretat on for eng neer ng site cat ons Lecture f e d tr ps requ red Prerequ s te. CEE 351

553 Advanced Soil Mechanics. 3 S
App cat on of theories of e ast c ty and p ast c ty to so s, theor es of conso dat on fa re theor es response to stat c and dynam c oad ng Lecture Prerequ s te CEE 351

554 Shear Strength and Slope Stability. 3 F
Shear trength of saturated and unsaturated so s strength deformat on re at onsh ps t me dependent strength parameters, effects of samp ng advanced s ope stab ty Lecture Prerequ s te CEE 351.

555 Applied Soil Mechanics. 3 S
Deep foundat ons, braced excavat ons anchored bu k heads re nforced earth underp nn ng and dewater ng Lecture Prerequ s te CEE 452

556 Seepage and Earth Dams. 3 F
Trans ent and steady state f u d f ow through so , conf ned and unconf ned f ow pore water press res and app cat on to earth dams Lecture. Prerequ s te CEE 351

557 Topics in Geotechnical Engineering. 3 F S
New and deve op ng techno ogy n geotechn ca eng neer ng Lecture Prerequ s tes graduate stand ng nstructor approva

558 Numerical Methods. 3 F 90
Const tut ve re at ons for so s n mer ca techn ques ap p ed t geotechn ca eng neer ng nc ud ng computer ap p cat ons. Lecture Prerequ s tes CEE 351, computer programm ng graduate stand ng

559 Earthquake Engineering. 3 F 89
Character st cs of earthquake mot o s select on of des gn earthquakes s te response ana yses se sm c s ope stab ty quefact on Lecture Prerequ s tes CEE 351, gradu ate stand ng

561 Physical Chem cal Treatment of Water and Waste. 3 F
Theory and des gn of phys ca and chem ca processes for the treatment of water and waste waters Prerequ s te CEE 361

562 Environmental Biochem stry and Waste Treatment. 3 S
Theory and des gn of b o og ca waste treatment systems Po lut on and env ronmenta ass m at on of wastes Pre requ s te CEE 362

563 Environmental Chem stry Laboratory. 3 S
Ana ys s of water, domest c and ndustr al wastes abora tory procedures for po ut on eva uat on and the contro of water and waste treatment processes Lecture ab Pre requ s te CEE 361 or 362

564 Industrial Hygiene. 3 N
Survey methods ega and phys o og ca aspects of occu pat ona hea th hazards Methods of measurement and ana ys s and phys o og ca act ons of such contam nants as tox c gases m nera dusts meta s and the r 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 eng neer ng, transportat on p ann ng and h ghway design prob ems Prerequ s te graduate stand ng or n structor approva

574 Traffic Eng neering. 3 F
Operator and veh c e character st cs street capac ty s g na s s gns and mark ngs etc A phases of traff c eng neer ng as app ed to urban areas P erequ s te CEE 372

575 Traffic Engineering. 3 S
See CEE 574 Prerequ s te CEE 372

576 Airport Engineering. 3 F
P ann ng and des gn of a rport fac t es Effect of a rcraft character st cs, a r traff c contro procedures and a rcraft demand for runway and passenger hand ng fac t es on s te se ect on runway conf gurat on and term na des gn Prerequ te CEE 372

577 Urban Transportation Planning. 3 S 90
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 ys s and econom c factors to the solut on of the urban transportat on prob em 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 n ng env ronmenta mpact econom c feas b l ty and fi nanc ng H ghways as a reg ona system Prerequ s te CEE 372

Students enro ed n CEE 580 590 592, 599, 792 and 799 are requ red to attend graduate student sem nars at t me shown n c ass schedu e Each semester every graduate student enro ed for more than 8 semester hours s to en ro for at least 1 semester hour of CEE 592 599, 792 or 799 Each c v eng neer ng graduate student ho d ng an appo ntment as a teach ng or research ass stant or assoc ate s to enro for 1 semester hour of CEE 580 such cred t does not app y toward graduat on

Special Courses: CEE 484 492 493 494 498 499, 580 584 590, 591 592 594 598 599, 792 799 See pages 43–44

Computer Science

PROFESSORS:
BARNH LL EC G 252 ASHCROFT, BLACKLEDGE, F NDLER LEWIS, N ELSON, WADGE, WOODFILL

ASSOCIATE PROFESSORS:
COLLOFELLO, FALTZ FARIN, HUEY, L NDQUIST MILLER, O GRADY, PHEANIS ROBBINS

ASSISTANT PROFESSORS:
DIETR CH FA NTER, FAUST NI, FOLEY, GOLSHANI, SEBAN, SEN

INSTRUCTORS:
HOUSTON TRANT NA

Computers have a significant impact on our daily life This impact may be even greater in the fu ture as the full potential of modern computing systems and techniques is realized Computer sci ence is concerned with the study, design, develop ment, construction and application of modern machinery, 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 are designed to prepare the stu dent to be a participant in this rapidly changing area of technology by presenting an in depth treatment of the fundamentals of computer sci ence. 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 an overall "C" (2 00 average, all computer sci ence students are required to obtain a minimum grade of "C" in all CSC courses used for degree credit

Computer Science—B.S.

The Department of Computer Science offers a B.S degree designed to give the student in depth knowledge in computer science. All students pur suing a B S. degree will complete the General Studies requirements described below, an Eng ish proficiency requirement, the computer science core courses, a senior level breadth requirement in the major and a set of technical electives It should be noted that the B.S degree requirements consistently exceed the university minimum re quirements

	Semester Hours
English Proficiency	
* ENG 101, 102 First Year Composition ..... or ENG 105 Advanced First Year Composition 3) See page 273 for English exemption.)	6

General Studies

Humanities and Fine Arts
*Social and Behavioral Sciences**
18 semester hours)
At least one upper division course must be included, two of the courses must be from the same department, and two departments or more must be represented in the total selection

Human ties and Fine Arts	6–12
Soc al and Behavioral Sciences	12–6

*Literary and Critical Inquiry**
6 semester hours
One cou se chosen from the university approved list. In genera this course w l be sophomore level and wi l include a series of formal, graded, written or spoken assignments in composing critical discourse 3
ECE 400 Eng neer ng Communications 3

Numeracy
7 semester hours)
† MAT 270 Calculus with Analytic Geometry I 4
or MAT 290 Calculus I 5
† CSC 355 Introduction to Theoretical Computer Science . 3

Natural Science
(8 semester hours
† PHY 121 University Physics I: Mechanics . . 3
† PHY 122 University Physics Lab I 1
† PHY 131 University Physics II Electricity and Magnetism 3
† PHY 132 University Physics Lab II 1

Total General Studies 39

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 50–80 for requirements and approved list

† Graduation requirement for the baccalaureate degree

			Semester Hours
Computer Science Core			
CSC	100	Introduction to Computer Science I	3
CSC	101	Introduction to Computer Science II	3
CSC	201	Application Languages Programming Laboratory	1 2
CSC	202	Functional Languages Programming Laboratory	2 1
CSC	220	Computer Organization and Assembly Language Programming .	4
CSC	310	Data Structures .	3
CSC	320	Computer Architecture and Organization	4
CSC	321	Computer Systems Architecture	4
CSC	340	Structure of Programming Languages	3
ECE	383	Probability and Statistics for Engineers	2
		or STP 326 Intermediate Probability	3
MAT	271, 2 2	Calculus with Analytic Geometry II, III	8
		or MAT 291 Calculus II	5
MAT	243	Discrete Mathematical Structures	3
MAT	342	Linear Algebra	3
		Total Computer Science Core	43
Computer Science Breadth Requirement			15
		Each student will complete 15 hours of CSC 400 level courses CSC 483 excluded that have no other CSC 400 level course as prerequisite Each such course serves as a foundation course in an area of specialization	
Technical Electives			14
		Each computer science student must complete 14 hours of courses chosen from the computer science technical elective list and approved by the student's advisor	
Unrestricted Electives			11
		Total Degree Requirements	128

Computer Science Program of Study
Typical Four-Year Sequence
Freshman Year

			Semester Hours
First Semester			
CSC	100	Introduction to Computer Science I	3
ENG	101	First Year Composition .	3
MAT	270	Calculus with Analytic Geometry I	4
General Studies Elective (HU or SB			3
Unrestricted Elective .			3
		Total	16
Second Semester			
CSC	101	Introduction to Computer Science II	3
ENG	102	First Year Composition ..	3
MAT	243	Discrete Mathematical Structures	3
MAT	271	Calculus with Analytic Geometry II . .	4
General Studies Elective HU or SB			3
		Total	16

Sophomore Year

First Semester			
CSC	201	Application Languages Programming Laboratory	1
CSC	220	Computer Organization and Assembly Language Programming .	4
MAT	272	Calculus with Analytic Geometry III	4
PHY	121	University Physics I Mechanics	3
PHY	122	University Physics Laboratory I	1
General Studies Elective HU or SB			3
		Total . .	16
Second Semester			
CSC	202	Functional Languages Programming Laboratory .	1
CSC	310	Data Structures	3
PHY	131	University Physics II Electricity and Magnetism	3
PHY	132	University Physics Laboratory II	1
General Studies Elective HU or SB			3
Literacy and Critical Inquiry Elective			3
Unrestricted Elective			3
		Total	17

Junior Year

First Semester

CSC	201	Application Languages Programming Laboratory	1
CSC	320	Computer Architecture and Organization	4
CSC	340	Structure of Programming Languages	3
MAT	342	Linear Algebra	3
ECE	383	Probability and Statistics for Engineers	2
General Studies Elective HU or SB			3
Total			16

Second Semester

CSC	321	Computer Systems Architecture	4
CSC	355	Introduction to Theoretical Computer Science	3
General Studies Elective HU or SB)			3
Unrestricted Elective			3
Technical Elective			3
Total			16

Senior Year

First Semester

CSC	400 level Computer Science Breadth Electives		6
ECE	400	Engineering Communications	3
Technical Electives			5
Unrestricted Elective			2
Total			16

Second Semester

CSC 400 level Computer Science Breadth Electives			9
Technical Electives			6
Total			15

See pages 50–8) for requirements and approved list

Computer Systems Engineering—B.S.E.

The Department of Computer Science offers a B.S.E. degree that prepares the student for a career in computer systems engineering. The requirements for English proficiency and General Studies are shown on pages 334–335

The following courses must be selected in the engineering core (only ECE 313 Introduction to Deformable Solids may be deleted :

			Semester Hours
CSC	220	Computer Organization and Assembly Language Programming	4
ECE	210	Engineering Mechanics I Statics	3
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	342	Linear Algebra	3
PHY	361	Introductory Modern Physics	3
Basic Science Elective)			

In addition, the following courses are required.

CSC	100	Introduction to Computer Science I	3
CSC	101	Introduction to Computer Science II	3
CSC	310	Data Structures	3
CSC	320	Computer Architecture and Organization	4
CSC	321	Computer Systems Architecture	4
CSC	340	Structure of Programming Languages	3
CSC	421	Microcomputer Fundamentals	4
CSC	422	Microcomputer Systems Design I	4
CSC	423	Microcomputer Systems Design II	3
CSC	430	Elementary Concepts of Operating Systems	3
MAT	243	Discrete Mathematical Structures	3
Area of Emphasis Technical Electives)			13
Total			50

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
CSC	100	Introduction to Computer Science I	3
CHM	114	General Chemistry for Engineers	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First Year Composition	3
MAT	290	Calculus I	5
Total			18

Second Semester

CSC	101	Introduction to Computer Science II	3
ENG	102	First Year Composition	3
ECE	106	Introduction to Computer Aided Engineering	3
MAT	243	Discrete Mathematical Structures	3
MAT	291	Calculus II	5
Total			17

Sophomore Year

First Semester

CSC	220	Computer Organization and Assembly Language Programming	4
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	320	Computer Architecture and Organization	4
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)			3
Literacy and Critical Inquiry Elective[2]			3
		Total	17

Junior Year

First Semester

CSC	340	Structure of Programming Languages	3
ECE	301	Electrical Networks I	4
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	18

Second Semester

CSC	321	Computer Systems Architecture	4
CSC	421	Microcomputer Fundamentals	4
ECE	333	Electrical Instrumentation	3
MAT	342	Linear Algebra	3
Technical Elective			3
		Total	17

Senior Year

First Semester

CSC	422	Microcomputer Systems Design I	4
ECE	340	Thermodynamics	3
ECE	400	Engineering Communications	3
General Studies Elective (HU or SB)			3
Technical Elective			4
		Total	17

Second Semester

CSC	423	Microcomputer Systems Design II	3
CSC	430	Elementary Concepts of Operating Systems	3
ECE	352	Properties of Electronic Materials	3
General Studies Elective HU or SB)[1]			3
Technical Electives			6
		Total	18

[1] See pages 50–80 for requirements and approved list

[2] See page 314, General Studies, for special requirements and selection of L1 elective.

COMPUTER SCIENCE

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

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 labs Nonmajors only Prerequisite MAT 117 *[Satisfies General Studies Requirement N3]*

183 Applied Problem Solving with FORTRAN. 3 F, S
A human oriented, systems approach to problem definition formulation and solution using FORTRAN. Computer solution required for projects Nonmajors only Prerequisite MAT 118 *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 CSC 300

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 CSC 300

220 Computer Organization and Assembly Language Programming. 4 F S SS
Computer organization assembly language programming, data representation, data structure and addressing modes assemblers linkers Lecture labs Prerequisite CSC 100 or ECE 105.

300 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 *[Satisfies General Studies Requirement N3]*

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

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

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, MAT 243

320 Computer Architecture and Organization. 4 F S SS
Comb nat ona and sequent a og c des gn reg ster bus evel CPU des gn nstruct on nterpretat on and m cropro gramm ng, O dev ces nterfaces and programm ng Lec ture ab Prerequ s tes CSC 220, MAT 243

321 Computer Systems Arch tecture. 4 F S
ntegrat'on of DMA, O and other process ng e ements nto a ng e system arch tecture Memory h erarchy and subsystems Processor context memory management. Lecture, ab Prerequ s te CSC 320

340 Structure of Programming Languages. 3 F, S
Forma spec f cat ons for a guage syntax and dynam c runt me env ronments troduct on to anguage trans a t on Prerequ s tes at east one un t of CSC 201 or 202 220 310

355 Introduction to Theoretical Computer Sc ence. 3 F, S
The theory of computat on ntroduct on to forma an guages recurs ve funct ons comp ex ty Prerequ s tes CSC 310, MAT 243 *[Sat sf es Genera Stud es Requ re ment N3]*

383 Applied FORTRAN Programming. 3 F S
Advanced FORTRAN character hand ng mach ne de pendency, sort ng and merg g p ott ng tapes d sks t me shar ng term na s brary programs Lecture ab Nonmajors on y Prerequ s te CSC 183

408 Introduction to Scene Analysis. 3 A
mage ana ys s and format on w eve p ocess ng object segmentat on texture ana ys s stereo v s on mot on· h gher eve nterpretat on act ve sens ng Prerequ s te CSC 310 or nstructor approva

410 Information Processing. 3 A
Pr mary, secondary f e access organ zat ons Mu t attr bute ndex ng F e process ng ntroduct on to databa e management and document retr eva Prerequ s te CSC 310 *[Sat sf es Genera Stud es Requ rement N3]*

412 Database Management. 3 S
ntroduct on to DBMS concepts Data mode s and an guages Re at ona database theory Database secur ty n tegrity and concurre cy Prerequ s te. CSC 310 *[Sat s f es General Stud es Requ rement N3]*

420 Comparison of Computer Architectures. 3 A
Evo ut on of ma n ne arch tectures nstruct on sets ad dress ng modes contro structures Character zat on of computer arch tectures Performance eva uat on Pre requ s te· CSC 321 or 423 *[Sat sf es Genera Stud es Re qu rement N3]*

421 Microcomputer Fundamenta s. 4 F S
Hardware software and assemb y anguage program ming of a m crocomputer system are used as veh c es to teach fundamenta s of d g ta system des gn Lecture ab Prerequ s te CSC 320

422 Microcomputer Systems Design I. 4 F S
Design of m crocompute systems us g contemp rary og c and m crocomputer system components Requ res assemb y anguage programm ng Prerequ s te CSC 421

423 Microcomputer Systems Design II. 3 S
Informat on and techn ques presented n CSC 422 a e used to deve op the hardware des gn of a mu t processor mu t programm ng m croprocessor based system Pre requ s te CSC 422

428 Computer-Aided Processes 3) A
Hardware and software cons derat ons for computer zed manufactur ng systems. Spec f c concentrat on on auto mat c nspect on numer ca contro robot cs, ntegrated manufactur ng systems Prerequ s te· CSC 321 *[Sat s f es Genera Stud es Requ rement N3]*

430 Elementary Concepts of Operating Systems. 3 F S
Des gn and mp ementat on of superv sory system compo nents. np t/output methods process management mu t programm ng and mu t process ng systems storage man agement f e systems Prerequis tes CSC 321 340

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 relocat ng nk ng oaders I O hand ers schedu ers etc Prerequ s te CSC 421 or nstructor approva .

440 Compiler Construction I. 3 F
ntroduct on to programm ng anguage mp ementat on mp ementat on strateg es compilat on nterpretat on trans at on Major comp at on phases· ex ca ana ys s semant c ana ys s opt m zat on, code generat on Pre requ s te CSC 340

450 Analysis of Algorithms. 3 F
Des gn and ana ys s of computer a gor thms us ng ana yt ca and emp r ca methods comp ex ty measures des gn methodo og es survey of mportant a gor thms Prerequ s te CSC 310 *[Sat sf es Genera Stud es Requ rement N3]*

451 Switching Theory. 3 N
Comb nat ona og c, funct ona decompos t on, NAND NOR c rcu t ana ys s and synthes s og c arrays, terat ve networks, fau t d agnos s sequent a c rcu t representa t on memory dev ces Prerequ s te CSC 320

457 Theory of Formal Languages. 3 A
Theory of grammar methods of syntact c ana ys 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 *[Sat sf es Genera Stud es Requ rement N3]*

459 Logic for Computing Scientists I. 3 F
Propos t ona og c symbo ic processing pr nc p es of og c programm ng reso ut on, pattern match ng Pro og, var ous app cat ons of pred cate og c n computer sc ence extens ns to pred cate og c Prerequ s te. CSC 355

460 Software Project Management and Development I. 3 F S
Software fe cyc e ana ys s, programm ng teams project documentat on and m estones; requ rements and spec f 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 dev ces, data structures transformat ons nterac t ve graph cs, 3 d mens ona graph cs h dden ne prob em Prerequ s tes CSC 310 MAT 342 *[Sat sf es Gen era Stud es Requ rement N3]*

471 Survey of Artificial Intelligence. 3 F S
ntroduct on to he r st c search games know edge repre sentat on techn ques forma and fuzzy ogics natura an guage understand ng expert systems, computer v s on. Prerequ s tes· CSC 310 know edge of PROLOG

473 Nonprocedural Programming Languages. 3 S
Funct ona and og c programm ng us ng anguages ke Luc d and Pro og Typ ca app cat ons wou d be a Screen Ed tor and an Expert System Prerequ s te. CSC 355 *[Sat sfies Genera Stud es Requ rement. N3]*

474 Modeling for Computer Simu ation. 3 A
Mathemat ca descr pt on of genera dynam c systems d crete event d screte t me, cont nuous n forms su t

ab e for computer mp ementat on Prerequ s tes. CSC 310 ECE 383 *[Satisf es Genera Stud es Requ rement N3]*

475 Simulation Theory and Languages. 3 A
Stat st ca background for s mu at on Mode construct on and va dat on ana ys s of resu ts Languages that support s mu at on Prerequ s te CSC 474 *[Sat sf es General Stud es Requ rement N3]*

476 Introduction to Natural Language Processing. 3 F
Princ p es of computat ona ngu st cs, forma syntax, se mant cs as app ed to the des gn of software w th natura human anguage I O Prerequ s te CSC 310 or nstruc tor approva

477 Introduction to Computer-Aided Geometric Design. 3 S
ntroduct on to parametr c curves and surfaces Bez er and B sp ne nterpo at on and approx mat on techn ques Prerequ s tes CSC 101· MAT 342

483 FORTRAN Programming for Graduate Research. 3 F S
ntroductory course for graduate research comput ng. Subrout nes program brar es mathemat cal and stat st ca app cat ons batch and t me shar ng env ronments data f es, p ott ng. Lecture ab Nonma ors only

508 Digital Image Processing I. 3 F
Dig ta mage fundamentals mage transforms mage en hancement and restorat on techn ques mage encod ng and segmentat on methods Prerequ s te EEE 303 or n structor approva

509 Digital Image Processing II. 3 S
Advanced ana yt ca techn ques app ed to d g ta mage process ng computer v s on appl cat ons nc ud ng robot cs Prerequ s te CSC 508

512 Database Systems Design. 3 F
Mu t eve genera zed DBMS arch tectures and des gn D str buted databases transparent funct ona t es, query process ng update synchron zation concurrency contro Prerequ s tes: CSC 410 412

513 Database Mach'nes. 3 N
Nonnumer c process ng Von Neumann bott enecks Par a e and assoc at ve processors Database mach nes. survey theory software performance Advanced topics n database arch tectures Prerequ s tes CSC 321 410 or 412

515 Information Storage and Retrieval. 3 N
Concepts of nformat on storage and retr eva theory ap p cations case stud es Prerequ s te CSC 410.

516 Digital Testing and Reliability. 3 A
Fau t mode ng test generat on and s mu at on for combi nat ona and sequent a c rcu ts, memory test ng se f check ng og c fau t to erant og c re ab ty ana ys s Pre requ s tes CSC 321 or 423, 451 or 355

517 Digital Design Automation. 3 N
Typ ca computer a ded des gn system S mu at on tech n ques test generat on m croprogrammed contro des gn a ds spec f cat on sheet ana ys s App cat ons Prerequ s te CSC 520 or 524

518 Hardware Design Languages. 3 N
ntroduct on to hardware des gn anguages HDL s) HDL descr pt on of ntegrated c rcu t components and systems HDL descr pt on of computer organ zat ons Prerequ s te CSC 321

520 Computer Architecture II. 3 A
Theoret ca structure of computer and computat ons per formance trade offs contro un ts memory h erarch es n put output, nterconnect on networks operat ng system support Prerequ s te CSC 430

521 Microprocessor Applications. 4 S
M croprocessor techno ogy and ts app cat on to the de s gn of pract ca d g ta systems Hardware assemb y an guage programm ng, nterfac ng of m croprocessor based systems Lecture ab Prerequ s te CSC 421

522 Microprogramming. 3 A
Theory pract ce and app cat on of m croprogramm ng Prerequ s te CSC 321

523 Microcomputer Systems Software 3 F
Deve op ng system software for a mu t processor, mu t programm ng m croprocessor based system us ng nfor mat on and techn ques presented n CSC 421 422 Pre requ s te CSC 422.

524 Multiprogramming Architectures. 3 N
Ma n i ne computer arch tectures mu t programm ng t meshar ng, mu t process ng hardware software trade offs memory h erarch es nput/output structures commu n cat ons Prerequ s te· CSC 321 or 423

526 Parallel Processing. 3 N
Real and apparent concurrency Hardware organ zat on of mu t processors mu t p e computer systems, scient f c at tached processors and other para le systems Prerequ s te CSC 321 or 423

527 High-Level-Language Machines. (3) N
Advantages and d sadvantages of high eve anguage mach nes Languages su tab ity M croprogramm ng and nterpret ve execut on. O operations Examp es Pre requ s te CSC 520 or 524

529 RISC Design Methodology. 4 N
Opt ma computer arch tecture des gn methodology based on the symb ot c re at onsh p of hardware and software d sc p nes Prerequ s te CSC 440 Pre or coreq s te CSC 520

530 Operating System Case Study. (3) F
Study of the des gn and mp ementat on of a t meshared mult programm ng operat ng system w th emphas s on the UN X operat ng system Prerequ s tes CSC 430· know - edge of C anguage

531 Distributed Operating Systems. 3 N
Interprocess commun cations concurrency contro f e system, anguage constructs, arch tecture and network cons derat ons n d str buted operat ng and mu t processor systems. Case stud es Prerequ s te CSC 530 or nstruc tor approva

532 Security in Computing Systems. 3 A
n depth deve opment of the concepts of computer secu rity mpact on computer hardware and software and on user Prerequ s te CSC 430

534 Computer Networks. 3) N
Computer network protoco s, hardware e ements and software a gor thms Error hand ng, routing, f ow contro host to host communicat on oca area networks Pre requ s te CSC 320

535 Performance Evaluation. 3) S
Top cs n computer system measurement and evaluat on hardware software mon tors work oad character zat on program behav or adapt ve schedu ng, s mu at on mod e s, measurement nterpretat on Prerequisite CSC 430

536 Theory of Operating Systems. 3 F
Forma methods of contro of concurrent processes proc ess schedu ng memory and aux ary storage manage ment Network operat ng systems Operat ng system de s gn Prerequ s te CSC 430

540 Compiler Construction II. 3 S
Forma pars ng strateg es opt m zat on techn ques, code generat on extens b ty and transportab ty cons dera t ons recent deve opments Prerequ s te CSC 440

545 Programming Language Design. 3 N
Language constructs, extens b ty and abstract on run t me support Language des gn process Prerequ s te CSC 440

550 Combinatorial Algorithms and Intractability. 3 N
Comb nator a a g r thms, nondeterm n st c a gor thms c asses P and NP NP hard and NP comp ete prob ems, ntractab ty Des gn techn ques for fast comb nator a a go thms. Prerequ s te CSC 450

554 Advanced Switching Theory. 3 S
Latt ces Boo ean algebras post a gebras Boo ean d ffer ent a calcu us, mu t va ued og c fuzzy og c f n te state mach nes Prerequ s te CSC 451

555 Automata Theory. 3 N
F nite state mach nes pushdown automata near bounded automata, Tur ng mach nes reg ster mach nes rams rasps, re at onsh ps to computab ty forma an guages Prerequ s te CSC 355

556 Expert Systems. 3 S
Know edge acqu t on a d representat on ru e based systems, frame based syste s va dat on of know edge bases nexact reaso g expert database systems

560 Software Project Management and Development II. 3 F S
Software project management cost est mat on conf gura t on management, qua ty a surance Advanced software eng neer ng fe cyc e top cs Prerequ s te CSC 460

563 Software Requirements and Spec fication 3 F
Exam nat on of the def n t ona stage of software deve op ment ana ys s of spec f cat on representat ons and tech n ques emphas z ng mportant app cat on ssues Pre requ s te CSC 460

564 Software Design. 3 S
Exam nat on of software des gn ssues and techn ques nc udes a survey of des gn representat ons and a com par son of des gn methods Prerequ s te CSC 460

565 Software Va idation. 3 F
Software re ab ty mode s and measures program test ng theory, fau t to erant software, pr gram ver f cat on re ab e software des gn and deve opment regress on test ng Prerequ s te CSC 460

566 Software Maintenance. 3 S
Survey of software ma ntenance prob ems too s metr cs, management approaches Imp cat ons of software ma n tenance on software deve opment Prerequ s te CSC 460

570 Advanced Computer Graphics I. 3 A
H dden surface a gor thms ght ng mode s and shad ng techn ques User nterface des g An mat on techn ques Fracta s and stoc a t c mode s Raster a gor thms P e requ s te CSC 470

571 Artificial Intelligence. 3 S
Def n t ons of nte gence computer prob em so v ng game play ng, pattern recogn t on theorem prov ng se mant c nformat on pro ess ng evo ut onary system heu r st c programm ng Prerequ s te. graduate stand ng

572 Pattern Recognition. 3 N
Pattern c ass f cat on by d stance funct ons and ke hood functions determ n st c and stat st ca approaches to tra n ab e pattern c ass f ers syntact c pattern recogn t on Pre requ s te ECE 383 or STP 326

573 Advanced Computer Graphics II. 3 A
Computer a ded geometr c des gn nteract ve and sur face representat on and des gn Scattered data tech n ques CAD CAM Construct ve so d geometry and mode ng Prerequ s te CSC 470

577 Advanced Computer-Aided Geometric Design I. 3 F
Genera nterpo at on rev ew of curve nterpo at on and approx mat on sp ne curves v sua smoothness of curves, parameter zat on of curves, ntroduct on to surface nterpo at on and approx mat on Prerequ s tes CSC 470 477 or nstructor approva

578 Advanced Computer Aided Geometric Design II. 3 S
Co ns patches and Bez er patches tr angu ar patches arb trar y ocated data methods, geometry process ng of surfaces h gher d mens ona surfaces Prerequ s tes CSC 470 477 or nstructor approva

Special Courses: CSC 294 484 492 493 494 498 499 580 59 591 592 598 599 790, 791 792 799
See pages 43–44

Electrical and Computer Engineering

REGENTS' PROFESSOR:
FERRY

PROFESSORS:
EC G 127 , AKERS
BACKUS BAJAJ BALAN S BOSE CROUCH
DeMASSA HADEN, HIGG NS, KARADY,
KAUFMAN KELLY, McKLVEEN PALAIS,
ROEDEL, RUSSELL SCHRODER,
SCHWUTTKE, SIRKIS, SM TH (ASU WEST
CAMPUS TICE WANG

ASSOCIATE PROFESSORS:
DAVIS, GREENE CH GRONDIN, KEARFOTT,
MARACAS SHEN TYLAVSKY W LSON ASU
WEST CAMPUS , Z MMER

ASSISTANT PROFESSORS:
EL GHAZALY GORUR HASHEMI YEGANEH,
KOZICK , MORRELL, SPANIAS TSAKAL S

PROFESSORS EMERITI:
AX BARKSON, DONNELLY, STEINMANN
THOMPSON WELCH

The professional activities of e ectrical engineers directly affect the lives of most of the world's population every day They are responsible for the design and deve opment of radio and televi sion 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 elec

trical engineer is concerned with a challenging and diverse array of design and development problems.

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

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 as well as 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 includes a number of required electrical engineering and technical elective courses. Approved technical elective courses serve to provide students with an opportunity to either 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, 352 and EEE 221. 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	302	Electrical Networks II	3
EEE	303	Signals and Filters	3
EEE	322	Microprocessor Applications	4
EEE	340	Electromagnetic Engineering I	3
EEE	360	Energy Conversion and Transport	4
EEE	396	Professional Seminar	0
EEE	490	Senior Design Laboratory	3
		Total	20

Technical Electives in Electrical Engineering

The program in Electrical Engineering requires a total of 28 hours of technical electives To ensure breadth of knowledge, students *must* select the courses indicated from not less than four of the following six areas:

Area	Course
Communications	EEE 455
Control	FEE 480
Electromagnetics	EEE 440
Electronics Circuits	EEE 425 or 433
Power Systems	EEE 470 or 471
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 the approval of their faculty advisor, qualified students may choose technical electives from other courses in engineering, mathematics and the sciences at or above the 300 level, including graduate courses. Students must have not less than a 3.00 grade point average 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

			Semester Hours
First Semester			
CHM	114	General Chemistry for Engineers	4
		or CHM 116 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			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			3
		Total	18

Sophomore Year

First Semester			
EEE	221	Digital Computer Fundamentals	4
ECE	210	Engineering Mechanics I: Statics	3
MAT	274	Elementary Differential Equations	3
MAT	342	Linear Algebra	3
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	3
ECN	111	Macroeconomic Principles	3
EEE	322	Microprocessor Applications	4
MAT	362	Advanced Mathematics for Engineers and Scientists I	3
		Total	17

Junior Year

First Semester			
ECE	334	Electronic Devices and Instrumentation	4
ECE	340	Thermodynamics	3
EEE	302	Electrical Networks II	3
EEE	340	Electromagnetic Engineering I	3
EEE	396	Professional Seminar	0
PHY	361	Introductory Modern Physics	3
Literacy and Critical Inquiry Elective[2]			3
		Total	19
Second Semester			
EEE	303	Signals and Filters	3
EEE	360	Energy Conversion and Transport	4
ECE	352	Properties of Electronic Materials	3
Technical Electives			4
General Studies Elective HU or SB [1]			3
		Total	17

Senior Year

First Semester			
EEE	490	Senior Design Laboratory	3
Technical Electives			14
		Total	17
Second Semester			
ECE	400	Engineering Communications	3
Technical Electives			10
General Studies Elective HU or SB)			3
		Total	16

See pages 50–80 for requirements and approved list

[2] See page 314, General Studies, for special requirements and selection of LI elective

Graduation Requirements

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

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 pages 361–362 for details and course requirements.

ELECTRICAL AND COMPUTER ENGINEERING

EEE 221 Digital Computer Fundamentals. 4 F, S, SS
Combinational and sequential logic network design. Data representations and arithmetic units; operations. Introduction to microcomputer programming and operation. Lecture, lab. Prerequisite: ECE 105 or CSC 100. *[Satisfies General Studies Requirement N3]*

302 Electrical Networks II. 3 F, S, SS
Analysis of linear and nonlinear networks. Analytical and numerical methods. Prerequisite: ECE 301.

303 Signals and Filters. 3 F, S, SS
Filtering and spectral analysis in continuous and discrete systems. Prerequisite: ECE 301.

322 Microprocessor Applications. 4 F S
Cont n at on of EEE 221 M crocomputer system organ za- t on and operat on O dev ce operat on, O programm ng and interfac ng Memory systems m crocomputer appl ca t ons Lecture, ab Prerequ s te EEE 221

340 Electromagnetic Engineering I. 3 F S SS
Stat c and t me vary ng vector f e ds· boundary va ue prob ems· d e ectr c and magnet c mater a Maxwe s equa t ons boundary cond t ons un form p ane waves Prerequ s tes MAT 362 PHY 131

360 Energy Conversion and Transport. (4 F S
Three pha e c rcu ts Energy supp y systems Magnet c c rcu t ana ys s synchronous generators transformers, n duct on mach nes, dc c rcu ts Load f ow and short c rcu t ca cu at ons Lecture ab Prerequ s te. ECE 301.

396 Professional Seminar. 0 F S
Top cs f nterest to upper d v s on e ectr ca eng neers One ecture Prerequ s te jun or stand ng

405 Filter Design. 3 F
Pr nc p es of act ve and pass ve f ter des gn T me and frequency doma n approx mat ons Prerequ s te EEE 303 or equ va ent

406 Computer-Aided Design. 3 S
Pr n p es and app cat on of modern CAD techn ques to so ve eng neer ng prob ems nc udes ndependent project Prerequ s te EEE 303 or equ va ent

407 Signal Processing I. 4 F
T me and frequency doma character zat on of determ n s t c t me ser es L near operators Four er and z transforms d g ta f ter synthes s system mode ng Lecture, ab Pre requ s te EEE 303

425 Digital Systems and Circuits. 4 F
D g ta og c gate ana ys s propagat on de ay t mes f gures of mer t no se marg ns App cat on of MOS and b po ar log c fam es nc ud ng NMOS CMOS standard and advanced TT and ECL regenerat ve og c c rcu ts memor es, VLS c rcu ts computer s mu at ons us ng PSPICE Lecture ab Prerequ s tes ECE 334 352

433 Analog Integrated Circuits. 3 S
Ana ys s des gn a d app cat ons of modern ana og c rcu ts us ng ntegrated b po ar and f e d effect trans stor techno o g es Prerequ s te ECE 334

434 Quantum Mechanics for Engineers. 3 F
Probab ty, Schroed nger equat on e genfunct ons har mon c osc ator, per od c potent a superpos t on, angu ar momentum scatter ng tunne ng perturbat on theory Pre requ s te EEE 340

435 Microelectronics. 3 S
Pract ce of so d state dev ce fabr cat on techn ques nc ud ng th n f m and ntegrated c rcu t fabr cat on pr nc p es Lecture ab Pre equ s te EEE 436 or equ va ent

436 Fundamentals of Solid State Devices. 3 F S
Meta sem conductor contacts P N junct ons ght nteract ng dev ces Schottky d odes b po ar and f e d effect trans s tors, p anar and th n f m ntegrated c rcu t C dev ces Prerequ s te ECE 352

439 Semiconductor Facilities and C eanroom Practices. 3 F
M crocontam nat on c eanroom concepts operat ona con s derat on u trapure water process mater a s safety prac t ces ntroduct on to ndustr a hyg ene emergency re sponse Mandatory for users of CEAS c eanroom

440 Electromagnetic Engineering II. 4 F S
Coax a and wavegu de transm ss on nes match ng tech n ques p ane wave n ossy med a po ar zat on ref ect on and refract on e ectromagnet c system concepts, rad at on Lecture ab Prerequ s tes ECE 105 301, EEE 340; or equ va ents

443 Antennas. 3 S
Fundamenta parameters engineer ng princ p es rad at on integra s near w re antennas oops arrays, numerica computat ons· measurements Prerequ s te EEE 440 or equ va ent

445 Microwaves. 4 F
Wavegu des, c rcu t theory for wavegu d ng systems m cro wave dev ces systems and energy sources; str p nes and m crostr ps, mpedance match ng transformers; measure ments Lecture ab Prerequ s te. EEE 440 or equ va ent

448 Fiber Optics. 4 F
Pr nc p es of f ber opt c commun cat ons Lectures ab Prerequ s tes. EEE 303, 340

451 Error-Correcting Codes. 3 N
App cat on of modern a gebra to the ana ys s and synthes s of random error detect ng and error correct ng b ock codes Prerequ s te EEE 221

454 Random Signal Theory I. 3 F S
App cat on of stat st ca techn ques to the representat on and ana ys s of e ect ca s gna s and to commun cat o s systems ana ys s Prerequ s te EEE 303

455 Communication Systems. 4 F S
S gna ana ys s L near exponent a and pulse modu at on Comparat ve ana ys s of c rcu ts and systems Lecture ab Prerequ s te EEE 303

459 Data Communication Systems. 3 S
System character st cs Commun cat ons med a Commun cat on codes Data va 'd ty check ng L ne protoco s, term na s system conf gurat ons Examp es Prerequ s tes EEE 303 322

460 Nuclear Concepts for the 21st Century. 3 S
The wor d energy s tuat on and the ro e of nuclear power Nuc ear f ss on and fus on theory The nuc ear fuel cyc e. U trasafe reactor des gns Rad at on damage to e ectronics nc ud ng soft errors and space rad at on Current and future app cat ons n nuc ear med c ne rad o ogy, and food preser vat on Cross sted as NUC 460.

461 Health Physics Principles and Radiation Measurements. 3 S
Sources, character st cs dos metry sh e d ng and measure ment techn ques for cosmogen c, terrestr al, and anthropo gen c rad at on on z ng and non on z ng rad at on theory ALARA concept Emphas s on nstrumentat on detectors and env ronmenta mon tor ng Lecture lab. Cross sted as BME 461 and NUC 461 Prerequ s te· ECE 301

462 Reactor Safety Analysis. 3 N
Power reactor safety and cens ng methodolog es Reactor trans ent and acc dent ana ys s T me dependent so ut on to neutron d ffus on equat on. Use of ndustry codes to assess f ss on product bu d up emergency core coo ng behav or react v ty off s te re eases and dose ca cu at ons Cross sted as NUC 462 Prerequ s te· EEE or NUC 460

463 Electrical Power Plant. 3 F
Nuc ear foss , and solar energy sources Ana ys s and des gn of steam supp y systems, e ectrica generat ng sys tems and aux ary systems Power p ant eff c ency opera tion and costs and ana yses Lecture Cross sted as NUC 463 Prerequ s tes ECE 301 340

464 Nuclear Engineering Experiments. 3 F
Theory and app ied concepts n reactor des gn nstrumenta t on e ectron cs and sh e d ng Expe menta measure ments of nuc ear parameters us ng subcr t ca reactors and fus on neutron generator Fast and therma act vat on ana y s s Pr mary coo ant ana ys s Mossbauer spectrometry

Lectures ab Cross sted as NUC 464 Corequ s te EEE or NUC 460

465 Clinical Nuclear Engineering I. 3 S
Fundamenta s of c n ca nuc ear eng neer ng and med ca hea th phys cs pract ce Rad at on b o ogy dos metry and sh e d ng for rad otherapy and d agnost c procedures Cross sted as BME 465 and NUC 465 Prerequ s te n tructor approva

470 Electric Power Devices. 3 F
Ana ys s of dev ces used for short c rcu t protect on nc ud ng c rcu t breakers re ays curre ta d vo tage transducers, etc Pr tect on aga nst sw tch ng and ghtn ng over vo tages. nsu at on coord nat on Lectures Prerequ s te EEE 360.

471 Power System Analysis. 3 S
Rev ew of transm ss on ne parameter ca cu at on Zero sequence mpedance symmetr ca components for fau t ana ys s short c rcu t ca cu at on rev ew of power f ow ana y s s, power system stab ty power system contro concepts D str b t on system ana ys s feeder des gn, vo tage drop capac tor p acement s bstat on o at on Prerequ te EEE 360

473 Electrical Machinery. 3 S
Ana ys s and des gn of transformers and rotat ng mach nes dc nduct on and synchronous mach nes Pr nc p es of motor dr ves thyr stor m croprocessor contro Prerequ s te EEE 360

480 Feedback Systems. 4 F, S
Ana ys s and des gn of near feedback systems Frequency response and root ocus techn ques ser es compensat on and state var ab e feedback Lecture ab Prerequ s te EEE 303

482 Introduction to State Space Methods. 3 S
D screte and cont nuous systems n state space form near systems and A R M A mode s E ements of rea zat on observer, and stab zat on theory Non near systems stab ty phase p ane and L apunav meth ds App cat ons to d g ta computer s mu at on

490 Senior Design Laboratory. 3 F S
Pro ect or ented aboratory Each student w comp ete severa des g projects dur ng the semester Lecture ab Prerequ s tes ECE 334 EEE 303, sen or status or nstructor approva

506 Signal Processing of Time Series II. 3 S
Study of random t me ser es autocorre at on sequence, power spectra dens ty opt mum f ters spectra ana ys s, rat ona mode ng of stat onary t me ser es Prerequ s te EEE 407

525 VLSI Design. 3 S
Ana ys s and des gn of Very Large Sca e ntegrated VLS C rcu ts Phys cs of sma dev ces fabr cat on regu ar struc tures and system t m ng Open on y to graduate students

531 Semiconductor Device Theory I. 3 F
Transport and recomb nat on theory pn and Schottky barr er d odes, b po ar and junct on f e d effect trans stors, MOS apac tors and trans stors Prerequ s te EEE 436 or equ va lent

532 Semiconductor Device Theory II. 3 S
Advanced MOSFETs charge coup ed dev ces so ar ce s, photodetectors ght em tt ng d odes m crowave dev ces, modu at on doped structures Prerequ s te EEE 531

533 MOS Integrated Circuit Engineering. 3 F
MOS dev ce phys cs, ntegrated c rcu t fabr cat on CMOS, ana og and d g ta c rcu t des gn s mu at on and ayout y e d and re ab ty mode s Prerequ s te EEE 436 or equ va ent

534 Semiconductor Transport. 3 N
Carr er transport n sem conductors Ha effect h gh e ectric f e d Bo tzmann equat on corre at on funct ons carr er car r er nteract ons Prerequ s te EEE 436 or equ va ent

535 Solar Cells. 3 F
Photovo ta c dev ces nc ud ng homojunct ons and heterojunct ons Photogenerat on of carr ers spectra re sponse e ectr ca character st cs eff c ency Prerequ s te EEE 436 or equ va ent

536 Semiconductor Characterization. 3 N
Measurement techn ques for sem conductor mater a s and dev ces E ectr ca , opt ca phys ca and chem ca charac ter zat on methods Prerequ s te: EEE 436 or equ va ent

537 Semiconductor Optoe ectronics I. 3 N
E ectron c states n sem conductors, quantum theory of rad at n absorpt n processes, rad at ve processes, nonra d at ve processes photo um nescence, photon c dev ces. Prerequ s te EEE 434

538 Semiconductor Optoelectronics II. 3 N
Mater a and dev ce phys cs of sem conductor asers f ght em tt ng d odes photodetector, etc Emerg ng mater a and dev ce techno ogy n I V sem conductors Prerequis te. EEE 537

539 Introduction to Solid State Electron cs. 3 S
Crysta att ces rec proca att ces, quantum stat st cs att ce dynam cs equ br um and nonequ br um processes n sem conductors Prerequ s te EEE 434

541 Electromagnetic Fields and Guided Waves. 3 F
Po ar zat on and magnet zat on, d e ectr c conduct ng an sotrop c and sem conduct ng med a, dua ty un queness and mage theory p ane wave funct ons, wavegu des, reso nators and surface gu ded waves Prerequ s te· EEE 440 or equ va ent

542 Selected Microwave Devices. 3 S
Use of ferr te, sem conductor, and p ezoe ectr c mater a s 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 ndependent antennas m niatur zat on aperture antennas horns ref ec tors ens antennas cont nuous sources des gn techn ques. Prerequ s te· EEE 443 or equ va ent

544 High Resolution Radar. 3 F
Fundamenta s w deband coherent des gn, waveforms and process ng stepped frequency synthet c aperture radar SAR nverse synthet c aperture radar SAR mag ng. Prerequ s tes 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 d rect ona coup ers phase sh fters DC b ocks, equa zers etc Pre requ s te EEE 445 or nstructor approva

546 Advanced Fiber Optics. 3 N
Theory of propagat on n f bers frequency modu at on of ght f ber opt c heterodyne rece vers, f ber opt c sensors b refr ngence n f bers Prerequ s te EEE 448 or nstructor approva

547 Microwave Solid State Circuit Design I. 3 N
App cat on of sem conductor character st cs to pract ca des gn of m crowave m xers detectors m ters switches attenuators mu t p ers, phase sh fters and amp f ers Pre requ s te EEE 545 or nstructor approva

548 Coherent Optics. 3 N
D ffraction enses opt ca process ng ho ography e ectro opt cs asers Prerequ s te EEE 440

549 Lasers. 3) N
Theory and des gn of gas, so d, and sem conductor asers Prerequ s te· EEE 448 or nstructor approva .

550 Transform Theory and Applications. (3 F
App cat ons of comp ex vanab es to Four er Lap ace and z transforms. Onented to appl cat ons n contro network, commun cat on and l near system theory. Prerequ s te EEE 303.

551 Information and Coding Theory. 3 N
Fundamental theorems of nformat on theory for sources and channe s, convo ut ona and burst codes Prerequ s tes EEE 451 454

552 Coherent Communications. 3) N
Systems ana ys s and des gn of te ecommun cat on systems us ng phase ocked oops Prerequ s te EEE 454

555 Random Signal Theory II. 3 S
Process ng of s gna s n the presence of no se Random s gna s corre at on frequency spectra, est mat on, f ter ng no se pred ct on trans ents Prerequ s te EEE 454

556 Detection and Estimation Theory. 3 N
Comb nat on of the c ass ca techn ques of statist ca nfer ence and the random process character zat on of commun cat on, radar and other modern data process ng systems Prerequ s tes EEE 454 455

558 Modulation Theory. 3 N
No se performance of ana og and d g ta modu at on sys tems. Emphas s on modern d g ta techn ques n terrestr a and sate 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 protoco s Packet and message sw tch ng software e ements Network contro Examp es Prerequ s te EEE 459

566 Medical Imaging Instrumentation. 3 N
Des gn and ana ys s of mag ng systems and nuc ear dev ces for med ca d agnos s, therapy and research Laboratory exper ments us ng d agnost c rad o ogy f uoroscopy u tra sound and CAT scann ng Lecture ab Cross isted as BME 566 and NUC 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 d agnost c rad o ogy cyclo trons and nuc ear reactors Monte Carlo and emp r ca computat ona methods regu at ons des gn prob ems Cross sted as BME 567 and NUC 567 Prerequ s te EEE 465

568 Medical Tomography. 3 S
CT SPECT PET, MR Three d mens ona *n v vo* measure ments Instrument des gn, phys olog ca model ng c n ca protoco s, reconstruct on algor thms quant tat on ssues. Cross sted as BME 568 and NUC 568 Prerequ s te EEE 465.

569 Radiochemistry and Radiopharmaceutical Production. 3 N
Advanced pr nc ples of cyc otron des gn, targetry, operat on and ut zat on Novel syntheses, tracer preparat on qua ty contro b od str bution stud es Cross sted as BME 569 and NUC 569. Prerequ s te EEE 465

571 Power System Transients. (3) N
Ana ys s of trans ent currents and vo tages generated by d sturbances n power networks EMTP method. Travel ng waves Trans ents in transformers and generators Protec t on aga nst trans ents Prerequ s te EEE 471

572 Power Electronics. 3 N
Ana ys s of dev ce operat on thyr stors gate turn off thyr s tors, trans stors Des gn of rect f er and nverter c rcu ts App cat ons var ab e speed dr ves, HVDC, motor contro uninterruptab e power supp es Prerequ s te EEE 471

573 Power System Control. 3 N
Concepts of economic and secure operat on of power sys tems oad frequency contro econom c d spatch un t com m tment, state est mat on cont ngency ana ys s Prerequ s te EEE 471

574 Computer Solution of Power Systems. 3 N
A gorithms for d g ta computat on for power f ow, fau t and stab ty ana ys s Sparse matr x and vector programm ng methods, opt m zat on stochast c methods. Prerequ s te EEE 471

577 Power System Planning. 3 F
Power f ow and trans ent stab ty ana ys s, oad forecast ng methods re ab ty concepts Transm ss on p ann ng, oss of oad probab ty and product on cost ana ys s optima net work and generat on expans on Prerequ s te EEE 470

579 Power Transmission and Distribution. 3 S
H gh vo tage t ansm ss on ne des gn· conductors corona R and TV no se dc transm ss on D str but on system ana ys s oad character st cs feeder vo tage drop, capac tor app cat ons Prerequ s te· EEE 471

581 Random Processes in Control Systems. 3 N
Stat stica f ter ng est mat on and contro w th emphas s on the Ka man f ter and ts app cat ons and computat ona prob ems Prerequ s tes EEE 454 550, 582

582 Linear System Theory. 3 F
Control ab ty observab ty and rea zat on theory for mu t var ab e cont nuous t me system Stab zat on and asymp tot c state est mat on D sturbance decoup ng non nter act ng contro and banded nput/banded output stab ty Prerequ s te EEE 482

585 Digital Control Systems. 3 N
Ana ys s and des gn of d g ta and sampled data contro systems nclud ng samp ng theory z transforms, the state trans t on method, stab ty des gn and synthes s Prerequ s tes EEE 550 582

586 Nonlinear Control Systems. (3 N
Stab ty theory nc ud ng phase p ane descr b ng funct on Liapunov's method and frequency domain cr ter a for con t nuous and d screte non near and t me vary ng systems Prerequ s te· EEE 582

587 Optimal Control Systems. 3) N
App cat on of ca culus of var at ons Pontryag n s princ p e and dynam c programm ng to control prob ems Computa t ona techn ques for so v ng opt ma control prob ems Prerequ s te EEE 582

641 Advanced Electromagnetic Field Theory. 3) N
Cy ndr ca wave funct ons wavegu des and resonators, spher ca wave funct ons and resonators, ntegra equat ons, scatter ng and rad at on; perturbational and vanat ona meth ods Prerequ s te· EEE 541 or equiva ent

643 Advanced Topics in Electromagnetic Radiation. 3 N
H gh frequency asymptot c techn ques geometr ca , and phys ca theor es of d ffraction (GTD and PTD moment method MM radar cross section RCS predict on, Founer transforms n rad at on synthes s methods Prerequ s te EEE 543

645 Microwave Filter Design. 3) N
Ana ys s and des gn of m crowave ow pass high pass, band pass and band stop f ters and m crowave d p exers mu t p exers Prerequ s te: EEE 545 or nstructor approva

647 M'crowave So id State Circuit Design II. 3 N
Pract ca des gn of m crowave free runn ng and vo tage contro ed osc ators us ng Gunn and Impatt d odes and trans stors· ana ys s of no se character st cs of the osc ator Prerequ s tes EEE 545 547

731 Small MOS Dev ces. 3 S
Subthresho d current, thresho d vo tage modu at on, sca ng and other smal s ze m tat ons Prerequ s te· EEE 532

732 Advanced Bipolar Devices and Circu ts. 3 F
Cr t ca exam nat on of new b po ar dev ce and c rcu t tech no og es Performance trade offs sca ng effects and mod e ng techn ques Prerequ s te. EEE 531.

770 Advanced Topics in Power Systems. 3 N
Power system prob ems of current nterest approached at an advanced techn ca eve fo mature students Prerequ s tes EEE 577 579 or equ va ents, nstructor approva .

Special Courses: Spec a Courses EEE 484 492 493 494 498 499 580 590 591 592 594 598, 599 680 690 691 692 790 791 792 799 See pages 43–44

Industrial and Management Systems Engineering

PROFESSORS:
WOLFE (EC G 120B BA LEY BEDWORTH, MONTGOMERY, SMITH
ASSOCIATE PROFESSORS:
ANDERSON COCHRAN, DEAN, KEATS, KNIGHT MACKULAK MOOR ROLLIER, SHUNK WILSON ASU WEST CAMPUS)
ASSISTANT PROFESSORS:
HUBELE, NUNO 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 re sponsibilities In a manufacturing enterprise, for example, the con mon 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 technology makes it possible to integrate people, material, machines, money, and other resources into pro ductive enterprises. Information systems includ ing networks, database models, and computer hardware and software that tie people and re sources together symbolize the essence of "inte gration" 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 disciplines 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 engineer ing is the emphasis on people In fact, industrial engineering is often referred to as the "people ori ented profession " It is a primary function of the IE to integrate people and technology oriented systems. IE's are active in the fields of human factors and ergonomics. With the development of the field of artificial intelligence and expert sys tems, the IE is being called upon to lead the movement from muscle based work to knowl edge based work. Industrial engineering is the only engineering discipline offering course work in quality assurance, so critical in today's com petitive environment.

The IE is not only the developer of people and technology integrated systems but also is a prime candidate for all levels of management, especially those in h gh tech organizations, because of the IE's background in technology integration, organ izational theory, management practice, and engi neering economics. This is evidenced by the fact that over 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 So ids may be deleted from the engineering core).

			Semester Hours
ECE	383	Probability and Statistics for Engineers	2
IEE	463	Computer Aided Manufactur ng and Control	3

In addition, the fol owing 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	43	Engineering Administration	3
IEE	46	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
MAE	351	Manufacturing Processes Survey	3
Area of Emphasis technical electives			2
		Total	57

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. FIN 301 BLW 306, IEE 411 510, 531

Information systems CSC 304, 305, 410, 412, IEE 464, 577.

Quality control reliability AET 409, MAE 441, 442, IEE 569, 570, 571, 573

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 fron this department.

Industrial Engineering Program of Study

Typical Four-Year Sequence

Freshman Year

			Semester Hour
First Semester			
CHM	114	General Chemistry for Engineers	4
ECE	105	Introduction to Languages of Engineering	3
ENG	101	First Year Composition	3
MAT	271	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
IEE	300	Economic Analysis for Engineers	2
MA	345	Elementary Linear Algebra	2
MAT	272	Calculus with Analytic Geometry II	4
PHY	131	University Physics II Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
		Total	15
Second Semester			
ECE	240	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			3
		Total	19
Second Semester			
ECE	353	Structure and Properties of Materials	3
ECE	333	Electrical Instrumentation	3
IEE	367	Methods Engineering and Facilities Design	4
MAE	351	Production Processes Survey	3
Technical Elective			3
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	4 5	Introduction to Simulation	3
		Total	18

Second Semester

ECE	40	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: Minimum semester hours including English requirement

No high school chemistry, take CHM 113 and 6

See pages 50–80 for requirements and approved list.

See page 3 4 General Studies, for specific requirements and selection of LI elective

[4] Select from BIO 181 CHM 331, GLG 100, PHY 361 or ZOL 201

Manufacturing Engineering

Manufacturing engineering is concerned with the application of the principles of science to increase productivity in industry This involves the design of systems that allow for the best utilization of men, machines, material, and money Modern manufacturing engineering is concerned with the application 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 will be well qualified to participate in the introduction of CAD CAM CIM and factory automation technology to industry

The following courses are required as part of the 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, PHY 361 CHM 331, GLG 100 or ZOL 201

In addition, the following courses are required

			Semester Hours
IEE	30	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	
IEE	464	Computer Integrated Design	3
EE	490	Project in Design and Development	3
MAE	31	Dynamic Systems and Control	3
MAE	315	Dynamic Systems and Control Lab	1
MAE	351	Manufacturing Processes Survey	3
MAE	422	Mechanics of Materials	4
MAE	441	Design Theory and Techniques	3
MAE	447	Robotics and Its Influence on Design	3
MET	44	NC Computer Programming	3
MSE	48	Manufacturing Engineering	3
Technical Electives			9
		Total	57

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 Prerequisites ECE 106 MAT 260 or 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 106 *[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 man machine systems emphasis on process design materials handling layout design and facilities location Lecture, lab Prerequisite EE 300

374 Quality Control. 3 F
In depth analysis of control chart and other statistical process control techniques Organization and managerial aspects of quality assurance Attribute and variable acceptance sampling plans Prerequisite ECE 383

411 Engineering Economy. 3 S
Equipment replacement analysis treatment of inflation cash flow studies and consideration of risk and uncertainty Prerequisite IEE 300

422 Information Systems Design. 3 F SS
Emphasis on the application of system analysis and design to information systems Microprocessor MS project required

431 Engineer ng Administration. 3 F SS
Eng neer ng organ zat on and adm n strat on, ntroduct on to dec s on mak ng quant tat ve and qua tat ve ap proaches to management and eng neer ng adm n strat on

437 Human Factors Engineering. 3 F
Study of peop e at w rk des gn ng for h man perform ance effect veness and product v ty Cons de at ons of human phys o og ca and psycho og ca factors Prerequ s te EE 367

461 Integrated Production Control. 3 F, S
Product o contro te hn ques for the p ann ng ana ys s, contro and eva uat o of operat ng systems T me ser es forecast ng, network p ann ng schedu ng and contro Prerequ s te ECE 383

463 Computer-Aided Manufacturing and Control. 3 F, S
Emphas s o computer contro n manufactur ng rea t me concepts C M NC group techno ogy and process p an n ng robot cs Prerequ s te ECE 105 *[Sat sf es Genera Stud es Requ rement N3*

464 Computer-Integrated Design. 3 F S
Use of CAD too s to create geometr c objects and ayout des gns Des gn nterfac ng through database structure w th manufactur ng p ann ng contro funct ons nc udes open shop des gn aboratory ass gnments n add t on to c assroom work P erequ s te ECE 105 *[Sat sf es Gen eral Stud es Requ rement. N3]*

475 Introduction to Simulation. 3 F S
Use of s mu at on n the ana ys s and des gn of network and d screte systems Methods for us ng a s mu at on an guage ntroduct on to stat st ca aspects t s mu at on Prerequ s tes ECE 105 383 *[Sat sf es Genera St d es Requ rement N3]*

476 Operations Research Techniques Applications. 4 F S
Top cs nc ude near programm ng etwork opt m zat on, dynam c programm ng Markov processes and queue ng mode s Emphas s on the des gn and deve pment of mode s for so v ng dec s on prob em n ndustr a sys tems Prerequ s tes ECE 383 MAT 242 *[Sat sf es Gen era Stud es Requ rement. N2]*

488 Industrial Engineering Analysis. 3 S
Labor mater a and overhead cost ana ys s parametric cost est mat ng, r sk ana ys s nvo v ng budget m tat ons assurance of est mates qua ty cost systems fe cyc e cost ana ys s nc ud ng effects on eng neer ng des gn, re ab ty ma nta nab ty serv ceab ty, testab ty and ava ab ty Prerequ s tes ECE 383, EE 300

490 Project in Des gn and Development. 3 F, S
Ind v dua pro ect n creat ve des gn and synthes s Pre requ s te. sen or stand ng

501 Foundations of Industrial Engineering I. 3 F
Techn ques for the ana ys s and des gn of man mach ne systems Emphas s on work p ann ng methods measure ments mater a hand ng and fac ty des gn. Not ava ab e for I E graduate cred t

502 Foundations of Industrial Engineering II. 3 S
ntroduct on to quant tat ve product on contro techn ques plann ng forecast ng nventory control and MRP sched ul ng Inf uence of CAD CAM and automat on on produc t on contro process Not ava ab e for I E. graduate cred t Prerequis te· ECE 383 or 500

503 Economic Analysis for Engineers. 2 F S
Econom c eva uat on of a ternat ves for eng neer ng dec s ons, emphas z ng the t me va ue of money Not ava ab e for E graduate cred t Prerequ sites ECE 106, MAT 260 or 270

510 Measurement of Productivity. 3 F
The eng neer ng econom c aud t and its use with app ca t ons to break even ana ys s var ab e budget contro cost ana ys s and product pr c ng Prerequ s te ECE 383 or 500

511 Analysis of Decision Processes. 3 F S
Methods of mak ng dec s ons n comp ex env ronments stat st ca de s on theory effects of r k uncerta nty and strategy on eng neer ng and manager a dec s ons Pre requ s te ECE 383 or 500

520 Ergonomics Design. 3 S
Human phys o og ca and psycho og ca factors n the de s gn of work env ronments and n the emp oyment of peop e n man ma h ne systems Open shop ab ass gn ments n add t on to c ass work Prerequ s te IEE 501

531 Topics in Engineering Administration. 3 S
Cons derat on g ven to ph osoph ca psycho og ca pol t ca and soc a mp cat ons of adm n strat ve dec s ons

533 Scheduling and Network Analysis Models. 3 S
App cat n of schedu ng and sequenc ng a gor thms de term n st and sto hast c network ana ys s and f ow a go r thms Prerequ s tes ECE 383 or 500 IEE 475 or 545

540 Engineering Economy. 3 S
Equ pment rep acement ana ys s treatment of nf at on n cash f ow stud es and cons derat on of r sk and uncer ta nty Open on y to students w thout prev ous cred t for EE 411 Prerequ s te IEE 300 or 503

541 Engineering Administration. 3 F, SS
E g neer ng organ zat n and adm n strat on ntroduct on to dec s on mak g quant tative and q a tat ve ap proaches to management and eng neer ng adm n strat on. Open n y to students w thout prev ous cred t for EE 431.

542 Information System Design. 3 F SS
Empha on the app cat o of system ana ys s and de s gn to nformat on systems M croprocessor M S project requ red Ope on y to students w thout prev o s cred t for IEE 422

543 Computer Aided Manufacturing and Control. 3 F S
Emphas s on omp ter ontro n manufactur ng rea t me concepts C M NC group techno ogy and process p an n ng robot cs Open on y to students w thout prev ous cred t for IEE 463 Prerequ s te ECE 105

544 Computer-Integrated Des gn. 3 F S
Use of CAD too s to create geometr c objects and layout des gns Des gn nterfac ng through database structure w th manufactur ng p ann ng contro funct ons nc udes open shop des gn ab ass gnments n add t on to c ass room work Open on y to students w thout prev ous cred t for IEE 464 Prerequ s te ECE 105

545 Introduction to Simulation. 3 F, S
Use of s mu at on n the ana ys s and des gn of network and d screte systems Methods for us ng a s mu at on an guage. ntroduct on to stat st ca aspects of s mu at on Open on y to students w thout prev ous cred t for IEE 475 Prerequ s tes ECE 105, ECE 383 or 500

546 Operations Research Techniques Applications. 4 F S
Top cs nc ude near programm ng network optm zat on dynam c programm ng, Markov processes and queueing mode s Emphas s on the des g and deve opment of mode s for so v ng dec s on prob ems n ndustr a sys tems Open on y to students w thout prev ous cred t for EE 476 Prerequ s tes ECE 383 or 500, MAT 242

547 Human Factors Engineering. 3 F
Study of peop e at work des gn ng for human perform ance effect veness and product v ty Cons derat ons of human phy o og ca and psycho og ca factors Open on y to students w thout prev ous cred t for EE 437 Prerequ s te EE 501

548 Industrial Engineering Analysis. 3 S
Labor mater a and overhead cost ana ys s parametr c cost est mat ng r sk ana ys s nvo v ng budget m tat ons assurance of est mates qua ty cost systems fe cyc e ana ys s c d ng effects on eng neer ng des gn re ab ty ma ta nab ty serv ceab ty testab ty and ava ab ty Open on y to st dents w thout prev ous credit for EE 488 Prerequ s tes: ECE 383 or 500, EE 300 or 503

560 Database Concepts for Industrial Management Systems. 3 F S
App cat on of data base concepts to ndustr a systems prob ems Top cs nc ude conceptua mode ng data struc tures, database software and perspect ves from expert and know edge base systems Prerequ s tes ASE 485 or 500, EE 330 IEE 422 or 542 MAT 242

561 Production Control Information Systems. 3 F S
Development of nformat on system des gns for product on contro Top cs nc ude MRP I MRP schedu ng se quenc ng and nventory contro On ne des gn concepts are covered Prerequ s tes ASE 485 or 500 EE 330 EE 422 or 542 MAT 242

563 Systems Ana ys s for Distributed Systems. 3 S
Ana ys s and des gn f d str buted systems for computer ntegrated manufactur ng and nformat on proces ng Concepts of host dr ven m croprocessors to co ect store and commun cate data

564 Planning for Computer-Integrated Manufacturing 3 F S
Theory and use of IDEF methodo ogy n p ann ng for f ex b e manufactur ng, robot cs and rea t me contro . S m a t on concepts app ed to computer ntegrated manufactur ng p ann ng. Prerequ s tes EE 501, 502

565 Computer-Integrated Manufacturing Research. 3 N
Determ nat on and eva uat on of research areas n com puter ntegrated manufactur ng nc ud ng rea t me soft ware manufacturing nformat on systems f ex b e and n tegrated manufactur ng systems robot cs, computer graph cs Prerequ s te IEE 463 or 543 EE 564 or structor approva

566 Simulation in Computer-Integrated Manufacturing Planning. 3 N
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 ex b e and ntegrated manufactur ng systems Use of computer graph cs comb ned w th s mu at on ana ys s for CIM dec s o support Prerequ s te EE 475 or 545 or nstructor approva .

567 System Simulation. 3 S
Use of s mu at on n the ana ys s and des gn of systems nvo v ng cont nuous and d screte processes s m at on anguages stat st ca aspects of s mu at on Prerequ s te IEE 475 or 545

569 Nonparametric Statist'cal Inference. 3 S
App cat on of stat st ca nference procedures based on ranks to eng neer ng prob ems Eff c ent a ternat ves to c ass ca stat st ca nference constra ned by norma ty as sumpt ons Prerequ s te ASE 485 or 500

570 Advanced Quality Control. 3 F
Econom c based acceptance samp ng mu t attr bute ac ceptance samp ng narrow m t gaug ng n nspector error and attr butes acceptance samp ng pr nc p es of qua ty management se ected topics from current terature Pre requ s te EE 374 or nstructor approva

571 Quality Management. 3 S
Tota qua ty concepts, qua ty strateg es qua ty and com pet t ve pos t on qua ty osts vendor e at on , the qua ty manua qua ty n the serv ces Prerequ s te graduate stand ng

572 Engineering Statistics. 3 F
Ana ys s of var ance and exper me ta des gn Top cs n ude genera des g methodo ogy comp ete b ocks confound ng fract ona rep cat on re ponse surface methodo ogy Prerequ s te ASE 485 or 500

573 Reliability Evaluation Techn ques. 3 S
Top cs nc ude the nature of re ab ty t me t fa ure den s t es espec a y the exponent a and We bu er es para e standby systems omp ex system re ab ty Bayes an re ab ty ana ys s and sequent a re ab ty tests Prerequ s te ECE 383 or 500

574 Applied Determ nistic Operations Research Models. 3 F
Formu at on, so ut on ana ys s and app cat on of deter m n st c mode s n operat ons research nc ud g those of nea prog amm ng nteger programm ng a d non near programm ng Prerequ s te MAT 242

575 Applied Stochastic Operations Research Models. 3 S
App cat on of stochast c mode s n ud ng nventory the ory queue ng theory Markov processes stochast c pro gramm ng and renewa theory Prerequ s te ECE 383 or 500

576 Applications of Operations Research 3 F
Case stud es of app cat on of ea and on ear mode and genera types of search te hn ques Prerequ s te EE 5"4 or nstructor approva .

577 Decision and Expert Systems Methodology. 3 S
Systems approach to the ana ys s des gn and mp eme tat on of dec s on support systems Emphas on deve op ment of databases mode bases d a ogs and systems arch tecture as we as systems effect veness ntroduc t on to expert systems as dec s on a d nc uded Term pro ect requ red Prerequ s te EE 422 or 542

578 Advanced Decision Theory. 3 S
Advanced dec s on theory techn ques for ndustr a sys tems Top cs nc ude conjugate fam es of d str but ons va ue theory dec s on w th mu t p e object ves and goa programm ng Prerequ s te EE 511

579 Time Series Analysis and Forecasting. 3 F
Forecast ng t me ser es by the B x Jenk ns and exponen t a smooth ng techn ques, ex st ng d g ta computer pro grams are ut zed to augment the theory Prerequ te ASE 485 or 500

581 Reliab lity, Availability and Serviceability. 3 F
nc udes orga z ng for RAS, hardware and software RAS, ntegr ty and fau t to erant des gn ma ntenance des gn and ma ntenance strategy Markov mode s fo RAS fau t free ana ys s and m tary standards for RAS Prerequ s te ECE 383 or 500

Special Courses: IEE 484, 492, 493 494 498 499 580 590 591 592 598 599 784 790 792, 799 See pages 43–44

Mechanical and Aerospace Engineering

PROFESSORS:
BOYER (EC G 346C) BEAKLEY BICKFORD CHEN, DAV DSON, D TSWORTH, EVANS, FLORSCHUETZ, HIRLEMAN JACOBSON, JANKOWSKI, LOGAN METZGER, NELSON, RICE, ROY, SARIC, SCHMIDT, SO, WALLACE WOOD, YAO

ASSOCIATE PROFESSORS:
FERNANDO LAANANEN L U, NE TZEL, PECK, RANK N, REED, TONG

ASSISTANT PROFESSORS:
B LIMORIA, BLECHSCHM DT, CASTELAZO HENDERSON, KOURIS, KUO, McNE LL, M GNOLET, NATSIAVAS SHAH, WELLS

PROFESSORS EMERITI:
ALLEN, AVERY, FRY, KAUFMAN, PR CE SHAW, THOMPSON, TURNBOW, WILCOX WOOLDR DGE

The Mechanical and Aerospace Engineering De partment is the administrative home for three un dergraduate majors:

Aerospace Engineering
Energy Systems Engineering
Mechanical Engineering

All three ma ors build on the broad exposure to the engineering, chemical, and physical sciences as well as the mathematics embodied in the Gen eral Studies and engineering core courses required of all engineering students.

The *Aerospace Engineering* major provides education for the aerospace industries and govern ment agencies. The *Energy Systems Engineering* major provides education for students interested in the energy field and in employment with en ergy companies (i.e , petroleum companies, solar energy agencies, the nuclear industry, and with utility companies). The *Mechanical Engineering* major is, perhaps, one of the most broadly appli cable programs in engineering, providing educa tion for a wide variety of employment opportuni ties. All of these majors are discussed in more de tail below

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

Degree Requirements

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

Engineering Core Options

Among the options listed on page 315 as part of the engineering core requirements, students in the Department of Mechanical and Aerospace Engi neering are required to select the following:

			Semester Hours
ECE	210	Engineering Mechanics: Statics	3
ECE	312	Engineering Mechanics: Dynamics	3
ECE	313	Introduction to Deformable Solids	3
ECE	340	Thermodynamics	3
ECE	350	Structure and Properties of Materials	3

The microcomputer microprocessor elective, when required by a degree requirement, must be selected from one of the fol owing:

			Semester Hours
CSC	220	Computer Organization and Assembly Language Programming	4
EEE	221	Digital Computer Fundamenta s	4
IEE	463	Con puter Aided Manufactur ng and Control	3
MAE	405	Microcomputer A ded Processes for MAE	3

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

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

			Semester Hours
First Semester			
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	274	Elementary Differential Equations	3
PHY	131	University Physics II: Electricity and Magnetism	3
PHY	132	University Physics Lab II	1
MAT	242	Elementary Linear Algebra	2
Literacy and Critical Inquiry Elective			3
General Studies Elective HU or SB			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

See pages 50–80 for specific requirements and approved list.

[1] See page 314 General Studies, for special requirements and selection of 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. 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 Microcomputer/Microprocessor Elective 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 one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Aerodynamics MAE 382, 402, 466, 471, 489, 490.

Aerospace materials. MSE 420, 440, 441, 470.

Aerospace structures. MAE 404, 490; MSE 470.

Design MAE 403, 404, 406, 435, 466, 490; MSE 440, 441, 470.

Propulsion MAE 382, 436, 465, 489, 490.

Stability and control. MAE 341, 417, 447, 490.

Aerospace Engineering
Program of Study
Typical Last Two-Year Sequence
Junior Year

			Semester Hours
First Semester			
ECE	333	Electrical Instrumentation or Microcomputer/Microprocessor Elective 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)[1]			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

[1] See pages 50–80 for requirements and approved list

Energy Systems Engineering—B.S.E.

There is little doubt that the long-range future of the United States is contingent upon our ability to deal effectively with our chronic energy problems. In an effort to solve these problems and to lessen their impact on economies and lifestyles, both government and industry have made commitments to energy production, conservation, and research. This in turn has stimulated employment of engineers and scientists trained in fields that relate to this problem area.

Of the established fields of engineering, the field of mechanical engineering is the most closely allied to energy, its production (i.e., conversion of one form to another), transportation and end use. In this context, it is natural to find energy systems engineering housed in the same department with mechanical engineering at ASU

It is the purpose of this option to build on the traditional mechanical engineering areas of fluid mechanics, thermodynamics, heat transfer, design and controls with student selected courses in the following areas of emphasis: alternative energy sources and conversion (including solar energy); conventional sources and conversion; electrical power and distribution; environmental aspects; and nuclear power A general area of emphasis is also available to allow a student to generate a pre approved sequence of interest.

Energy Systems Engineering Major

Energy Systems Engineering students are required to select the following in the engineering core:

			Semester Hour
ECE	333	Electrical Instrumentation	3
ECE	384	Numerical Analysis for Engineers I	2
ECE	386	Partial Differential Equations for Engineers	2
PHY	361	Introductory Modern Physics	3
Microcomputer/Microprocessor Elective			3

The Energy Systems Engineering major consists of:

			Semester Hours
EEE	360	Energy Conversion and Transport	4
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	422	Mechanics of Materials	4
MAE	430	Introduction to Nuclear Engineering	3
MAE	441	Design Theory and Techniques	3
MAE	488	Heat Transfer	3
MAE	491	Experimental Mechanical Engineering	3
MAE	490	Projects in Design and Development or MAE 443 Engineering Design (3)	2
MAE	498	PS: Energy Systems Engineering	3
Area of Emphasis (Technical Electives			8 10
		Total	47–49

Energy Systems Engineering Areas of Emphasis

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

Alternative sources and conversion EEE 436, GLG 302, 310, IEE 300, MAE 336, 436, 437, 438 446

Conventional sources and conversion IEE 300; MAE 415, 417, 435, 436, 446.

Electrical power and distribution EEE 302, 470, 471, 473; IEE 300; MAE 415, 417, 435, 437, 442

Environmental BIO 320, 330, CEE 361, 362; EEE 461; GLG 302; IEE 300; MAE 336, 417

Nuclear EEE 461, 462, 463, GLG 321; IEE 300, MAE 415, 417, 431, 435, 437, 442.

Energy Systems Engineering
Program of Study
Typical Last Two Year Sequence

Junior Year

			Semester Hours
First Semester			
ECE	333	Electrical Instrumentation or ECE 334 Electronic Devices and Instrumentation	3 4
MAE	371	Fluid Mechanics	3
MAE	382	Thermodynamics	3
MAE	422	Mechanics of Materials	4
PHY	361	Introductory Modern Physics	3
		Total	16
Second Semester			
EEE	360	Energy Conversion and Transport	4
MAE	372	Fluid Mechanics	4
MAE	430	Introduction to Nuclear Engineering	3
MAE	488	Heat Transfer	3
MAE	317	Dynamic Systems and Control	3
MAE	318	Dynamic Systems and Control Laboratory	1
		Total	18

Senior Year

			Semester Hours
First Semester			
MAE	441	Design Theory and Techniques	3
MAE	49	Experimental Mechanical Engineering	3
Microcomputer Elective			3
Technical Electives			5
General Studies Elective (HL or SB)			3
		Total	17
Second Semester			
ECE	400	Engineering Communications	3
MAE	493	Projects in Design and Development or MAE 443 Engineering Design	2 3
MAE	498	PSE Energy Systems Engineering	3
Technical Electives			5
General Studies Elective (HL or SB)			3
		Total	16

See pages 50–58 for requirements and approved list

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 which involve mechanical work and its conversion from, and into, other forms. It includes the conversion of thermal, chemical, and nuclear energy into mechanical energy through various engines and powerplants; the transport of energy via devices like heat exchangers, pipelines, gears, and linkages; and the use of energy to perform a variety of tasks for the benefit of society, such as in transportation vehicles of all types, manufacturing tools and equipment, and household appliances. Furthermore, since all manufactured 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 man. Therefore, a major strength of a mechanical engineering education is the flexibility it provides in future employment opportunities for its graduates.

The undergraduate curriculum includes the study of principles governing the use of energy; principles of design, instruments and control devices; and the application of these studies to the creative solution of practical, modern problems.

Mechanical Engineering Major

Mechanical Engineering students are required to select the following in the engineering core:

			Semester Hours
MAT	242	Elementary Linear Algebra	2
ECE	333	Electrical Instrumentation	3
ECE	386	Partial Differential Equations for Engineers	2
PHY	361	Introductory Modern Physics	3
Microcomputer Microprocessor Elective			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 System Design	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 one or more of the following areas. A student may, with prior approval of the department, select a general area or a set of courses that would support a career objective not covered by the following categories.

Aerospace. MAE 413, 435, 436, 437, 460, 461, 462, 463, 466, 467, 471, 489.

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.

Control and dynamic systems CSC 320; ECE 383, EEE 360; IEE 463; MAE 413, 416, 417, 462

Design MAE 34 , 351, 403, 404, 406, 417, 434, 435, 438, 442, 446, 447.

Engineering mechanics MAT 464, 466; MAE 341, 402, 404, 413, 426, 442, 460, 461, 471

Manufacturing. 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, 430, 434, 435, 436, 437, 446, 460, 471.

Mechanical Engineering
Program of Study
Typical Last Two-Year Sequence
Junior Year

			Semester Hours
First Semester			
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
MAE	491	Experimental Mechanical Engineering	3
Technical Electives			4
General Studies Elective (HU or SB)			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)			3
	Total		15

[1] See pages 50–80 for requirements and approved list.

Special Programs

For those students interested in engineering mechanics, an option in this area of emphasis is available under the Engineering Special Programs See pages 359–361 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 311 312 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 Analys s and Design. 3 F
Pos t ons ve oc t es and acce erat ons of mach ne parts cams gears f ex b e connectors ro ng contact ntroduc t on to synthes s Prerequ s te ECE 312

351 Manufactur ng Processes Survey. 3 F S
Product on techn ques and equ pment Cast ng and mo d ng pressure form ng mater a remova jo n ng and as semb y processes automat on and mater a hand ng Lecture, rec tat on Prerequ s te ECE 350

361 Aerodynamics I. 3 F S
F u d stat cs conservat on pr nc p es stream funct on ve oc ty potent a , vort c ty nv sc d f ow Kutta Joukowsk th n a rfo theory, pane methods Prerequ s tes ECE 312, 340

371 Fluid Mechanics. 3 F S
ntroductory concepts of f u d mot on f u d stat cs contro vo ume forms of bas c pr nc p es ntroduct on to oca pr n c p es Prerequ s tes ECE 312, 340

372 Fluid Mechanics. 4 F S
App cat on of bas c pr nc p es of f u d mechan cs to prob ems n v scous and compress b e f ow Lab exper menta t on demonstrat ons. Prerequ s tes. ECE 384 386 MAE 371

382 Thermodynamics. 3 F S
App ed thermodynam cs gas m xtures, power cyc es and react ve systems ab exper mentat on demonstrat ons Prerequ s te· ECE 340

402 Introduction to Cont'nuum Mechanics. 3 S
App cat on of the pr nc p es of continuum mechan cs to such fie ds as f ow n porous med a b omechan cs e ectromagnet c cont nua magneto f u d mechan cs Pre requ s tes ECE 313 MAE 361 or 371 MAT 242

403 CAD Systems Development. 3 S
Des gn and mp ementat on of CAD System user nterface des gn, computer graph cs data structures extens ve code deve opment Prerequ s tes ECE 105 or equ va ent CSC 220 or EEE 221· jun or stand ng n program

404 Finite Elements in Engineering. 3 S
Introduct on to deas and methodo ogy of f n te e ement ana ys s App cat ons to so d mechan cs, heat transfer f u d mechan cs v brat ons Prerequ s tes ECE 313 MAT 242

405 Microcomputer-Aided Processes for MAE. 3 F S
M crocomputer and m croprocessor fundamenta s Over v ew of programm ng anguages nput/output nterfac ng and ana og d g ta convers on data acqu s t on contro app cat ons Prerequ s te CSC 100 or ECE 106 *[Sat s f es Genera Stud es Requ rement N3]*

406 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 too s n so d mode ng engineer ng ana y s s and manufactur ng se ect on of mode ng parameters rel ab ty tests on software Prerequ s te nstructor ap prova .

413 Spacecraft Dynamics and Control. 3 F S
K nemat cs of part c es and r g d bod es Eu er s moment equat ons sate te orb ts and maneuvers, spacecraft att tude dynamics and contro Prerequ s te ECE 312

415 Vibration Analysis. 4 F S
Free v brat on and forced response of s ng e and mu t p e degree of freedom systems norma modes random v bra t ons. Lecture, ab Prerequ s tes ECE 312, MAE 422

416 Aerospace Vibrations. 4 F S
F n te degree of freedom systems self exc ted systems; one d mens ona cont nuous system v brat ons two d mens onal f utter theory f utter ana yses us ng norma modes Prerequ s tes MAE 361 425, MAT 242

417 Control System Design. 3 S
Too s and methods of contro system design and compen sat on s mu at on response opt m zat on frequency do ma n techniques state var ab e feedback sens t v ty ana ys s ntroduct on to non near and d screte t me sys tems Prerequ te MAE 317

422 Mechanics of Materials. 4 F S
Fa ure theor es, energy methods f n te e ement methods p ates tors on of nonc rcu ar members, unsymmetr ca bend ng, shear center beam co umn Lecture, rec tat on ab Prerequ s tes ECE 313, MAT 242.

425 Aerospace Structures I. 3 F S
Stab ty oads energy methods tors on, curved bars f n te e ements p ates she s of revo ut on. Prerequ s tes ECE 313, MAT 242

426 Aerospace Structures II. 4 F S
Jo nts and connect ons tors on stab ty unsymmetr ca bend ng shear ag str nger sk n ana yses mu t ce con struct on f n te e ement app cat ns compos te mater a s Lecture iab Prerequ s te MAE 425

430 Introduction to Nuclear Engineering. 3 F
Neutron nteract ons w th matter Pr nc p es of neutron cha n react ng systems Neutron d ffus on and moderat on Heat remova from nuc ear reactors Po nt reactor k net cs Prerequ s te. PHY 361.

431 Nuclear Reactor Theory I. 3) N
Neutron transport theory, d ffus on theory app cat ons. Reactor k net cs app cat ons React v ty, nterdependence between neutron cs and therma hydrau cs Prerequis te MAE 430

434 Internal Combustion Engines. 3 S
Performance character st cs, combust on carburet on and fue njection coo ng and contro of nterna combust on eng nes Computer mode ng Lab demonstrat ons Pre requ s te MAE 382.

435 Turbomachinery. 3 S
Design and performance of turbomach nes nc ud ng steam gas and hydrau c turb nes centr fuga pumps, compressors, fans and b owers Corequ s tes MAE 372 382

436 Combustion. 3 N
Thermodynam cs and chem ca k net cs of combust on. Structure, propagat on and stab ty of f ames ign t on theor es drop et and so d part c e combust on Po utant format on Prerequ s te MAE 382

437 Direct Energy Conversion. 3 F
Unconvent ona methods of energy convers on fue ce s, thermoe ectr cs, therm on cs, photovo ta cs and magne tohydrodynam cs Prerequ sites ECE 340 350.

438 Solar Energy. 3) S
So ar rad at on and nstrumentat on des gn and test ng of co ectors performance ana yses of systems therma stor age, photovo ta cs mater a s and econom c ana ys s. Pre requ s tes· MAE 382 488

441 Design Theory and Techniques. 3 F S
The des gn process· prob em def n t on, conceptua de s gn form and funct on dec s on mak ng, mater a se ec t on manufacturab ty modes of fa ure, fat gue, profes s ona sm and eth cs Prerequ s tes. ECE 106 350, MAE 422 or 425

442 Mechanical Systems Design. 3 F S
App cat on of eng neer ng pr nc p es and techniques to the mode ng and ana ys s of mechan ca systems and compo

nents Opt m zat on techn ques presented and use dem onstrated Prerequ s te: MAE 441

443 Engineering Design. 3) F, S
Group projects to des gn eng neer ng components and systems Prob em def n t on deat on, mode ng, and analysis, dec s on mak ng and documentat on act v t es emphas zed 6 hours ab Prerequ site MAE 442 or 446

446 Thermal Systems Design. (3 F
App cat on of eng neer ng pr nc p es and techn ques to the mode ng and analys s of therma systems and compo nents Opt mizat on techn ques are presented and the r use demonstrated Prerequ s te MAE 441.

447 Robotics and Its Influence on Design. 3 S
Robot app cations conf gurat ons singular pos t ons, and work space modes of contro v s on programm ng exer c ses, des gn of parts for assemb y Prerequ s te MAE 317

460 Gas Dynamics. 3 F, S
Compressib e f ow at subson c and superson c speeds, duct f ow; norma and ob que shocks, perturbat on theory w nd tunne des gn Prerequ s te MAE 361 or 371

461 Aerodynamics II. (3 F, S
Transon c/hyperson c f ows w ng theory Navier Stokes, laminar turbu ent shear f ows, pressure drop n tubes, separat on, drag v scous nv sc d nteract on w ng des gn. Prerequ s te MAE 460

462 Dynamics of Flight. (3 F,S
Aerodynam c forces and moments, stat c stab ty and con trol, equat ons of mot on stab ty der vat ves atera and ong tud na mot on and contro Prerequ s tes MAE 413 467.

463 Propulsion. (3 F S
App cation of gas dynam cs and thermodynam cs to a r breath ng eng nes and rockets emphas s 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 flows; f ow over a rfo s wedges and cones Gas turb ne eng ne performance So id rocket heat p pe, rad at on Lecture ab Prerequ s te MAE 460 Pre or corequ s te MAE 461

465 Rocket Propulsion. (3) S
Rocket f ight performance nozz e des gn; combust on of iquid and so d prope lants, component des gn; advanced propu s on systems nterp anetary m ss ons test ng Pre requ s te MAE 460

466 Rotary Wing Aerodynamics and Performance. (3 F, S
Introduct on to he copter and prope er analys s tech n ques. Momentum b ade element, vortex methods. Hover and forward f ght Ground effect autorotat on compress b ty effects Prerequ s tes ECE 386 MAE 361 or nstructor approva

467 Aircraft Performance. 3 F, S
Techn ca aspects of f ght ntegrat ng aerodynam c pr n- c p es re at ng to ft drag and thrust w th power operat ng character stics, performance of an a rp ane ana yzed as a system Prerequisite MAE 361. Pre- or corequ s te MAE 441

468 Aerospace Systems Design. 3 F, S
Group projects re ated to aerospace veh c e des gn, work ng from m ss on def n t on and cont nu ng through pre m nary des gn dec s on making and commun cat on act v t es emphas zed Prerequ s tes: MAE 426 441 467

471 Computational Fluid Mechanics. 3 F
Numer ca so ut ons for se ected prob ems n f u d me chan cs Prerequ s te: MAE 372

488 Heat Transfer. 3 F, S
Steady and unsteady heat co duct on nclud ng numer ca so ut ons therma boundary ayer concepts and app ca t ons to free and forced convect on Therma rad at on concepts Lab exper mentat on, demonstrat ons Pre or corequ s te MAE 372

489 Thermophysics. 3 F
Bas c princip es of heat transfer and the r app cation to propu s on dev ces, therma contro , heat reject on and cryogen c systems Prerequisite ECE 340

490 Projects in Design and Development. 2 F S
Capstone projects n fundamenta or app ed aspects of eng neer ng Prerequ s tes· mechan ca eng neer ng and energy systems majors MAE 441 491 eng neer ng me chan cs majors. MAE 422

491 Experimental Mechanical Engineering. 3 F, S
Exper menta and ana yt ca stud es of phenomena and performance of f u d f ow, heat transfer thermodynam cs, refr gerat on, and mechan ca power systems. 6 hours ab P erequ sites ECE 334 MAE 371 382 Pre or corequis te MAE 488

498 Pro-Seminar. 1 3 N
Spec a top cs for advanced students App cat on of the eng neer ng d sc p nes to des gn and ana ys s of modern techn ca dev ces and systems Prerequ s te· nstructor approva

504 Laser Diagnostics for the Thermal Sciences. 3 S
Fundamenta s of asers and ght scatter ng a er veloc metry, part c e and drop et siz ng

505 Perturbation Methods in Mechanics. 3 N
Non near osc at ons stra ned coord nates renorma za t on mu t p e sca es, boundary ayers matched asymptot c expans ons turn ng point problems WKBJ method

506 Advanced System Modeling, Dynamics and Control. 3 F
Lumped parameter mode ng of phys ca systems w th ex amp es State var ab e representat ons and dynam c re sponse. ntroduct on to modern contro Prerequ s te· MAE 317 or nstructor approval

507 Modern Control Theory and Applications. 3 S
Advanced techn ques for the contro of phys ca systems and processes Opt mal contro . Pontryag n formulat on, numer ca methods near regu ator Accommodat on of d sturbances determ n stic observers Introduct on to sto chast c est mat on and contro · Ka man fi ter ng. Prerequ - s te MAE 506

510 Dynamics and Vibrations. 3 F
Lagrange s and Ham ton s equat ons, r g d body dynam- cs, gyroscop c mot on sma osc at on theory moda ana ys s.

511 Acoustics. (3 F
Pr nc p es under y ng the generat on transm ss on and re- cept on of acoust c waves App cat ons to no se contro arch tectura acoust cs random v brat ons acoust c fa t gue

512 Random Vibrations. 3 S
Rev ew of probab ty theory, random processes stat onar ty, power spectrum, wh te o se process random re sponse of sing e and mu t p e DOF systems Markov proc esses s mu at on Prerequ s tes MAE 510 or nstructor approva

515 Structural Dynamics. 3 S
Free v brat on and forced esponse of d screte and con t nuous system , exa t and approx mate methods of so u t on f n te e ement mode g, computat ona techn ques Prerequ s te MAE 510 or nstructor approva

517 Nonl near Oscillations 3 F
Phase p ane s ngu ar po nts and m t cyc es b furcat on theory approx mate ana ys s methods stab ty ana ys s L apunov s theorem Prerequ s te MAE 510 r nstructor approva

518 Dynamics of Rotor Bearing Systems. 3 S
Cr t ca peed and response ana ys s of r g d and f ex ble rotor systems Bear ng nf ue ce and representat on Sta b ty ana ys s Method of ba anc ng

520 Solid Mechanics. 3 F
ntroduct on to tensors k nemat cs k net cs and const tu t ve assumpt ons ead ng to e ast c p ast c and v s oe as t c behav or App cat ons

522 Variational Principles of Mechanics. 3 S
Virtua w rk stat onary and comp ementary potent a ener g es Ham ton s pr c p e App cat on of these and d rect methods to v brat ons e ast c ty and stab ty Prerequ s te MAE 52 or equ va ent

523 Theory of Plates and Shells 3 F
L near a d on near theor es of p ates Membrane and bend ng theor es of she s She s of revo ut on Prerequ s te MAE 520

524 Theory of Elasticity. 3 S
Formu at on a d s to of two and three d mens ona boundary va ue prob ems Prerequ s te MAE 520

527 Finite Element Methods in Eng neering Science. 3 F
D scret zat on nterpo at n e ementa matr ces assem b y c mputer mp eme tat n App at on to so d and f u d mechan cs heat transfer t me dependent prob ems Prerequ s te ASE 582

529 Theory of Elastic Stability. 3 S
Stab ty of d screte and cont nuous mechan ca systems Dynam c nstab ty Prerequ s te MAE 523

536 Combustion. 3 N
K net c theory and chem ca k net cs of combust on Ex p os on and gn t on theor es React ve gas dynam cs detonat o s Structure propagat on and stab ity of f ames Combu t on of condensed phase fue s Exper menta methods Prerequ s te MAE 436 or nstructor ap prova

537 Direct Energy Conversion 3 N
Advan ed se ected top s d rect energy convers on, the ory des gn and app cat ons Cross sted as MSE 533 Prerequ s te MAE 581

541 CAD Tools for Engineers. 3 F
E ements of computer techn ques requ ed to deve op CAD software Data structures c ud ng sts trees, and graphs C mputer graph cs c ud ng 2 D and 3 D a go r thms and user nterface techn ques

542 Geometric Modeling in CAD CAM. 3 S
Ge metr c and so d mode ng c rve and surface des gn CAD database a h tectures ntegrat on of so d mode ng nto eng neering processes Prerequ s te MAE 541

544 Mechan'ca Design and Fai ure Prevention. 3 F
Modes of mechan a fa ure app cat on of pr nc p es of e ast c ty and p ast c ty n mu t ax a state of stress to de s gn synthe s fa ure theor es fat gue, creep mpact Prerequ 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 too s n so d mode ng, eng neer ng ana y s s and manufactur ng se ect on of mode ng parameters re ab ty tests on software Open on y to students w thout prev ous cred t for MAE 406 or w th nstructor app ova

547 Mechanical Design and Control of Robots. 3 N
Homogeneous transformat ons three d mens ona k ne mat cs geomet y of mot on so v ng k nemat c equat on d fferent a re at onsh ps mot o trajector es dynam cs contro stat c forces

548 Mechanism Synthesis and Analysis. 3 S
A gebra c and graph ca methods for exact and approx mate synthes s of cam gear and nkage mechan sms; des gn opt m zat on methods of p anar mot on ana ys s, character st cs of p ane mot on· spat a k nemat cs

557 Mechanics of Composite Materials. 3 S
Ana ys s of compos te mater a s and app cat ons M cromechan ca and macromechan ca behav or Class ca am nat on theory deve oped w th nvest gat on of bend ng extens on coup ng

560 Propulsion Systems. 3 N
Des gn of a r breath ng gas turb ne eng nes for a rcraft propu s on m ss on ana ys s; cyc e ana ys s eng ne s z ng component des gn

561 Computational Aerodynamics. 3 S
F n 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 Prerequ s te MAE 571 or structor approva

562 Transonic Flow. 3 F
Transon c f ow non near sma d sturbance equat ons m xed f ow w th shock waves Ana yt ca and numer ca treatme ts for a rfo s App cat ns 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 b e f ow W ngs and bod es n osc atory and trans ent mot ons Kerne funct on approach and pane methods Aeroe ast c app cat ons Prerequ s tes MAE 460 or 461 562.

564 Advanced Aerodynamics. 3 F
Perturbat on method L near zed subson c and superson c f ows Th n w ng s ender body theories L fting surface theory Pane method computat on Prerequ s te MAE 460 or 461

565 Turbomachinery. 3 N
Des gn and performance of turbomach es nc ud ng tur b nes comp essors, pumps fans and b owers

571 Fluid Mechanics. 3 F
Bas c k nemat c dynam c and thermody am c equat ons of the f u d cont nuum and the r app cat on to basic f u d mode s

572 Inviscid Fluid Flow. 3 S
Mechan cs of f u ds for f ows n wh ch the effects of v scos ty may be gnored Potent a f ow theory waves nv sc d 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 v scos ty are s gn ficant Exact and approx mate so ut ons of the Navier Stokes system am nar f ow at ow and h gh Rey nolds 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 press b ty and v scos ty are s gn f cant Compress ble boundary ayers free shear ayers shock waves nterna f ows Prerequ s te MAE 572

575 Turbulent Shear Flows. 3 F
Homogeneous and sotrop c turbu ence wa turbu ence Exper menta resu ts Introduct on to turbu ent f ow ca cu iat ons Prerequ s te MAE 571

577 Turbulent Flow Modeling. 3 S
Reyno ds equat ons and the r c osure Mode ng of mp e and comp ex turbu ent f ows ca cu at ons of nterna and externa f ows and app cat on to eng neer ng prob ems Prerequ s te MAE 571

581 Thermodynamics. 3 F
Bas c concepts and aws of c ass ca equ br um thermo dynam cs ntroduct on to stat st ca thermodynam cs Ap p cat ons to eng neer ng systems

582 Statistical Thermodynamics. 3 N
Cont nuat on of MAE 581 nc ud ng stat st ca and rre vers b e thermodynam cs Cross sted as MSE 531 Pre requ s te MAE 581

585 Conduction Heat Transfer. 3 F
Bas c equat ons and concepts of conduct on heat transfer Mathemat ca formu at on and so ut on ana yt ca and nu mer ca of steady and unsteady, one and mu t d men s ona heat conduct on prob ems Prerequ 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 nterna and externa flows Natura and m xed convect on Prerequ s te MAE 488

587 Radiation 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 ng heat transfer condensat on heat transfer, var ous mode s of vapor qu d m xture f ow 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 mode s for heat transfer App cat ons to conduct ve convect ve ra d at ve a d comb ned mode heat transfer Prerequ s te MAE 488

594 Graduate Research Conference. 1 F S
Top cs n contemporary research Requ red every semes ter of a departmenta graduate students reg stered for 9 or more semester hours. Not for degree c ed t

598 Special Topics. 1 3 F S
Spec a top cs courses nc ud ng the fo ow ng wh ch are regu ar y offered a e open to qua f ed students
a Dynam cs and Contro
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

Special Courses: MAE 484 492, 493 494 498, 499 500 590 591 592 598, 599, 790 792 799 See pages 43–44

Programs in Engineering Special and Interdisciplinary Studies

George C. Beakley Jr., Ph.D., Director

The following degree programs are administered by the Dean's Office of the College of Engineering and Applied Sciences

B S E Bioengineering see pages 320–322
B S E Engineer ng Specia Programs
- Engineering Mechani s see pages 360–361
- Eng eering Synergy see page 361
- Manufactur ng Engineer ng see page 348
- M croelectronics Manufacturing Engineering see pages 361 362
- Nuclear Sciences (see pages 362 363)
- Pre medical Eng neering see pages 363 365
- Systems Engineer ng see pages 365 366)

B S Engineering Interdisciplin ry Programs
- Engineer ng Business and Prelaw (see page 366
- Geolog ca Engineer ng see page 366)

Descriptions of these programs 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 accom modate students whose educational objectives re quire more intensity of concentration on a par ticular subject or more curricular flexibility within an engineering discipline than the tradi tional departmental majors generally permit. These majors are School of Engineering pro grams. Unlike the departmental ma or areas, how ever 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 engineer ing work where proficiency in the application of science and the physical and social technologies is brought to bear on problems of large scope. The necessary breadth that these students seek of ten is not obtainable in traditional engineering fields. Rather, especially designed programs of course work that merge the required principles and approaches drawn from all fields of engineer

ing and other pertinent disciplines are desired. As an answer to this need, two types of course arrangements are available: (1 the Bachelor of Science in Engineering degree Special Programs; and 2) Engineering Interdisciplinary Programs that lead to the degree Bachelor of Science.

The B.S.E. Engineering Special Programs are designed primarily for students intending to pursue engineering careers at a professional level in industry or graduate studies The B S Engineering Interdisciplinary Programs accommodate those students who desire the integrity of an engineering education but plan to enter professions other than engineering, or particularly to serve society in socially relevant activities. Both are developed beyond the General Studies and the engineering core

The curricula leading to both the Bachelor of Science in Engineering (B.S.E. and the Bachelor of Science (B.S. have been accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET

Engineering Special Programs—B.S.E.

Engineering Mechanics. The engineering mechanics curriculum 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 majors.

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 which 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 .... or ECE 334 Electronic Devices and Instrumentation (4)	3
ECE	384	Numerical Analysis for Engineers I	2
ECE	386	Partial Differential Equations for Engineers	2
PHY	361	Introductory Modern Physics[1]	3
Microcomputer/Microprocessor Elective			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 or MAT 460 Applied Real Analysis (3)	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

			Semester Hours
First Semester			
ECE	333	Electrical Instrumentation or ECE 334 Electronic Devices and Instrumentation 4)	3
MAE	371	Fluid Mechanics	3
MAT	371	Advanced Calculus I or MAT 460 Applied Real Analysis 3)	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	415	Vibration Analysis	4
MAE	441	Design Theory and Techniques	3
MAE	488	Heat Transfer	3
Microcomputer Elective			3
		Total	16
Second Semester			
ECE	400	Engineering Communications	3
MAE	490	Projects in Design and Development	2
General Studies Elective (HU or SB)			3
Technical Electives			8
		Total	16

[1] See pages 50–80 for requirements and approved list

Engineering Synergy. Engineering synergy is the concept of bringing together diverse disciplines, some outside of engineering, which interact in an enhanced fashion. This program accommodates those students with broad interests who wish to pursue an individualized engineering degree program which 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 314–315 The major requirements are determined and approved by an advisory committee consisting of three faculty members appointed by the Director of the Programs in Engineering Special and Interdisciplinary Studies It is expected that the major will 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 348)

Microelectronics Manufacturing Engineering. The successful demonstration of the first integrated circuit in 1958 inspired the creation of a new industry to manufacture these truly amazing devices. This dynamic growth industry is vital to the economic well-being and security of the United States. Today, integrated or microelectronic circuits are essential components in products that range from inexpensive, mass produced consumer goods to extremely sophisticated electronic systems.

Microelectronics manufacturing engineers play crucial roles in the realization of commercially viable microelectronic products from design prototypes Their involvement begins with the product design and does not end until the completed microelectronic circuit or system is delivered to the purchaser A microelectronics manufacturing engineer needs diverse knowledge and abilities in order to participate effectively in the identification and implementation of cost effective solutions to significant manufacturing problems.

This Engineering Special Programs curriculum has been established to prepare students for challenging and rewarding careers in microelectronics manufacturing engineering.

This option is administered by the Department of Electrical and Computer Engineering

The following courses are required as part of the engineering core and mathematics electives:

			Semester Hour
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	221	Digital Computer Fundamentals	4
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 Hour
CHE	461	Process Control	3
EEE	302	Electrical Networks II	3
EEE	322	Microprocessor Applications	4
EEE	435	Microelectronic	3
		or UET 418 Hybrid Integrated Circuit Technology	4
EEE	436	Fundamentals of Solid State Devices	3
EEE	439	Semiconductor Facilities and Cleanroom Practices	3
IEE	300	Economic Analysis for Engineers	3
IEE	463	Computer Aided Manufacturing and Control	3
		or MET 426 Applied Computer Integrated Manufacturing	3
MET	401	Statistical Process Control	3
		or IEE 374 Quality Control	3
MSE	472	Integrated Circuit Materials Science	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	Electronics Fabrication Principles	3
Technical Electives			10–11
Total			49–50

Nuclear Sciences. The nuclear sciences curriculum encourages an individualized program based on the student's own career interests and objectives The program provides a strong foundation in basic engineering and nuclear concepts. Electives are generally taken during the junior and senior years and must be approved by a designated faculty advisor. The electives should focus on a technical or environmental area associated with the (1) discovery, development or utilization of energy or (2) materials or products which use, release, or may be affected by radiation

Individual elective programs may also be aligned with a traditional discipline such as chemical, civil, electrical, or mechanical engineering. They may be tailored toward specific energy resources such as those associated with fission, fusion, solar, geothermal, fossil fuels or synthetic fuels such as oil shale. They may be structured for specific high demand areas such as radiation health physics, medical physics, radiological imaging, power systems engineering, corrosion and radiation effects on materials, computer aided operation and accident analysis at power generation facilities or designing better man machine interfaces Finally, there are opportunities to pursue selected areas such as waste disposal, radiation effects on electronics in space, biomedical applications, nuclear applications in forensics, low level radiation measurements of our natural radiation environment or anomalies from trace amounts of natural radioactivity in computer microprocessing circuits.

Motivated students who have demonstrated scholastic excellence will be encouraged to participate in summer research programs at national laboratories, with an industry, or participate in the ASU Nuclear Sciences summer exchange program. 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 Hour
CSC	22	Computer Organization and Assembly Language Programming	4
		or EEE 221 Digital Computer Fundamentals 4 or MAE 405 Microcomputer Aided Processes for MAE	3)
ECE	210	Engineering Mechanics I: Statics	3
ECE	312	Engineering Mechanics I: Dynamics	3
ECE	350	Structure and Properties of Materials	3
		or ECE 352 Properties of Electronic Materials	3
PHY	361	Introductory Modern Physics	3
		Basic Science Elective	

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	Clinical Nuclear Engineering I	3
MAE 415	Vibration Analysis ... or EEE 481 Feedback Systems (4)	4
MAE 371	Fluid Mechanics ... or EEE 302 Electrical Networks II (3	3
MAE 382	Thermodynamics ... r EEE 303 Signals and Filters 3) or EEE 322 Microprocessor Applications 4	3
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 situation and the role of nuclear power Nuclear fission and fusion theory The nuclear fuel cycle Ultrasafe reactor designs Radiation damage to electronics, including soft errors and space radiation Current and future applications in nuclear medicine radiology and food preservation Cross listed as EEE 460

461 Health Physics Principles and Radiation Measurements. 3 S
Sources characteristics, dosimetry shielding and measurement techniques for cosmogenic, terrestrial and anthropogenic radiation ionizing and nonionizing radiation theory ALARA concept Emphasis on instrumentation detectors, and environmental monitoring Lecture, lab Cross listed as EEE 461 and BME 461 Prerequisite ECE 301.

462 Reactor Safety Analysis. 3 S
Power reactor safety and censing methodologies. Reactor transient and accident analysis. Time dependent solution to neutron diffusion equation. Use of industry codes to assess fission product buildup emergency core cooling behavior reactivity offsite releases and dose calculations Cross listed as EEE 462 Prerequisite EEE or NUC 460

463 Electrical Power Plant. 3 F
Nuclear fossil, and solar energy sources Analysis and design of steam supply systems electrical generating systems and auxiliary systems Power plant efficiency operation and costs and analyses Cross listed as EEE 463 Prerequisites: ECE 301 340.

464 Nuclear Engineering Experiments. 3 F
Theory and applied concepts in reactor design, instrumentation electronics and shielding. Experimental measurements of nuclear parameters using subcritical reactors and fusion neutron generator Fast and thermal activation analysis Primary coolant analysis Mossbauer spectrometry Lecture, lab Cross listed as EEE 464 Corequisite EEE or NUC 460

465 Clinical Nuclear Engineering I. 3 N
Fundamentals of clinical nuclear engineering and medical health physics practice Radiation biology dosimetry and shielding for radiotherapy and diagnostic procedures Cross listed as BME 465 and EEE 465 Prerequisite instructor approval

566 Medical Imaging Instrumentation. 3 N
Design and analysis of imaging systems and nuclear devices for medical diagnosis, therapy and research Laboratory experiments using diagnostic radiology fluoroscopy ultrasound and CAT scanning Lecture, lab Cross listed as EEE 566 and BME 566. Prerequisite BME 465 or EEE 465 or NUC 465 or instructor approval

567 Radiation Shielding and Transport. 3 F
Shielding for radiation therapy, diagnostic radiology cyclotrons and nuclear reactors Monte Carlo and empirical computational methods, regulations designs problems Cross listed as BME 567 and EEE 567 Prerequisite EEE 465

568 Medical Tomography. 3 S
CT, SPECT PET MRI Three dimensional *in vivo* measurements. Instrument design physiological modeling, clinical protocols, reconstruction algorithms, quantitation issues Cross listed as BME 568 and EEE 568 Prerequisite EEE 465

569 Radiochemistry and Radiopharmaceutical Production. 3 N
Advanced principles of cyclotron design targetry operation and utilization Novel synthesis tracer preparation, quality control biodistribution studies Cross listed as BME 569 and EEE 569 Prerequisite EEE 465

Special Courses: NUC 484 492 493 494 498 499 584 590, 591 592 593 594 598 599 792 799 See pages 43–44

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 involved in all branches of medicine As this develops, so will the need for physicians trained in the engineering sciences medical men and women with a knowledge of computer technology, transport phenomena, biomechanics, bioelectric phenomena, operations research and cybernetics. This program emphasis would be of special interest to students desiring entry into a medical college and whose medical interests lie in research, aerospace and undersea medicine, artificial organs, prostheses, biomedical engineering or biophysics Since both engineering and medicine have as their goal the well being of man this program could be compatible with any field of medical endeavor.

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 are required in the undergradu

ate pre medical engineering program which have been selected to meet all university requirements and ABET accreditation requ rements

			Semester Hours
BIO	82	Genera Biology	4
BME	331	Transport Phenomena I: Fluids	3
BME	334	Heat and Mass Transfer	3
BME	411	Biomedica Engineer ng I	3
BME	412	Biomed ca Engineer ng II	3
BME	413	Phys'o ogical Instrumentation	3
BME	417	B omedical Engineer ng Design	3
BME AGB	435	Anima Phys ology I	4
BME	490	B omedical Engineer ng Pro ects	2
BME	496	Professional S minar	0
CHM	1 3	Genera Chemistry	4
CHM	33	General Organic Chemistry	3
CHM	332	Genera Organic Chemistry	3
CHM	335	General Orga ic Chemistry Laboratory	1
CHM	336	General Organ c Chemistry Laboratory	1
Engineering Technica Electives to be se ected from an area of emphasis			6
Total			48

Students must reg ster for BME 496 ea h semester

Students interested in pre medical engineering may elect to emphasize either general b oengi neering or computer science

General bioengineering This emphasis is designed to strengthen the student's knowledge of bioengineering It emphasizes biomed cal research The following courses are required in the engineering core ECE 333, 340, 350 and MAE 405 (ECE 312 is not required in the engineering core) The eight hours of technical e ectives may be selected from engineering, biology or chemis try upper division courses but these courses must include adequate engineering science and design content

C mputer science This emphasis is designed for students interested in the app ication of modern computer technology for medical information processing, medical scientific computation and for the recognition, storage, retrieva , and process ing of medical data. The following courses are required in the engineering core· CSC 220, ECE 334, 340, 352 and MAT 242 (ECE 312 is not re quired in the engineering core Technical elec tives must include CSC 310, one advanced com puter programming course selected from CSC 383, 400 or 470, and upper division engineering courses of engineer ng science and design con tent

Pre-medical Engineering Program of Study
Typical Four-Year Sequence

First Year

			Semester Hours
First Semester			
BME	496	Profess ona Seminar	0
CHM	113	General Chem stry	4
ECE	105	Introduct on to Languages of Engineering	3
ECN	111	Macroeconomic Principles	3
ENG	101	First Year Composition	3
MAT	290	Calcu us I	5
	Total		18
Second Semester			
BME	496	Profess onal Seminar	0
ECE	106	Introduction to Computer Aided Engineering	3
CHM	116	General Chemistry	4
MAT	291	Calcu us II	5
PHY	21	University Physics I: Mechanics	3
PHY	122	University Physics Lab I	1
	Total		16

Second Year

First Semester			
BIO	18	General B ology	4
BME	496	Professional Seminar	0
ENG	102	First Year Composit on	3
MAT	2 4	E ementary Differential Equations	3
PHY	31	University Phys cs II Electr c ty and Magnet sm	3
PHY	132	Un versity Physics Lab II	
Genera Studies Elect ve (HU or SB			3
	Total		17
Second Semester			
BIO	82	General Biology	4
BME	496	Professional Seminar	0
CHM	331	General Organic Chem stry	3
CHM	335	Genera Organic Chemistry Lab	
ECE	2 0	Engineering Mechanics I: Statics	3
ECE	301	Electrical Networks I	4
Literacy and Critical Inquiry Elective			3
	Tota		18

Third Year

First Semester			
BME	331	Transport Phenomena I Fluids	3
BME	435	An mal Physiology I	4
BME	496	Profess onal Sem nar	0
CHM	332	General Organic Chemistry	3
ECE	312	Engineering Mechanics II Dynamics or Technical E ect ve	3
ECE	313	Introduction to Deformable Sol ds	3
ECE	340	Thermodynamics o CHM 441 General Physica 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 Part a Differential Equations for Engineers 2) or MAT 242 Elementary Linear Algebra 2	2
General Studies Elective HU or SB			3
Technical Elective			3
Total			18

Fourth Year

First Semester

BME	411	Biomedical Engineering I	3
BME	413	Physiological Instrumentation	3
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 220 Computer Organization and Assembly Language Programming (4) or EEE 221 Digital Computer Fundamentals 4) or IEE 463 Computer Aided Manufacturing and Control 3	3
General Studies Elective HU or SB)			3
Technical Elective			3
Total			17

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			2
Total			16

Graduation requirements 133 semester hours plus English proficiency

[1] See pages 50–80 for requirements and approved list of courses.

Systems Engineering. Systems engineering deals with the integration of diverse components into a functioning whole This curriculum combines the more traditional studies of electrical and industrial engineering with contemporary analytical and computer based problem solving skills The program also has a strong computer science component. Graduates are prepared for a broad variety of industrial, manufacturing and design engineering career opportunities.

After completing a basic core of fundamental courses in mathematics, physical sciences and engineering sciences, each systems engineering student undertakes a major which includes courses in computer science, electronic circuits, operations research, computer simulation, microprocessors, engineering economics, digital system design, microcomputer fundamentals, and integrated production control. Technical electives may be selected to allow the student to acquire concentrated knowledge in electrical engineering, industrial engineering, or computer science.

The following courses are required as a part of the engineering core and mathematics electives:

			Semester Hours
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
EEE	221	Digital Computer Fundamentals	4
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 Hour
ASE	490	Project in Design and Development	3
CSC	220	Computer Organization and Assembly Language Programming	4
CSC	320	Computer Architecture and Organization	4
CSC	422	Microcomputer Systems Design I	4
EEE	302	Electrical Networks II	3
EEE	303	Signals and Filters	3
EEE	455	Communication Systems	4
EEE	480	Feedback Systems	4
IEE	300	Economic Analysis for Engineers	2
IEE	461	Integrated Production Control	3
IEE	475	Introduction to Simulation	3
IEE	476	Operations Research Techniques Applications	4

Technical Electives			11
Total			52

Engineering Interdisciplinary Programs—B.S.

Engineering Business and Pre-Law. This program accommodates especially those engineering students whose primary intent is to earn a law degree (J.D.) or a graduate degree in Business Administration (M.B.A.). The success with which engineers have risen to positions of leadership in business and government is well established. It is predicted that with the rapid increase in technological advance on every hand, opportunities for engineers to enter business and legal careers will be enhanced to an even greater degree in the future.

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	353	Probability and Statistics for Engineers	3
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 Hour
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	5
Total			52

Geological Engineering. This program incorporates the joint application of engineering and geological principles to the planning, analysis, and design of engineering projects directly related to the earth, its materials, structures, and forces. The goal of the program is to investigate the physical properties of the shallow portions of the earth's crust which influence the design and construction of engineering structures such as foundations, excavations, dams, highways, and sites for waste disposal. Additionally, the geological factors associated with land use planning and with the 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 Hour
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	3

In addition, the following courses are required:

			Semester Hour
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	322	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 non majors to become culturally literate through participation and involvement in the creative and performing arts.

The college, through its programs in art, dance, music and theatre, reflects a wide range of challenges facing the artist and scholar in the 20th century. The arts as an integral part of our curriculum and of human expression offer the student a rewarding educational development balanced and strengthened by studies in related fine arts areas, the humanities, social sciences and the sciences.

In addition to professional curricula offered in each department or school, the college makes available courses designed to meet the specific educational needs of students pursuing majors in other colleges. The cultural life of the university community is further enriched by study opportunities offered at off campus sites. The College of Fine Arts also offers community audiences many hours of cultural enjoyment through the University Art Collections, the Louise Lincoln Kerr Cultural Center, myriad concerts, art exhibitions, music and dance 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 will be accepted up to a maximum of 64 semester hours Community college students planning to transfer at the end of their first or second year should plan their community college courses to meet the requirements of the Arizona State University curriculum selected Students attending Arizona community colleges will be permitted to follow the degree requirements specified in the Arizona State University *Catalog* in effect at the time they began their community college work, providing their college attendance has been continuous.

Courses transferred from community colleges will not be accepted as upper division credit at Arizona State University. Arizona students are urged to refer to the *Arizona Higher Education Course Equivalency Guide* for transferability of specific courses from Arizona community colleges Copies of the guide are available in counselors' offices In choosing courses at a community college, students should be aware that a minimum of 50 hours of work taken at the university must be upper division credits While attending a community college, it is suggested that students elect General Studies and lower division courses in the major field

General Transfer Credit. Direct transfer of courses from other accredited institutions to the College of Fine Arts will be subject to: 1) the existence of parallel and equal courses in the college's curriculum and (2) departmental or

school evaluation of studio courses with respect to performance standards. A minimum of 30 semester hours earned in resident credit courses at Arizona State University is required of every candidate for the bachelor's degree Transfer 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 graduate advisement procedures Students are encouraged to make appointments through the central office of their major discipline.

Degrees

Baccalaureate Degrees

Bachelor of Arts (B.A.)
- Art
  - Emphases in Art History, Photographic Studies, Studio
- Dance
- Music
- Theatre

Bachelor of Fine Arts (B.F.A.)
- Art
  - Concentrations in Art Education, Ceramics, Drawing, Fibers, Graphic Design, Intermedia, Metals, Painting, Photography, Printmaking, Sculpture, Wood
- Dance
  - Concentrations in Dance Education, Performance and Choreography
- Theatre
  - Concentrations in Performance/Production (Acting, Design/Technology), Theatre Education

Bachelor of Music (B M.)
- Choral–General Music
- Instrumental Music (Instrumental, String
- Music Therapy
- Performance (Guitar, Jazz, Keyboard, Music Theatre, Orchestral Instrument, Piano Accompanying, Voice,)
- Theory and Composition Composition, Theory

The three baccalaureate degrees differ in curricula with respect to the amount of specialization permitted in the major field. The Bachelor of Arts degree provides a broad, scholarly, humanistic program, while the other two programs place greater emphasis upon the major field. General Studies play an integral role within the educational mission of the university and as such comprise an important component of all undergraduate degrees in the College of Fine Arts. See below for General Studies requirements.

In cooperation with the College of Education, certification is available at the secondary level in the disciplines of art, dance, music and theatre for students preparing for a teaching career in the public schools. Students should, with the advice and counsel of their arts education advisors, fulfill the requirements for the appropriate area of specialization under the Bachelor of Fine Arts or Bachelor of Music degrees. In addition, students wishing to be admitted to the Professional Teacher Preparation Program in the College of Education (leading to teaching certification) must obtain an advisor from the Office of Student Affairs in the College of Education prior to making application for the PTPP. Students must have completed 56 hours with a 2.50 GPA and also have passed the three Pre Professional Skills Tests in order to be eligible for the program. Further detail on admission requirements and procedures for the PTPP can be found on page 246 under the College of Education.

Graduate Degrees

Master of Arts (M.A.)
- Art
  - Art Education
  - Art History
- Music History and Literature
- Theatre

Master of Fine Arts (M.F A
- Art
  - Concentrations in Ceramics, Drawing, Fibers, Intermedia, Metals, Painting, Photography, Printmaking, Sculpture, Wood
- Dance
  - Concentration in Performance and Choreography
- Theatre
  - Concentrations in Scenography and Theatre for Youth

Master of Music (M.M.)
- Choral Music
  - Choral Music
  - General Music
- Instrumental Music
- Performance
  - Music Theatre Musical Direction
  - Music Theatre Performance
  - Piano Accompanying
  - Solo Performance (Instrumental, Keyboard, Voice)

Theory and Composition
Composition
Theory
Doctor of Musical Arts (D.M.A
Choral Music
Instrumental Music
Solo Performance
Doctor of Philosophy and
Doctor of Education (Ph D , Ed.D.
Major in Secondary Education with concentrations in Art Education, Choral Music, General Music or Instrumental Music, Music Education, Theatre Education

Master's programs range from 30–60 semester hours dependent upon the degree chosen. Doctoral 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 below, consult the sections of this *Catalog* listed under School of Art, Department of Dance, School of Music, or Department of Theatre for specific degree requirements.

Bachelor of Arts Degree (B.A.). The Bachelor of Arts degree requires 45–60 semester hours for the major. Dependent on the major, 18 24 hours must be selected from upper division courses 300 or 400 evel) The semester hour requirements 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 the student in consultation with his/her advisor under rules and regulations of the department or school concerned

Bachelor of Fine Arts Degree (B.F.A.). The Bachelor of Fine Arts degree requires 65 85 semester hours for the major. At least 30 of these hours, dependent on the major, must be selected from upper division courses (300 or 400 level) The curriculum for the major is designed as pre professional study n art, dance, or theatre Auditions and or interviews are required for admission to the B.F.A program in Dance or Theatre. Consult these departments for specific information.

Bachelor of Music Degree (B.M.). The Bachelor of Music degree requires 84 semester hours 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, or choral general music. Entering undergraduate Music majors, regardless of area of specialization, must perform an entrance audition in their primary performing medium (voice or instrument).

General Studies Requirements

To meet the General Studies requirement, a minimum 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.

	Semester Hours
Core Areas:	
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 fulfil 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 50–53 of this *Catalog* for a description of the university's 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 54–80. 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 which may be selected from anthropology, architecture, biology, botany, chemistry, communication, economics, English except English 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 of 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 will meet the university English proficiency requirement: ENG 101 and 102 (six hours) or ENG 105 (three hours For eign 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 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 will be placed in language study at the level above comp eted 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 385 and 386) 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 49 of this *Catalog*, except for Theatre For the B F A in Theatre, a student must have a 3.00 GPA in the major to enroll in upper division courses and remain in good standing. In addition, a student disqualified in any program is normally not eligible for reinstatement for two semesters.

Special Programs

Together with faculty, visiting scholars and artists in residence, students in all fields of the College of Fine Arts participate in dynamic, innovative programs The creative energy that infuses the visual and performing arts finds expression in research and study

The Visual Arts Research Studios VARS), 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 country. It brings together artists, master printers and photographers to encourage collaboration and research. Students are appointed to assist VARS personnel in the planning and production of projects in the Print Research facility, the Photography 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 modern 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 visiting artists, artists in residence, a curator of dance and researchers investigating labanotation, as well as the possibilities of video and computer technol ogy in dance and dance music composition 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 un dergraduate students and others featuring works by facu ty and visiting artists. Dance Arizona Repertory Theatre (DART) gives graduate and undergraduate students the opportunity to per form and tour in the metropolitan area, the region and the state.

Faculty in the School of Music include a wide range of performers, teachers, conductors and scholars whose knowledge and guidance support the training of students in degree programs The school sponsors such events as the recent Tercen tenary Festival, celebrating the 300th birthdays of J.S. Bach, George Frederick Handel and Domenico Scarlatti with an outstanding, compre hensive program. The Festival featured more than 50 performances by faculty, students, en sembles, distinguished musicologists and baroque performers. Such unique events as the Festival complement the established success of the school's programs, which include the acclaimed Lyric Opera Theatre. LOT's production of *The Cunning Little Vixen* won a first place award in the national opera contest of the National Opera Association.

The Theatre Department takes special pride in its scenography and theatre for youth programs. The theatre for youth program enjoys an interna tional reputation, provides comprehensive train ing and attracts students, scholars and visitors from around the world. Students are challenged to excel in every aspect of theatrical training. They have the opportunity to act in and direct mainstage and touring shows, conduct research, as well as teach on and off campus. The program has developed Hayden Library's Child Drama Special Collection, which includes rare books, plays and personal and national association ar chives. It is the most complete and extensive col lection in the country. Students in the scenogra phy program are actively involved in all aspects of design and technology for mainstage and stu dio productions and receive regional and national awards for their work on a regular basis.

A playwright-in-residence works with both un dergraduate and graduate students, creating and showcasing original scripts from students and fac ulty. An interdisciplinary M.F A. in Creative Writing encourages graduate students to work closely with writers of drama, fiction and poetry as they explore the possibilities of the verbal arts Faculty in the Departments of Theatre and Eng lish offer students a unique opportunity to tailor a course of study to fit individua 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 gradu ate courses for undergraduate credit. Application for admission to a graduate course for under graduate 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 faculties of the School of Music and Department of Dance, gives special recognition to excellence in interpretation and technical proficiency in music or dance performance. Specific information may be obtained by contacting the Department of Dance or School of Music. The Performer's Certificate parallels the Certificate of Merit in intent and may or may not be awarded every year.

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 GASOWSK , HELLER JAY KELLY, L NDERMAN, MAGENTA ME SSINGER, P LE, PIMENTEL, STULER J. J TAYLOR, J. R TAYLOR WAGNER, WOODS

ASSOCIATE PROFESSORS:
ALQUIST, BRITTON, DE MATTIES, DETRIE ECKERT FAHLMAN FRONSKE, GILLINGWATER, GULLY, HAJ CEK JENKINS, KA DA, KRONENGOLD P TTSLEY RABINER, RISSEEUW, ROWLEY, SCHMIDT, SHARER, SWEENEY, UMBERGER, WATSON WE SER, WH TE, B YOUNG, J YOUNG

ASSISTANT PROFESSORS:
BERNHISEL OSBORN, COCKE, HAYES THUMANN, HUL CK LOEB, MAXWELL, SCHLEIF SCHUTTE, SERWINT, SH PP

PROFESSORS EMERITI:
BROADLEY, FARNESS, FINK, GOO, GRIGSBY HAHN, HALE JACOBSON, SCHAUMBURG WOOD

Major Requirements

For advisement purposes, all students registering in an Art degree program will enroll through the College of Fine Arts. Each degree program and area of specialization has its own checksheet which describes the particulars of course sequence and special requirements. These are available in the School of Art office.

Bachelor of Arts Degree Curriculum

The School of Art offers 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. Consists of a minimum of 45 semester hours as approved by the student's advisor. An emphasis in studio art 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 a "C" or better. The foreign language requirement of the B A. degree is optional but strongly recommended.

Art History. Consists of a minimum of 45 semester hours as approved by the student's advisor.

An emphasis in art history 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 (nonwestern course), one ARS 498 Pro Seminar; ART 111, 112 and 115 Knowledge in at least one foreign language is required, equivalent to the level obtained through the completion of two years' study at the college level. For specific courses, see Foreign Language Department

Photographic Studies. 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 and 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 Foreign Language Department.

Bachelor of Fine Arts Degree Curriculum

Art. 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: ART 111, 112, 113 and 115; ARS 101 and 102.

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 "C" or better. The specific requirements for the concentration are determined by the faculty advisors of the area and are listed on School of Art checksheets.

Courses from other departments, when approved by the advisor and the School of Art, may be applied to the major if deemed appropriate to the student's program of study

Graphic Design. The concentration in graphic design requires a special application procedure The application procedure for new and transfer students is separate from, and in addition to, the required admission to Arizona State University. Acceptance is determined by the graphic design faculty and is based on an application, test and portfolio. Applications must be made between February 15 and March 15 for admission for the following fall semester. Students are accepted for entry into the graphic design program in the fall semester only of each academic year. Selection of applicants is made by April 1. Due to space limitations, not all qualified applicants can be accommodated and the admission process is necessarily selective For application forms and further information, contact the School of Art.

Art Education. The concentration in art education consists of 75 semester hours 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, 380, 470 480, 484 (Internship), 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 fifteen. Participation in the workshop is part of the requirements for ARE 484

A student with a GPA of 2.50 or better, pursuing a B.F.A. 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 and students must meet the United States and Arizona constitution requirement Certification may also be pursued after receiving an undergraduate degree through the postbaccalaureate program in the College of Education. Admission of postbaccalaureate students into art education certification courses requires a minimum of 18 semester hours of studio art and ARS 101 and 102. Art education courses for certification are ARE 380, 480, 484, and 496. These courses are to be taken in the sequence of ARE 380 and 480 in the spring semester, ARE 484 in the following fall semester, and ARE 496 the next spring semester. ARE 484 meets the state certification requirements for the elementary methods class and ARE 496 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 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
Fundamenta s of three d mens ona form 6 hours a week Prerequ s tes ART 111 112

DRAWING

ART 211 Drawing II. 3 F S SS
Cont nued deve opment of techn ca and perceptua sk s Emphas s on materia s and p ctor a content 6 hours a week Prerequ s tes ART 113, 115

214 Life Drawing I. 3 F S, SS
Deve opment of sk and express veness n draw ng the bas c form construct on and gesture from the human f g ure 6 hours a week Prerequ s tes ART 113 115

311 Drawing III. 3 F, S
Emphas s on compos t on exp orat on of draw ng med a 6 hours a week Prerequ s tes. ART 211 214 nstructor ap prova

314 Life Drawing II. 3 F S
Draw ng from the mode w th greater reference to struc tura graph c and compos t ona concerns 6 hours a week Prerequ s te ART 214 or nstructor approva

315 Life Drawing III. 3 F, S
The human f gure as the sub ect for draw ng Emphas s on conceptua a ternat ves and management of mater a s 6 hours a week Prerequ s te: ART 314 or nstructor ap prova

411 Advanced Drawing. 3 F S
V sua and nte lectua concepts through prob em so v ng and ndependent study Emphas s on the nd v dua crea t ve statement. May be repeated for cred t 6 hours a week Prerequis tes· ART 311· nstructor approva

414 Advanced Life Drawing. 3 F S
Var ous med a and techn ques on an advanced eve The human f gure as an express ve veh c e n var ous contexts May be repeated for cred t 6 hours a week Prerequ s te ART 315 or nstructor approva .

415 Art Anatomy. 4 N
Study of human anatom ca structures as app ed to the pract ce of f gure onented art. 3 hours lecture, 5 hours stu d o a week Prerequ s te· ART 214

PAINTING

ART 223 Painting I. 3 F, S, SS
Fundamenta concepts and materia s of trad t ona and exper mental pa nt ng med a Emphas s on preparat on of pa nt ng supports compos t on and co or 6 hours a week Prerequ s tes ART 113 115.

227 Watercolor I. (3 F, S
Fundamenta concepts mater a s and techn ques of wa terco or Emphasis on problem so v ng, bas c sk s com pos t on and co or 6 hours a week Prerequ s tes ART 113 115

323 Painting II. 3 F S
Deve opment of competency n sk s and express on. As s gned prob ems nvo ve ght, space co or form and con tent 6 hours a week Prerequis te ART 223 or nstructor approva

324 Painting III. 3 F, S
Cont nuat on of ART 323 6 hours a week Prerequ s te. ART 323 or nstructor approva

325 Figure Painting. 3 F, S
The human f gure c othed a d nude as the subject for pa nt ng 'n se ected med a 6 hours a week Prerequ s tes ART 314 323

327 Watercolor II. 3 A
Exp orat ons of persona express on n waterco or Cont n ued deve opment of waterco or sk s us ng trad t ona and exper menta mater a s and techn ques 6 hours a week Prerequ s te ART 227

421 Pa nting Materials and Techniques. 3 A
Trad t ona and modern mater a s and techn ques of pa nt ng Exper menta prob ems n tempera encaust c, case n emu s ons, Maroger s Med um and synthet c med a. 6 hours a week Prerequ s te nstructor approva .

423 Advanced Paint'ng. 3 F S
Cont nuat on of ART 324. May be repeated for cred t 6 hours a week Prerequ s te ART 324

425 Advanced Figure Painting. 3 F S
Cont n at on of ART 325 May be repeated for cred t 6 hours a week Prerequis tes ART 315 324 325

427 Advanced Watercolor. 3 F S
Cont nuat on of ART 327. May be repeated for cred t 6 hours a week Prerequ s te ART 327

INTERMEDIA

ART 340 Intermedia. 3 F, S
Exper menta conceptua and nterdisc p nary stud o art w th emphas s on new med a and techno og es 6 hours a week May be repeated once for cred t Prerequ s tes· ART 113, 115 6 hours add t ona stud o req rements, or nstructor approva

341 Mixed Med a. 3 A
Exp onng v sua effects by comb n ng trad t ona and non trad t onal methods, techn ques and concepts May be re peated once for cred t 6 hours a week Prerequis tes ART 113, 115 6 hours add t ona stud o requ rements or nstructor approva

440 New Media Concepts. 3 F S
Cont nued exper ments w th new med a and nterd sc p nary concerns in art. May be repeated for cred t 6 hours a week. Prerequ s te: ART 340

441 Video Art. 1 F, S
Ut z ng v deo and aud o equ pment essent a to the pro duct on of broadcast qua ty v deo art May be repeated for cred t 2 hours a week Corequ s tes ART 340 341 or 440 nstructor approval

PHOTOGRAPHY

ART 201 Photography I. 3) F S
Deve opment 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 exp orat on nto persona photograph c aesthet cs 6 hours a week Prerequ s tes ART 113 115, 201, or nstructor approval.

304 Advanced Photography. 3 F, S
nterpretat on and man pu at on of ght as a too n the per formance of express ve photography 6 hours a week Prerequ s te ART 301 or nstructor approva

305 Color Photography I. 3 F, S
App cat on of co or transparenc es and pr nts to photo graph c art 6 hours a week. Prerequ site ART 304 or n structor approva

306 Photo Techniques. 3 F S
Exp oration of camera and darkroom techn ques w th em phas s on creat ve contro for the we l crafted b ack and

wh te pr nt. 6 hours a week Prerequis te ART 301 or n structor approva

401 Nonsilver Photography. 3 F, S
Recogn t on of the nherent character st cs of nons ver processes and the use of these processes n the commu n cat on of deas May be repeated for cred t. 6 hours a week Prerequ s te ART 306 or nstructor approva

403 Black and White Photography. 3) F S
Advanced exp orat on of exper menta , nterpret ve and stra ght photography May be repeated for cred t 6 hours a week Prerequ s te ART 304 or nstructor approva .

404 Portraiture Photography. 3 F, S
Photograph ng peop e. Cr t ca d scuss ons and s de ec tures on ssues n portra ture May be repeated for cred t 6 hours a week Prerequ s tes ART 304 306 or nstructor approva

405 Advanced Color Photography. 3 F S
Intens ve use of subtract ve co or process n photograph c pr nt ng. May be repeated for cred t 6 hours a week Pre requ s te· ART 305 or nstructor approva

409 Photographic Exhibition. 3 A
Care of photograph c pr nts, pr nt presentat on and exh b t on Pract ca exper ence n ga ery operat ons. 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 wh te p a ograph c pr ntmak ng ut z ng stone and a um num p ate processes 6 hours a week Prerequ s tes ART 113 115.

351 Intaglio I. 3 F, S
ntroduct on to contemporary and trad t ona developmen ta techn ques for b ack and wh te pr nts 6 hours a week Prerequ s te· nstructor approva

352 Lithography II. 3 F S
Cont n at on of ART 252. ntroduct on to co or techn ques and advanced mage format on processes. 6 hours a week Prerequ s te ART 252 or nstructor approva

354 Screen Printing I. 3 A
Various methods and app cat ons nc ud ng the photo graph c stenc and transfer techn ques. 6 hours a week Prerequ s te nstructor approva

355 Photo Process for Printmaking I. 3 A
Introduct on to photograph c pr nc p es and sk s for photo mechan cal pr ntmak ng processes nc ud ng photo s kscreen photo itho and photo etch ng 6 hours a week Prerequ s te nstructor approva .

451 Advanced Intaglio. 3 F S
Var ous contemporary and trad t ona methods of pr nt ng to ach eve 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
Cont n at on of ART 352 May be repeated for cred t 6 *hours a week Prerequ s te. 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 nstructor approva

455 Advanced Photo Processes for Printmaking. (3 A
A cont nued study of photomechan ca techn ques and app cat ons to pr ntmak ng or photograph c processes. Prerequ s te ART 355 or in tructor approval.

456 Fine Printing and Bookmaking I. 3 A
Letterpress pr nt ng and typography as f ne art Study of h story, a phabets, mechan cs of hand typesett ng, press work and var ous forms of pr nted matter. Prerequ s te· n structor approva

457 Fine Printing and Bookmaking II. 3 A
Cont nuat on of ART 456 Bookb nd ng book des gn and pr nt'ng advanced typography theory and presswork May be repeated for cred t Prerequ s tes ART 456 n structor approva

458 Papermaking. 3 F S
H story theory, demonstrat ons, sheet forming, co age treatments and 3 d mens o a approaches. May be re peated for cred t 6 hours a week Prerequ s te nstructor approva

459 Monoprinting. 3 F S
The nonmu t ple pr nted mage us ng a var ety of techn ca approaches. May be repeated for cred t 6 hours a week Prerequis tes ART 311 323 or any 300 eve pr ntmak ng c ass; instructor approva

SCULPTURE

ART 231 Sculpture I. 3 F S, SS
Explorat on and express on of scu ptura form through deas and concepts re ated to bas c mater a s stud o safety 6 hours a week Prerequ s tes ART 113, 115

331 Sculpture II. 3) F, S
Cont nuat on of ART 231 6 hours a week Prerequ s te ART 231.

332 Advanced Sculpture. 3 F S
Scu ptural prob ems re ated to arch tecture and man s en v ronment Exp orat on in a med a Co or re at onsh ps as app ed to scu pture 6 hours a week Prerequ s te ART 331

333 Experimental Sculpture. 3 N
An exper menta approach to form mater a re at 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 nstruc tor approva .

431 Special Problems in Sculpture. 3 F S
Deve opment of a persona approach to scu pture, empha s s on form, individual prob ems and re ated co or techno ogy Profess ona pract ces and presentat on May be re peated for cred t 6 hours a week Prerequ s tes· ART 332 nstructor approva

432 New Directions in Sculpture. 3 A
Exam nat on of env ronment as resource for mages and deas Exper mentat on n nontrad t ona methods and nterre ating d sc p nes May be repeated for cred t. 6 hours a week Prerequ s te ART 332 or nstructor ap prova

436 Architectural Sculpture. 3 N
Scu ptura concepts as re ated to arch tecture and other manmade env ronments Sca e draw ng mode s and re ef scu pture May be repeated for cred t 6 hours a week Prerequ s te ART 332 or nstructor approva .

437 Non-Permanent Sculpture. 3 N
Art of a temporary nature nc ud ng sequent a and con ceptual works. Att tudes may be presented n f ms or other v'sua med a May be repeated for cred t 6 hours a week. Prerequ s te. nstructor approva

438 Experimental Systems in Sculpture. 3 N
Systems and concepts for phase changes of mater a s temperature pressure f e d, t me compress on extens on

and e ectron c act vat on of dimens ona forms May be re peated for cred t 6 hours a week Prerequ s te nstructor approva

CERAMICS

ART 261 Ceramic Survey. 3 F S SS
Handform ng methods throw ng on the whee decorat ve processes, g aze app cat on 6 hours a week Prerequ s tes· ART 112 115.

360 Ceramic Throwing. 3 F S
Des gn analys s and product on of funct ona pottery Em phas s on throwing techn ques surface enr chment and glaze appl cat on May be repeated once for cred t. 6 hours a week Prerequ s te ART 261

364 Ceramic Handbuilding I. (3 F
Search for form us ng hand bu ld ng techn ques K n f r ng and related prob ems Prerequ s te ART 261

365 Ceramic Handbuilding II. (3 S
Cont nuat on of ART 364 w th an add t ona focus on arge sca e works surface treatments and g aze decorat on w th re ated k n f r ng app cat ons Prerequ s te ART 364 or nstructor approva

460 Ceramic Clay. 3) A
Research nto var ous clay body formu at ons oca natura mater a s, s p glazes and engobes 6 hours a week. Pre requ s te ART 360 364, or nstructor approval.

463 Ceramic Glaze. 3 A
G aze formu at on and ca cu at on us ng var ous g aze sur faces and colors 6 hours a week Prerequ s te: ART 460 or nstructor approva

466 Special Problems in Ceramics. 3 F S SS
Emphas s on persona express on w th n structure of sem nars, cr t ques studio work Profess ona methods of pres entat on documentat on of work May be repeated for cred t 6 hours a week Prerequ s te ART 364 or nstructor approva

FIBERS

ART 276 Fiber Arts I. (3) F S
Structura use of f ber ut z ng a variety of techn ques Sur face treatment nclud ng bat k block pr nt ng, fold and t e dye 6 hours a week

376 Fibers: Loom Techniques. (3 A
Investigation of oom contro ed techn ques P a n weave doub e weave tapestry w be explored 6 hours a week Prerequ s tes ART 113 276, or nstructor approval

377 Fibers: Surface Design. (3 A
Surface des gn techn ques. s k screen ng pa nt ng stamp ng dye ng on fabric w l be exp ored. Prerequ s tes: ART 113, 276 or nstructor approva

476 Advanced Fibers. 3 F, S
Exper mentat 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 nstructor approva .

METALS

ART 272 Jewelry I. (3 F S
Emphasis on fabr cation n jewe ry mak ng. Bas c tech n ques of form ng, cutt ng and p erc ng, forging and so der ng 6 hours a week.

372 Jewelry II. (3 F S
Fabricated approach to jewe ry mak ng Techn ques n stone setting and surface embe shment 6 hours a week Prerequ s tes: ART 113, 115 272 or nstructor approva

373 Metalworking I. (3 A
Compress on d e and stretch form ng as app ed to hol ow form construct on Hot and co d forg ng techn ques as ap p ed to sm th ng 6 hours a week. Prerequ s tes ART 113 115 272 or nstructor approva

472 Advanced Jewelry. (3) F S
Jewelry mak ng w th emphas s on deve op ng personal statements and craftsmansh p May be repeated for cred t 6 hours a week Prerequ s tes ART 372 nstructor ap prova

473 Advanced Metalworking. (3) A
Forg ng and form ng techn ques n nd v dua zed d rec t ons May be repeated for cred t 6 hours a week Pre requ s tes ART 373 nstructor approva

WOOD

ART 274 Wood I. 3 F, S
Fundamenta woodwork ng techn ques to produce creat ve funct ona 3 d mens ona objects 6 hours a week

374 Wood II. 3 F, S
Ind v dua and d rected problems n wood re ated to the product on of un que funct ona art objects. 6 hours a week Prerequ s tes ART 113 115 274 or nstructor ap prova .

378 Furniture I. 3 A
Des gn and bu d ng of contemporary furn ture Exp orat on n the techn que of jo nery am nat on, carv ng and f n sh ng procedures 6 hours a week Prerequ s tes ART 113 115 274, or nstructor approva .

474 Advanced Wood. 3 F S
Extended exper ence and advanced techn ques n the use of wood to create functiona works of art May be repeated for cred t. 6 hours a week Prerequ s tes ART 374 n structor approva

478 Advanced Furniture. 3 A
Form concepts are exp ored n construct on of nvent ve furn ture Emphas s on med a 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
Draw ng of etterforms with focus on proport on and struc ture. Introduct on to etterform nomenc ature and class fi cat ons. 6 hours a week Prerequ s tes ART 113, 115 acceptance nto graph c des gn program Corequis te ART 284

284 Visual Communications I. (4 F
Theoret ca and app ed stud es n shape draw ng and co or 8 hours a week Prerequ s tes· ART 113, 115 ac ceptance nto graph c des gn program Corequ s te. ART 283.

285 Typeset I. 3) S
Theoret ca exerc ses n spat al and textura qualit es of type Prob ems n tension activat on and ba ance Exer c ses n s mp e typograph ca appl cat ons. 6 hours a week Prerequ s tes ART 283, 284· acceptance nto graph c des gn program Corequ s te ART 286

286 Visual Communications II. 4 S
Trans tion from theoret ca to app ed prob ems. Emphas s on ref nement of v sua sk s 8 hours a week Prerequi s tes ART 283 284 acceptance nto graph c des gn pro gram Corequ s te ART 285

382 Graphic Representation. (3 F
Stud o pract ce n draw ng w th an app cat on towards graphic commun cat on May be repeated once for cred t 6 hours a week Prerequisites ART 284, nstructor ap prova

385 Typeset II. 3) F
Prob ems in compos t on cho ce and comb nat ons of type faces, formats and their app cat on to a var ety of des gn *projects 6 hours a week Prerequisites ART 285 286* Corequ s te ART 386

386 Visual Communications III. 3) F
Prob ems n spec f c design app cat ons such as poster packaging pub cat ons, etc Emphas s on deve opment of concepts n v sua commun cat ons. 6 hours a week Pre requis tes ART 285, 286 Corequ s te· ART 385

387 Visual Communications IV. 3 S
Cl ent or ented projects Problems wi be mu t faceted and the emphases w l be on cont nu ty of des gn n more than one medium 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 ys s, prob em solving and profess ona portfo o preparation 6 hours a week Prerequ s'tes ART 387, nstructor approval

482 Visual Communications VI. (3 S
Ind v dua and group pro ects w th outs de cl ents A proj ects cu m nate n an exh b t 6 hours a week Prerequ s te *ART 481*

485 Graphic Design Pre-Professional Program. (3 F S SS
Preprofess ona c ent/des gner s tuat 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 approval

SPECIAL STUDIO ART

ART 444 Computer Art I. 3 F S
A study of PC hardware and software for creat ng art Emphas s on computer graph cs h story, hardware soft ware conf gurations DOS pr nc ples of 2D and 3D graph ics 2 hours ecture 2 hours stud o Prerequ s tes ART 111 112 or equ valent nstructor approva *[Satisfies General Studies Requirement N3]*

621 Studio Problems. 3 F, S, SS
Advanced study n the fo ow ng areas

(a)	Draw ng	f	Ceram cs
b)	Paint ng	g)	Metals
c	Photography	(h)	Wood
d)	Pr ntmak 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 instructor approval

680 Practicum: M.F.A. Exhibition. 1 15) F S, SS
Stud o work in preparat on for requ red M.F A exh b't on. Pub c exh b t to be approved by the student s superv sory *comm ttee and accompanied by a f na ora exam nat on* Photograph c documentat on and written statement of prob em. Prerequ s te approval of the student s superv sory committee

Special Courses: ART 294, 394, 484 493, 494, 498 499 591, 592 594 598. See pages 43–44)

ART EDUCATION

ARE 301 Art in the Elementary School. 3 F S
The study of ch dren s v sua art work from ear y ch d hood to ear y ado escence 1 ecture 4 hours stud o For nonmajors only

350 Design. 3 F S
Pr nc p es of v sual organ zat on; des gn as a trad t on n art and art educat on; sequenc ng des gn nstruct on 2 ectures 2 hours stud o Prerequ s tes ART 113 115 ARS 101, 102; or nstructor approva

380 Studio Art: Art History I. 3 F S
Art trad t ons pr or to the 20th century as a bas s for stud o and art h story nstruct on w th K 12 and community co ege popu at ons 2 ectures, 2 hours stud o Pre or core qu s te ARE 350

420 Crafts for the Elementary School Teacher. (3 A
Practica aboratory exper ences stress ng a var ety of med a and act v t es for c assroom teach ng. Not for M A cred t n art educat on 1 ecture 4 hours stud o

470 Art Criticism: Aesthetics. 3 F, S
Trad t ons of aesthet cs and art cr t cism conceptua s sues in contemporary art; educat on n the v sua arts 2 ectures, 2 hours stud o Prerequ s te ARE 380 Core qu s te ARE 480 recommended

480 Studio Art: Art History II. 3 S
Art trad t ons of the 20th century as a bas s for stud o and art history nstruct on w th K 12 and community co ege popu at ons 2 ectures, 2 hours stud o Must be taken before enro ment n ARE 484 Internsh p: Art Educat on Prerequ s te ARE 380 Corequ site ARE 470 recom mended

484 Internship: Art Education. 3) N
The mplementat on and eva uat on of art nstruction for K 9 popu at on Inc udes teach ng of Saturday c asses n the Ch dren s Art Workshop Prerequis te: ARE 480

496 Senior Project. 3 A
nd v dua or group research on an art educat on prob em which ncorporates theory and practice Prerequ s tes: ARE 470 480, 484 or instructor approva

510 Art in the Self-Contained and Open Classroom. 3) A
A ternate teaching earn ng strategies, art concepts and sk s re evant to e ementary schoo art experiences for teachers.

511 Issues in Art Education. (3 A
Investigat on of ssues n art educat on.

515 Art Foundations of Art Education. 3) A
Foundat ons of art education w th an emphasis on psycho ogical, ph osoph ca and h stor ca frames of reference

525 Art and Society. 3) A
nterre at onsh p of art, soc ety and soc a change and the r re evance to areas such as government museums and techno ogy

540 Instructional Resources, Art Education. 3) N
Development of audio v sua materia s n art and inqu ry nto strateg es for the r mp ementation May be repeated once for cred t

545 Perception and Learning. (3 A
Concepts of percept on and earning n art nstruct on

550 Aesthetic Inquiry. (3) A
L terature on aesthet cs, methods of inqu ry and mp ca t ons for art education

570 Analyzing Works of Art. 3 N
The cr t ca exam nat on of art or statements about art and the deve opment of ways for gu d ng th s exam nat on

575 Curriculum in Art and Education. 3 A
terature n art educat on and educat on on ex st ng strateg es for deve op ng curr c um the ssues and prob ems of d ffer ng curr cu um or entat ons

610 Issues and Trends in Art Education. 3 N
Do tora eve nvest gat on of h stor ca and contemporary sues re ated to teach ng and research n art educat on.

611 Curriculum Development in Art Education. 3 N
Doctora eve nqu ry nto the ph osoph ca psycho og ca and soc o og ca foundat ons of curr cu um deve opment.

Special Courses: ARE 294 394 484 493 494 498, 499 584 590 591 592 593 594, 598 599, 690 691, 692 790 791 792 799. See pages 43–44.

ART HISTORY

ARS 100 Introduction to Art. 3 F S, SS
Deve opment of nderstand ng and enjoyment of art and ts re at onsh p to everyday fe through the study of pa nt ng, scu pture, arch tecture and des gn May not be taken for cred t by student who has comp eted ARS 300 nor used as art h story cred t by Art majors *[Sat sfies Genera Stud es Requ rements HU H]*

101 Art of the Western World I. 3 F S
H story of Western art from the Pa eo th c per od to the M dd e Ages *[Sat sf es Genera Stud es Requ rements HU, H]*

102 Art of the Western World II. 3 F S
H story of Western art from the Rena ssance to the present *[Sat sf es Genera Studies Requ rements HU, H]*

201 Art of the Non-Western World I. 3 A
H story of the art of the As an cu tures w th an emphas s on nd a Ch na and Japan *[Sat sfies General Stud es Requ rements· HU, G H]*

202 Art of the Non-Western World II. 3 A
H story of the art of Afr ca Ocean a and the New Wor d *[Sat sf es Genera Stud es Requirements HU G, H]*

300 Introduction to Art. 3 F S
Course content same as ARS 100 but requ res a h gher eve of accomp shment and comprehens on May not be taken for cred t by student who has comp eted ARS 100, nor used as art h story cred t by Art majors *[Sat sfies Genera Stud es Requ rements HU H]*

325 History of Christian Art. 3 N
Chr st an art from the 4th century n Rome to the present Mean ng and use of arch tectura pa nt ng, scu ptura and decorat ve art forms Prerequ s tes ARS 101 102 or in structor approva *[Sat sf es Genera Stud es Requ re ments HU H]*

400 History of Printmaking. 3 A
H story of the pr nt as an art form and ts re at on to other modes and forms of art st c express on Prerequ s tes· ARS 101 102, or nstructor approva *[Sat sfies Genera Stud es Requ rements HU H]*

402 Ancient Near Eastern Art. 3 N
H story of pa nt ng scu pture and arch tecture n Mesopo tam a, Egypt and the Aegean Prerequ s tes ARS 101 102 or nstructor approva *[Sat sfies Genera Stud es Requ'rements. HU, H]*

404 Greek Art. 3 A
Art and arch tecture of Greece and the He en st c Emp re Prerequ s tes ARS 101 102 or nstructo approva *[Sat sf es Genera Stud es Requ rements HU H]*

406 Roman Art. 3 A
Art and arch tecture of Etrur a Rome and the Roman Em p re Prerequ s tes ARS 101 102 or n tructor approva *[Sat sf es Genera Stud es Requ rements HU H]*

410 Early Christian and Byzantine Art. 3 A
Art and arch tecture of the ear y church and the Byzant ne Emp re from the 4th to the 15th century Prerequ s tes ARS 101 102 or nstructor approva *[Sat sf es Genera Stud es Requirements HU H]*

412 Early Medieval Art. 3 A
Arch tecture scu pture and pa nt ng n the Lat n West from the 7th century to the end of the Ottoman Per od Pre requ s tes ARS 101 102 or nstructor approva *[Sat s f es Genera Stud es Requ rements. HU H]*

414 Romanesque Art. 3 A
Scu pture, pa nt 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 *[Sat sf es Genera Stud es Requ rements HU H]*

416 Gothic Art. 3 A
Pa nt ng, scu pture and arch tecture n western Europe dur ng the Goth c per od Prerequ s tes ARS 101 102 or nstructor approva *[Sat sf es Genera Stud es Requ re ments HU H]*

418 Renaissance Art in Northern Europe. 3 A
Paint ng, scu pture and arch tecture dur ng the 1400s and 1500s north of the A ps Prerequ s tes ARS 101 102 or nstructor approva *[Sat sf es Genera Stud es Requ re ments HU H]*

420 Early Renaissance Art in Italy. 3 A
Paint ng, scu pture and arch tecture n Ita y from 1300 to 1500. Prerequ sites ARS 101 102· or nstructor approva . *[Sat sf es Genera 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 nc ud ng the ach evements and nf uence of Leonardo da V nc , Ra phae and M che ange o P erequ s tes ARS 101 102 or nstructor approva *[Sat sf es Genera Stud es Requ re ment HU]*

424 Italian Baroque Art. 3 A
Ita an pa nt ng scu pture and arch tecture of the 17th cen tury Prerequ s tes ARS 101 102 or nstructor approval *[Sat sf es Genera Stud es Requ rements HU H]*

426 Art of the 17th Century in Northern Europe. 3 A
Baroque pa nt ng, scu pture and arch tecture n F anders the Nether ands France and Eng and Prerequ s tes ARS 101, 102 or nstructor approva *[Sat sfies General Stud es Requ rements HU, H]*

428 Art of the 18th Century. 3 A
H story of pa nt ng, 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 nstructor approva *[Satisf es Genera Stud es Requ rements HU H]*

430 Art of Spain and Its Colonies. 3 A
Arch tecture pa nt ng and scu pture from 1500 to 1800 Co on a focus on Mex co the Amer can Southwest and Andean South Amer ca Prerequ s tes· ARS 101 102 or nstructor approva *[Sat sf es Genera Stud es Requ re ments· HU, H]*

432 Art and Revolution. 3 A
mpact of Amer can and French Revo ut ons and the Na po eon c epoch on v sua arts Concentrat on on Goya, Dav d, Ger cau t, B ake, etc Prerequ s tes· ARS 101 102· or nstructor approva *[Satsf es Genera Stud es Requ re ment HU]*

434 Romanticism and Realism. 3 A
H story of the v sua arts n the f rst ha f of the 19th cen tury Prerequ s tes ARS 101 102, or nstructor approva *[Sat sf es Genera Stud es Requ rement HU]*

436 Impressionism and Late 19th-Century Art. 3 A
H story of pa nt ng scu pture and graph c arts in atter ha f of the 19th century. Prerequ sites ARS 101 102, or n structor approva *[Sat sfies General Stud es Requ re ment HU]*

438 Art of the 20th Century I. 3 A
Deve opments and d rect ons n art between 1900 and Wor d War I Prerequ s tes ARS 101, 102 or nstructor approva *[Sat sf es Genera Studies Requ rement HU]*

439 Art of the 20th Century II. 3 A
Art s nce Wor d War I , w th cons derat on of new concepts and experimentat on with med a and modes of presenta t on Prerequ s tes ARS 101, 102 438, or instructor approva . *[Sat sf es General Stud es Requ rements HU, H]*

442 American Art I. 3) A
Art n the Un ted States from European sett ement to 1850 Prerequ s tes 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 approva

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
H story of photography from the med um s preh story to 1914· persona t es processes, mages and deas Pre requ s tes ARS 101, 102; or nstructor approva *[Sat s f es General Stud es Requirements HU H]*

451 20th-Century Photography. 3 A
Personal t es processes mages and deas n photogra phy from 1914 to present Prerequ s tes. ARS 101, 102 or nstructor approva *[Sat sf es Genera Stud es Requ re ments HU H]*

454 Research and Writing in Photography. 3 A
Pr nc p es and pract ce of research and wr ting in the h s tory and cr t c sm of photography. Papers requ red Pre requis tes ENG 101 102 or equ va ent; ARS 450, 451, or nstructor approva *[Satisf es Genera Stud es Requ re ment HU]*

456 History of Art Criticism I. 3 N
H story of theor es of cr t c sm of the visua arts Read ngs from v sual arts cr t ca terature from P ato to 18th cen tury Prerequ s tes *ARS 101 102* or nstructor approva . *[Sat sfies General Studies Requ rements HU H]*

457 History of Art Criticism II. 3 N
Theor es of cr t c sm of the v sual arts from ate 18th cen tury to present Prerequ s tes ARS 101 102 or nstruc tor approva *[Sat sf es General Stud es Requ rements HU, H]*

458 20th-Century Art Criticism. 3 N
Sem nal, 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 re at on to art commun ty Prerequ sites ARS 101 102 or nstructor approva *[Satisf es Genera Stud es Requ rement· HU]*

459 Writing Art Criticism. 3 N
Trad t ona and contemporary approaches to the cr t c sm of art Students w wr te cr t ca essays. The atter ha f of the semester w stress the cr t cism of contemporary art n var ous med a Prerequ s te ARS 458 or nstructor approva *[Sat sf es General Studies Requ rement HU]*

462 Precolumbian Art I. (3 A
Arch tecture scu pture ceram cs, pa nt ng and other arts of Mesoamer ca pr or to European contact Prerequ s tes· ARS 101, 102 or nstructor approva *[Sat sf es General Stud es Requ rements HU, H]*

463 Precolumbian Art II. 3 A
Arch tecture scu pture, ceramics text es, and other art of South Amer ca prior to European contact w th focus on the Centra Andes. Prerequ s tes. ARS 101 102 or nstructor approval *[Sat sf es General Stud es Requirement HU]*

465 North American Indian Art. 3 A
Nat ve Amer can art forms of the Un ted States and Can ada from preh stor c t mes to present. Prerequ s tes ARS 101 102, or nstructor approva *[Sat sf es General Stud es Requ rement HU]*

466 Southwest Indian Art. 3 A
Amer can Ind an art n the southwestern states from ts or g ns to the present day Prerequ s tes· ARS 101, 102, or nstructor approva *[Sat sf es Genera Studies Requ re ments HU H]*

468 Shamanism and Art. 3 A
Performance arts as we as trad t ona art objects assoc ated w th the shaman n S ber a and North Amer ca Pre requ sites ARS 101 102 or nstructor approva *[Sat s f es Genera Stud es Requ rements HU SB G]*

469 Mexican Art. 3 A
Art of Mex co and re ated Centra Amer can cu tures from the preh stor c to the contemporary schoo s Prerequ s tes ARS 101, 102, or instructor approva *[Sat sf es Genera Stud es Requ rements· HU G H]*

472 Art of China. 3 A
Study of major forms n Ch nese art r tua bronze, scu p ture, ceram c ca graphy, pa nt ng and arch tecture Pre requ s tes· ARS 101, 102 or nstructor approva *[Sat s f es General Stud es Requirements HU G H]*

473 Art of Japan. 3 A
Japanese art from the Joman period to the present. Pre requ s tes· ARS 101, 102 or nstructor approva *[Satis f es General Stud es Requirements· HU G H]*

475 Chinese Painting. 3 A
From Ku K a ch n to Ch Pa sh h. Major art sts sty es and movements n Ch nese pa nt ng Prerequ s tes. ARS 101 102; or nstructor approva *[Satisf es General Stud es Requirements: HU, H]*

480 Research Methods. 3 F, S
Methodo ogy and resource mater a for art histor ca re search Techn ques of scholar y and cr t ca wr ting and *evaluat on of b b ograph c sources. Prerequ s tes:* ARS 101 102, or nstructor approva *[Satisfies General Stud es Requ rements HU H]*

498 Pro-Seminar. (3–6 A
Undergraduate sem nar n topics se ected from the fo ow ng. Prob ems or cr t c sm n

(a)	Ch nese Art	f	Modern Art
(b)	Anc ent Art	(g)	American Ind an Art
c	Med eva Art	h	Pre Co umb an Art
d	Rena ssance Art	(	Photograph c H story
e)	Baroque Art	(j	Amer can Art

Prerequ s te. nstructor approva

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.

Special Courses: ARS 294, 394, 480, 484, 492, 493, 494, 498, 499, 500, 590, 592, 598, 599. (See pages 43–44.)

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]*

Special Courses: ARA 294, 394, 484, 494, 498, 584, 591, 594, 598. (See pages 43–44.)

Dance

PROFESSORS:
LESSARD (PEBE 107B), JONES, LUDWIG
ASSOCIATE PROFESSORS:
CHLISTOWA, HUSKEY, KEUTER, MARION
ASSISTANT PROFESSORS:
CHENG, KAPLAN
INSTRUCTORS:
HARPER, MATT
SENIOR LECTURER OF DANCE:
NAGRIN
CURATOR-OF-DANCE:
ROSEN
PROFESSORS EMERITI:
DESJARDIN, GISOLO

Departmental Major Requirements

For advisement purposes, all students registering in a Dance degree program will enroll through the College of Fine Arts. Each degree program and area of specialization has its own checksheet which describes the particulars of course sequence and special requirements. These are available in the Department of Dance office.

Bachelor of Arts Degree Curriculum

Dance. Consists of a minimum of 50 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, 261, 262, 334, 340, and 464. Fifteen additional hours approved by an advisor must be in no more than two related fields. Additional requirements are listed on the departmental checksheet.

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 Ballet; ENG 101; MUS 100; and one General Studies requirement.

Bachelor of Fine Arts Degree Curriculum

Dance. Consists of 66 to 85 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, 261, 262, 263, 334, 340, 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; THP 101. For the specialization in Secondary Education, MUS 100, DAN 350, 351 357 and one hour of Jazz Dance must be completed as well as all state secondary certification requirements. Other requirements for each option are listed on the departmental checksheet.

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 Ballet, 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 degree with a major in Dance. The program is designed to train professionals in the technique, performance, choreography and theoretical bases of modern dance. Consult the *Graduate Catalog* for requirements.

DANCE HISTORY

DAH 100 Introduction to Dance. 3 F S
Orientation to the field of dance focusing on history styles cultural and theatrical aspects of the art form *[Satisfies General Studies Requirement HU]*

190 Introduction to the Dance Profession. (1) F
Seminar introducing career options study of anatomical landmarks and basic injury prevention principles.

300 Introduction to Dance. 3) F, S
Course content same as DAH 100 but requires a higher level of accomplishment and comprehension May not be taken for credit by student who has completed DAH 100 *[Satisfies General Studies Requirement. HU]*

301 Philosophy and Criticism of Dance. (3 F, S
Philosophical issues in dance and dance criticism, with emphasis on written analysis and interpretation Prerequisite. 1 semester of First Year Composition *[Satisfies General Studies Requirements HU]*

401 Dance History I. (3 F
Cultural and theatrical development of dance from prehistory through the 19th century Romantic period, including the early history of ballet *[Satisfies General Studies Requirements· HU H]*

402 Dance History II. (3 S
Cultural and theatrical development of dance from 19th century Romantic period through Contemporary times including ballet modern and musical theatre dance *[Satisfies General Studies Requirements HU, H]*

501 Philosophy of Dance. (3) S
Analytical and critical study of the implications of traditional and contemporary philosophies of dance regarding meaning identity, form content genre and style

502 Cultural Concepts of Dance. (3 S
Cultural concepts trends economic political and geographical forces in major eras of dance history

Special Courses: DAH 494, 500, 580, 590, 591, 593, 594 598 See pages 43–44

DANCE

DAN 130 Dance. 1 F S SS
Ballet improvisation, jazz modern, Afro Caribbean Ballet Folkorico, Tap Chi and other dance forms. 2½ hours a week May be repeated for credit.

131 Music Theory for Dance. 2) S
Elements of music, music structures and their relationship to dance Emphasis on rhythmic analysis and dance accompaniment Prerequisite MUS 100 or instructor approval.

134 Technique and Theory of Modern Dance. 3) F, S
Elementary concepts of modern dance technique Development of movement quality and performance skills 6 hours weekly. May be repeated for credit Placement audition required Prerequisite Dance major

135 Technique and Theory of Ballet. (2) F S
Elementary ballet technique with emphasis on alignment control and development of the feet with proper awareness of style and phrasing 4 hours weekly. Placement and auditions required May be repeated for credit

171 Dance Production Lab. (0 F, S
Required of all dance majors for four semesters with DAN 172 173 and 174 to assist in production of one concert each semester

172 Dance Production Lab. (0 F S
See DAN 171.

173 Dance Production Lab. 0 F, S
See DAN 171

174 Dance Production Lab. (0 F S
See DAN 171

230 Dance. 1 F S
Intermediate level Continuation of DAN 130 2½ hours a week May be repeated for credit.

232 Dance Notation I. 3 S
Survey of systems of dance notation Introduction to effort shape analysis of movement. Emphasis on earning elementary Labanotation. Prerequisites DAN 131 MUS 100 or instructor approval

234 Technique and Theory of Modern Dance. (3) F S
Intermediate concepts of modern dance technique Development of movement quality and performance skills. 6 hours weekly May be repeated for credit. Placement audition required Prerequisite Dance major

235 Technique and Theory of Ballet. 2 F, S
The advanced study of elementary ballet technique through the traditional exercises, with proper awareness of style and phrasing 4 hours weekly May be repeated for credit Placement audition required

237 Beginning Pointe. (1) F, S
The study of elementary pointe technique through the traditional exercises 2 hours weekly. May be repeated for credit Prerequisites basic ballet training; instructor approval

261 Fundamentals of Choreography. (3 F, S
ntroduct on to and app cat on of bas c choreograph c pr nc p es w th emphas s on movement nvent on and de ve opme t of eva uat ve sk s Prerequ s tes DAN 130 mprov sat on nstructor approva

262 Dance Production I. (2 F
Theory of ght ng scenery and sound as re ated to dance

263 Dance Production II. 2 S
Theory and pract ce of pub c ty makeup costum ng house and stage management as re ated to dance pro duct on Prerequ s te DAN 262 or nst uctor approva

330 Dance. 1 F S
Advanced eve s Cont nuat on of DAN 230 2 hours week y *May be repeated for cred t*

331 Music Literature for Dance. 3 F
H stor ca survey of mus c relat ve to dance Emphas s on deve op ng sten ng sk s and know edge of mus ca ver sus choreograph c forms Prereq s te. DAN 131 or n structor approva

332 Dance Notation II. 2 F
ntermed ate study of Labanotat on. Emphasis on score read ng Prerequ s te DAN 232 or equ va ent

334 Technique and Theory of Modern Dance. 3 F S
Advanced concepts of modern dance techn que Deve op ment of movement qua ty and performance sk s 6 hours week y May be repeated for cred t P acement aud t on requ red

335 Technique and Theory of Ba let. 2 F S
Intermed ate ba et techn que w th emphas s on strength, dynam cs, rhythm ca mpu ses and trans t ons w th aware ness of proper style and phras ng 4 hours week y May be repeated for cred t Placement aud t on requ red

337 Intermediate Pointe. 1 F S
Study of ntermed ate and advanced po nte techn que through the trad t ona exerc ses 2 hours week y May be repeated for cred t Prerequ s te DAN 237 or nstructor approva

340 Dance Kinesiology. 3 S
K nes o og ca pr nc p es app ed to dance techn que n c ud ng ana ys s of muscu ar patterns n dance movement and the pathemechan cs of dance njury Prerequ s te ZOL 201 or equ va ent

342 Ideokinesis. 3 F S
A study of posture us ng the v sua zat on of mage goa s to fac tate mproved a gnment and movement eff c ency May be repeated for cred t

350 Methods of Teaching Modern Dance in Secondary Education. 3 F
Ana ys s and acqu s t on of teach ng materia s for the techn que mprov sat on and choreography of modern dance Prerequ s te DAN 334 or equ va ent

351 Methods of Teaching Ballet and Jazz in Secondary Education. 2 S
Analys s and acqu s t on of teach ng techn ques and mate r a s for ba et and azz dance forms Prerequ s te DAN 334 or equ va ent

357 Children's Dance. 3 F SS
Theory and pract ce of teach ng creat ve and other dance forms for ch dren Des gned for dance majors and re ated curr cu a but open to a students

359 Dance Education Theory. 3 S
App cat on of pr nc p es of mot vat on earn ng and eva u at on to the teach ng of dance Prerequ s te DAN 334 or equ va ent

364 Dance and Video. 2 N
Fundamenta s of dance video product on nc ud ng cam era operat on scr pt ng and n camera ed t ng Prerequ s te. at east jun or stand ng or nstructor approva

371 Dance Theatre Performance Production 1 F S
Performance or techn ca theatre work n des gnated dance product ons 3 hours a week per semester hour May be repeated for cred t Prerequ s te nstructor ap prova

380 Jazz Dance Styles. 2 F
Study of 150 year of azz dance n Amer ca through the earn ng of per od dances read ng creat ve work and per formance May be repeated for cred t Prerequ s te n structor approva

434 Technique and Theory of Modern Dance 3 F S
Preparat on n the performance and comprehens on of profess ona eve modern dance techn q e 6 hours week y May be repeated for cred t P acement aud t on re qu red

435 Technique and Theory of Ballet 2 F, S
The study of profess ona advanced ba et techn que w th emphas s on preparat on for performa ce. 4 hours week y May be repeated for cred t P acement aud t on requ red

437 Partnering. 2 S
Fundamenta techn que theory and pract ce of partner ng app cab e to a dance forms Var at ons from ba et on po nte and off May be repeated for cred t Prerequ s te nstructor approva

464 Choreography and Accompaniment. 3 F
Funct on of accompan ment for dance exper ence n the se of percuss on vo ce records p a o and se ected n strume ts n re at o to the r se n choreography Pre req s te· DAN 261 or nstr ctor app ova

465 Advanced Choreography. 3 S
nvest gat on and pract ce of contemp rary sty es of cho reography Prerequ s te DAN 261 or nstruct r approva

480 Senior Performance in Dance. 2 F
Org a ch reography for group perf rmance w th ana y s s and cr t que of prob ems encountered n product on Must be repeated for a tota of 4 cred ts Prerequ s tes DAN 464 465

531 Choreographer Composer Workshop. 3 N
Ana ys s of exper mentat on w th, and pract ce n work ng w th composers of mus c for choreography Open to expe r enced choreographers and composers Prerequ s te n structor approva

534 Technique and Theory of Modern Dance. 2 F S
Preparat on n the performance and comprehens on of profess o a eve modern dance for f rst year graduate students 6 hours week y May be repeated for cred t *P acement aud t on requ red*

535 Technique and Theory of Ballet. 1 F S
Graduate eve study of profess ona advanced ba et tech n que w th empha s on preparat on for performance 4 hours week y May be repeated for cred t P acement aud t on requ red

537 Partnering. 2 S
Fundamenta techn que theory and pract ce of partner ng app cab e to a dance forms Var at ons from ba et on po nte and off May be repeated for cred t Prerequ s te nstructor approva

542 Ideokinesis. 3 F S
A theoret ca exam nat on of deok net c methods of *fac* tat ng postura change and movement eff c ency

550 Graduate Dance Pedagogy: Modern. 3 S
Adva ced ana ys s of teach ng techn ques for modern dance

551 Graduate Dance Pedagogy: Ballet. 3 F
Advanced ana ys s of teach ng techn ques for ba et Pre requ s te nstructor approva

562 Dance Stagecraft and Production. 3 N
Theory of ght ng costum ng make up scenery and sound as re ated to dance performance. May be repeated once for cred t Prerequ s te DAN 263 or equ va ent.

563 Individual and Group Choreography. 3 F
Ong na choreography created for so o and group perform ance May be repeated once for cred t Prereq s tes. DAN 464, 465 or equ va ent

564 Video Dance Production. 2 N
Dance v deo product on and ana ys s of urrent research n the f e d Spec a pro ects nc ud ng thes s documenta t on are d scussed

571 Dance Theatre. 1 F, S
Performance n spec a y choreographed dance produc t ons. 3 hours a week May be repeated for cred t Pre requ s te: nst uctor approva

580 Jazz Dance Styles. 2 F
Study of 150 years of jazz dance n Amer ca, earn ng pe r od dances, read ng and choreograph c ass gnments May be repeated for cred t Prerequ s te: nstructor ap prova .

591 Sem nar. 0–3 F S
Sem nar focus ng on enr chment top cs prod ct on as pects of thes s projects teach ng concerns spec a ec tures, f ms or cr t ques

632 Dance Notation III. 3 S
Advanced study of Labanotat on Exper ences n notat ng and reconstruct on of Labanotat on dance scores Pre requ s te DAN 332 or equ valent.

634 Technique and Theory of Modern Dance. 2 F S
Preparat on n the performance and comprehens on of profess ona eve modern dance for second year gradu ate students. 6 hours week y May be repeated for cred t P acement aud t on requ red

640 Advanced Problems in Analysis of Dance Technique. 3 S
Theor es and pr nc p es of human anatomy k nes o ogy and the psycho ogy of earn ng app ed to ana ys s of dance movement Prerequ s tes DAN 340, 342, or n structor approva

680 MFA Performance. 1 9 F S
Stud o work n preparat on for requ red M F A concert Pub c performance to be approved by the student's superv sory comm ttee and be fo owed by a f na ora ex am nat on A wr tten bound document as we as v deo documentat on must be eft w th the department Pre requ s te nstructor approva

Special Courses: DAN 294, 484, 494, 498 499 500 580 584, 590 591 593 594 598 691 See pages 43–44

School of Music

PROFESSORS:
UMBERSON MUS C 183) ANDRESS ATSUMI, BOSWELL, M BR TTON, CLARK, DEBENPORT, DOAN, HAM LTON, H CKMAN, HOOVER, KL EWER BR TTON, LOCKWOOD, LOMBARD MAGERS, McEWEN, McLEOD, PAGANO, PERANTONI, ROSEN SEIPP, SH NN SKOLDBERG, SP NOSA STOCKER, STRANGE, SWA M, WYTKO

ASSOCIATE PROFESSORS:
BARROLL ASCHAFFENBURG D BRITTON, COSAND, CROWE DeMARS, FLEMING, HACKBARTH, HAEFER, HARRIS, HOFFER, HOLBROOK HUMPHREYS, KOONCE MAROHN C METZ MEYER, OLDANI, RAUSCH, RAVE, REYNOLDS ROUX SM TH, SPRING STALZER SUNKETT, UNG, WELLS W LLIAMSON W LSON

ASSISTANT PROFESSORS:
CARPENTER, FERRIS, MAY, METZ ASU WEST CAMPUS), ROGERS

PROFESSORS EMERITI:
BOWERS, CARROLL, COHEN, D ANDREA, DRESSKELL, ENGL SH FLETCHER HANNA, H NES, LAMM, RICKEL, ROBINSON, SCOULAR

The School of Music is a member of the National Association of Schools of Music, and the requirements for entrance and graduation set forth in this *Catalog* are in accordance with the published regulations of the association. The following statement of basic musicianship is endorsed by the School of Music:

"All musicians, whether performers, composers, scholars or teachers, share common professional needs. Every musician must to some extent be a performer, a listener, a historian, a composer, a theorist, and a teacher For this reason, certain subject matter areas and learning processes are common to all baccalaureate degrees in music.

"Basic musicianship is developed in studies which prepare the student to function in a variety of musical roles which are supportive of his/her major concentration. All undergraduate curricula, therefore, provide the following:

1 A conceptual understanding of such musical properties as *sound rhythm melody harmony, texture* and *form* and opportunities for developing a comprehensive grasp of their in

terrelationships as they form the cognitive affective basis for listening, composing and performing.
2. Repeated opportunities for enacting in a variety of ways the roles of listener (analysis), performer interpretation), composer creation), scholar (research), and teacher.
3. A repertory for study that embraces all cultures and historical periods."

Major Requirements

For advisement purposes, all students registering in a Music major program will enroll through the College of Fine Arts. All Music degree programs require a minimum of 126 hours for graduation In addition to the major requirements listed below, General Studies and other academic requirements are listed on pages 50–84 of this *Catalog*.

Placement Examination. All students who enroll in an undergraduate Music degree program are required to perform an entrance audition in their primary performing medium instrument or voice). Audition forms and specific audition requirements for each instrument or voice may be obtained upon request by writing the School of Music. Official dates for these auditions will be set for each academic year. Students may request to audition on other dates if necessary or may send a tape recording if distance prohibits coming to the campus. Entering students must also take placement tests in theory and piano at the time they enter the university. This includes transfer students who have completed four semesters of theory and piano at another institution; they are required to reach a minimum level of achievement indicated on the Theory Placement Exam and Piano Placement Exam.

Bachelor of Arts Degree Curriculum in the Music Program

Consists of 50 semester hours. The following courses are required:

Music theory: MTC 125, 221, 222, 223, 320, 327, 422.

Music history: MHL 341, 342.

Major performing medium: Eight semester hours (MUP 111/311)

Class piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Recital attendance: Six semesters of MUP 100.

Note: The remaining hours in music will be selected by the student in consultation with his/her advisor. Areas of study may include music history, ethnomusicology and music theory At least 23 semester hours, 12 in field of specialization, must be upper division Language requirements are listed on page 370 of this *Catalog*

Bachelor of Music Degree Curriculum in the Music Program

Consists of 84 semester hours. This curriculum offers fields of specialization in Choral–General Music, Instrumental Music, Performance, Music Therapy, and Theory and Composition. Choral General Music and Instrumental Music majors are provided for students wishing to meet certification requirements for teaching in the public schools. The following requirements are included in each field of specialization:

Choral–General Music

(Note This degree program may include a teaching minor in instrumental music.)

Music theory MTC 125, 221, 222, 223, 327, 431.

Music history MHL 341, 342.

Conducting. MUP 209, 339

Music education MUE 313, 315, 480

Major performing medium Eight semester hours of MUP 111 and eight semester hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 completes the requirement.

Minor performing medium A proficiency equal to six semesters of study in keyboard or voice (whichever is not the major performing medium. Students wishing to extend their proficiency beyond this level may continue to study in MUP 321

Ensemble. Eight different semesters of participation including at least six semesters of MUP 352 and or MUP 353, four of which must be at Arizona State University

Recital attendance: Six semesters of MUP 100

Instrumental Music

Instrumental Concentration

(Note It is strongly recommended that this degree program include a minor in choral music or a minor in jazz education.)

Music theory MTC 125, 221, 222, 223, 327.

Music history MHL 341, 342

Conducting MUP 210, 340.

Music education MUE 315, 317, 318, 327, 328, 336, 337, 338, 481, 482

Class piano. MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Major performing medium Eight semester hours of MUP 111 and eight semester hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 completes the requirement

Ensemble· Eight different semesters of participation, four of which must be at Arizona State University. For wind and percussion players, two of the four ASU semesters must be in marching band String players must have a minimum of six semesters of MUP 345. Wind and percussion players must have a minimum of six semesters of MUP 361.

Recital attendance. Six semesters of MUP 100.

Instrumental Music

String Concentration

Music theory. MTC 125, 221, 222, 223, 327, 433.

Music history: MHL 341, 342.

Conducting. MUP 210, 340.

Music education MUE 315, 317 or 318 (whichever does not include the major instrument), 485, 486, MUP 121 (4 hours, a string instrument in the area other than the major instrument), MUP 121 (two hours, a third string instrument), MUP 121 (two hours, a fourth string instrument).

Class piano MUP 131, 132, 231, 232 (unless waived by proficiency exam)

Major performing medium. Eight semester hours of MUP 111 and eight semester hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirement. MUP 495 completes the requirement.

Ensemble. Eight different semesters of participation, four of which must be at Arizona State University. Must have a minimum of six semesters of MUP 345.

Recital attendance: Six semesters of MUP 100.

Recommended electives: MUE 313 and MUP 481.

Performance

Keyboard Concentration

Music theory. MTC 125, 221, 222, 223, 320 or 321, 327, 425 (or 428)

Music history· MHL 341, 342, 447.

Repertoire and pedagogy· MUP 451 or 452, 481 or 482.

Conducting· MUP 209 or 210.

Major performing medium Sixteen semester hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495 and a full recital (MUP 496) are required.

Ensemble: Eight semester hours within a minimum of six different semesters, of which two semesters of accompanying and two semesters of chamber music are required.

Recital attendance Six semesters of MUP 100.

Performance

Orchestral Instrument Concentration

Music theory MTC 125, 221, 222, 223, 320, 327, 425.

Music history. MHL 341, 342, 447.

Repertoire and pedagogy MUP 451 or 481

Conducting: MUP 210, 340.

Major performing medium: Sixteen semester hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital MUP 496) are required.

Class piano MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Ensemble· Eight semester hours of large ensembles within a minimum of six different semesters, plus four semester hours of small ensembles within a minimum of four different semesters.

Recital attendance. Six semesters of MUP 100.

Performance

Voice Concentration

Music theory MTC 125, 221, 222, 223, 320, 327, 425.

Music history MHL 341, 342, 447.

Repertoire and pedagogy MUP 451, 481: Two semester hours selected from MUP 453, 454 or a repeated enrollment of MUP 451.

Diction. MUP 250, four semester hours of diction for singers English, Italian, German, French.

Conducting MUP 209.

Major performing medium Sixteen semester hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital (MUP 496) are required.

Class piano: MUP 131, 132, 231, 232 (unless waived by proficiency examination)

Ensemble. Four different semesters of large ensembles plus five semester hours of ensembles with no five different semesters to be selected from large and or small ensembles

Recital attendance Six semesters of MUP 100

Additional requirements Sixteen semester hours in more than one foreign language, chosen from French, German or Italian. A student may elect one year of one language, and either one or two semesters of the others, chosen in conference with the advisor

Performance

Guitar Concentration

Music theory MTC 125, 221, 222, 223, 320, 327

Music history. MHL 341, 342, 447.

Repertoire and pedagogy MUP 451, 481

Conducting MUP 210

Major performing medium Sixteen semester hours of MUP 127 and 16 hours of MUP 327 to attain a proficiency level necessary to meet the graduation recital requirements. A half recital (MUP 495) and a full recital (MUP 496 are required

Class piano: MUP 131, 132, 231, 232 unless waived by proficiency examination)

Ensemble Eight semester hours of ensemble within a minimum of six different semesters. Four of the eight hours must be MUP 379: Chamber Music Ensemble–Guitar

Recital attendance: Six semesters of MUP 100.

Performance

Piano Accompanying Concentration

Music theory MTC 125, 221, 222, 223, 320, 327, 428.

Music history MHL 341, 342, 447.

Diction and repertoire: MUP 250 (two semesters), 451, 453, 454

Conducting MUP 209 or 210.

Major performing medium Sixteen semester hours of MUP 127, eight semester hours of MUP 311, eight semester hours of MUP 337. In addition, student will accompany two half recitals (MUP 495), one for a singer, one for an instrumentalist during the junior year. (A half solo recital may be substituted for either of the above.) During the senior year the student will accompany two full recitals MUP 496), one vocal and one instrumental.

Ensemble Two semesters of MUP 379 (chamber music, one semester of MUP 379 two piano ensemble); one semester of MUP 487 (piano accompanying), four semesters of MUP 388; two semesters of ensemble elective (minimum of six different semesters).

Recital attendance Six semesters of MUP 100.

Language Eight hours of one foreign language French, Italian, or German are required.

Performance

Music Theatre Concentration

Music theory. MTC 125, 221, 222, 223, 327.

Music history MHL 341, 342, 447 and two elective hours.

Conducting MUP 209 or 210.

Major performing medium Eight semester hours of MUP 111 and eight semester hours of MUP 311 to attain a proficiency level necessary to meet the graduation requirement of a public performance of two roles, one of which must be of major proportion.

Class piano. MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Ensemble: Three semesters of MUP 370, five semesters of MUP 371 and eight semesters of MUP 373.

Recital attendance Six semesters of MUP 100.

Additional requirements: Minimum of six semester hours each in theatre and dance

Performance

Jazz Performance Concentration

Music theory. MTC 125, 221, 222, 223, 315, 316, 321, 324, 327, 441.

Music history: MHL 152, 341, 342, 352.

Conducting MUP 210

Pedagogy MUP 341.

Major performing medium Eight semester hours of MUP 111 and eight semester hours of MUP 311 to obtain a proficiency level necessary to meet the graduation recital requirements. Two half recitals (MUP 495) are required, with one in the jazz idiom.

Class piano MUP 131, 132, 231, 232, 235, 236, 335, 336.

Improvisation: MUP 141, 142, 217, 218, 417, 418.

Ensemble: Eight semesters including two semesters of MUP 386 and six semesters of MUP 379 (Chamber Music Ensembles: Jazz).

Recital attendance. Six semesters of MUP 100.

Music Therapy

Music theory MTC 125, 221, 222, 223, 327, 422.

Music history MHL 341, 342

Conducting MUP 209 or 210.

Music education. MUE 211, 313, 319, 329, 335, 336 339

Music therapy: MUE 161, 261, 361, 362, 381, 384, 385, 386, 387, 388, 441, 475, 476

Major performing medium Six to eight semesters, must include at least four hours of MUP 311

Piano Proficiency equal to four semesters of study.

Voice Two semesters of study.

Ensembles Six semesters of participation with at least four semesters in large groups.

Recital attendance Six semesters of MUP 100.

Additional requirements Four semester hours of functional dance, specified courses in science and social and behavioral sciences.

(Note: Students must apply to the National Association for Music Therapy for registration as a music therapist on completion of the requirements for graduation.)

Theory and Composition

Music Theory Concentration

Music theory. MTC 125, 221, 222, 223, 320, 321, 323, 327, 422, 425, 428, 496, 10 hours electives in MTC courses 300 or above, to be chosen in consultation with advisor.

Music history. MHL 341, 342, 447, and three elective hours.

Conducting MUP 209 and 339 or MUP 210 and 340.

Applied music Twelve semester hours of study, eight of which must be MUP 111.

Class piano MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Ensemble Eight semesters of participation.

Final project. MTC 496

Recital attendance: Six semesters of MUP 100.

Language: The equivalent of 16 semester hours of credit in one foreign language; the choice of language subject to approval of advisor.

Music Composition Concentration

Music theory: MTC 125, 221, 222, 223, 320, 321, 323 (four semesters), 327, 422, 425, 428, 429, 430, 433.

Music history MHL 341, 342, 447 and three elective semester hours.

Conducting MUP 209 and 339, or MUP 210 and 340

Applied music: Twelve semester hours of study, eight of which must be MUP 111.

Class piano MUP 131, 132, 231, 232 (unless waived by proficiency examination).

Ensemble. Eight semesters of participation.

Final project. MTC 495.

Recital attendance. Six semesters of MUP 100.

Music Minor

For information concerning music education minors, consult with the School of Music Undergraduate Coordinator.

Graduate Programs

The School of Music offers the following graduate programs: the Master of Arts degree provides advanced studies in Music History and Literature; the Master of Music degree has majors in the fields of Performance (voice, keyboard, instrumental, piano accompanying, pedagogy, music theatre musical direction, music theatre performance, Choral Music (choral music, general music), Instrumental Music, and Theory and Composition The Doctor of Musical Arts degree, the Doctor of Education degree in Secondary Education (Music Education), and the Doctor of Philosophy degree in Education Secondary Education (Music) are offered in cooperation with the College of Education Consult the *Graduate Catalog*. A document on graduate degree programs in music may be obtained by writing to the School of Music.

MUSIC

(General Studies Electives)

MUS 100 Fundamentals of Music Notation. 3 F, S, SS
Provides non Music majors with sufficient symbol literacy to begin work in the field of musical learning No credit for Music majors

107 Introduction to Music. 2) F S SS
Correlation of music with literature, science and art A nontechnical course in the humanities for non Music majors *[Satisfies General Studies Requirement HU]*

340 Survey of Music History. 3 F S SS
Major per ods, composers and compos t ons n the h story of mus c. May be used to meet the mus c h story requ re ment for a m nor n mus c *[Sat sf es Genera Stud es Re qu rements HU, H]*

347 Jazz in America. 3 F S SS
Current pract ces emp oyed by contemporary jazz mus c ans the h stor ca deve opment of jazz techn ques *[Sat sfies General Stud es Requ rement HU]*

353 Survey of Afro-American Music. 3 A
Afro-Amer can mus c traced from ts or g ns n Afr ca to the present w th emphas s on sp r tua b ues azz gospe and c ass ca sty es *[Sat sf es Genera Stud es Requ rements HU, H]*

354 Popular Music. 3) A
Emphas s on h stor ca cu tura and performance patterns n a var ety of popu ar mus c d oms *[Sat sf es Genera Stud es Requ rement HU]*

355 Survey of American Music. 2 F S SS
Growth and deve opment of Amer ca s mus c *[Sat sf es General Stud es Requ rement HU]*

356 Survey of the Musical Theatre. 3 N
Mus c s p ace n the theatre v ewed n terms of h stor cal mportance and re at ve funct on *[Satisf es Genera Stud es Requ rement HU]*

357 Aesthetic Percept on in Music Performance. 3 F S SS
Introduces the non Mus c major to the aesthet cs of per formance by stress ng the r phys ca and emot ona n vo vement n the d rect on, mot on ntens ty and co or spectrum of mus c *[Sat sf es Genera Stud es Require ment HU]*

Special Courses: MUS 294, 298 394 484 492 493 494 497 498 499 500 580 583, 584 590, 591 592 593 594, 598 599 600 680 683, 684, 690, 691 692, 693 700 780 783 784 790 791 792 799 See pages 43–44

MUSIC EDUCATION

MUE 161 Introduction to Music Therapy. 2 F
Overv ew of mus c therapy Or entat on to menta hea th spec al educat on and re ated therap es. Requ red on s te v s ts.

211 Music in Recreation. 2 F
Mater a s methods and organ zat ona structures appropr ate for recreat ona mus c

261 Music Therapy as a Behavioral Science. 2 F
Or entat on to pre c n ca exper ence w th an emphas s on observat on sk s assessment goa sett ng and profes s ona eth cs Requ red off campus observat ons. Pre requ's'te: MUE 161

310 Music in Early Childhood Education. 3 F
dent fy ng and understand ng mus'ca needs of young ch dren Methods and mater a s for program development for c assroom teachers

311 Music for the Classroom Teacher. 3 F, S
Deve opment of the c assroom mus c program n the e e mentary schoo No prev ous mus c exper ence or course work requ red Not for Mus c majors or m nors

313 Music in the Elementary School. (3 F
Methods of nstruct on organ zat on and presentat on of appropr ate content n mus c Prerequ s te· Mus c major

314 Music in the Elementary School. 3) S
Se ected prob ems n e ementary schoo classroom mus c and chora program Observat on and partic pat on n schoo mus c c assrooms Prerequ s te MUE 313

315 Music in the Junior High School. 2 A
Student charactenst cs, curr cu um and teach ng strate g es for chora and genera mus c Prerequ s te. Mus c major

The fol ow ng Educat onal Methods for Teach ng Instru ments 317 339 offer teaching and p ay ng sk ls. Three hours per week.

317 Educational Methods for Vio in and Viola. 1 F S
Teach ng and p aying sk s for mus c teachers.

318 Educational Methods for Cello and String Bass. 1 F S
Teach ng and p ay ng sk s for mus c teachers

319 Educational Methods for Strings. 1 F
Teach ng and p ay ng sk s for mus c therap sts and music m nors

327 Educational Methods for Trumpet and Horn. 1 F S
Teach ng and p ay ng sk s for mus c teachers

328 Educational Methods for Trombone, Euphonium and Tuba. 1 F, S
Teach ng and p ay ng sk s for mus c teachers

329 Educational Methods for Brass. 1 S
Teaching and p ay ng sk s for mus c therap sts and mus c m nors

335 Educational Methods for Guitar. 1 F S
Teach ng and p ay ng sk s for mus c teache s

336 Educational Methods for Percussion. 1 F, S
Teach ng and p ay ng sk s for mus c teachers.

337 Educational Methods for Flute, Clarinet, Saxophone. 1 F, S
Teach ng and p aying sk s for mus c teachers.

338 Educational Methods for Double Reed Instruments. 1 F, S
Teach ng and p ay ng sk s for mus c teachers.

339 Educational Methods for Woodwinds. 1 F
Teach ng and p ay ng sk s for mus c therap sts and mus c m nors

361 Music Therapy Theory and Practice in Psychopathology. 3 F
Inf uence of mus c on behav or pr nc p es and pract ces of mus c therapy and psych atr c c ents. Prerequ s tes. MUE 261 Mus c Therapy major.

362 Music Therapy Techniques. 3 S
Organizat on, adm n strat on and use of mus c n rehab tat on w th var ous c ent popular ons Prerequ s tes· MUE 361 Mus c Therapy major

381 Music Therapy Research. 3 S
Stat stics and research des gn appropr ate for nvest ga t ons n mus c therapy *[Satisfies General Stud es Re qu rement L2]*

384 Therapy Pre-Clinical I. 1 F S
Pa red students w prov de mus c therapy for sma l groups at a commun ty agency for menta y retarded ger atr cs or phys ca y d sab ed c ents for a m nimum of ten c ock hours. Prerequ s tes MUE 211, 261

385 Therapy Pre-Clinical II. (1 F S
See MUE 384.

386 Therapy Pre-Clinical III. 1 F, S
See MUE 384

387 Therapy Pre-Clinical IV. 1) F, S
See MUE 384

388 Therapy Pre-Clinical V. (1 F S
See MUE 384

441 Psychology of Music. 3 S
Psycho og ca and phys o og ca aspects of music empha s z ng mus ca behav or funct on, percept on and earn ng Prerequ s tes Music Therapy major or nstructor approval jun or stand ng

475 Group Process and Music Therapy. 1 F
Pr nc p es of group process, verba counse ng, profes s onal wr ting as re ated to mus c therapy practice Pre requ s tes MUE 362 Mus c Therapy major

476 Internship in Music Therapy. 1 F, S
A 6 month res dency in an approved cl n ca nst tution

480 Choral Music Practicum. 3 S
Methods of nstruct on organ zat on and presentat on of appropr ate content n chora music classes Prerequ s te. Secondary Educat on major

481 Instrumental Music Practicum. 5 F S
Instrumental mus c as a means of deve op ng mus c sk s understand ngs and attitudes n e ementary and secon dary schoo students Prerequ s te· Secondary Educat on major

482 Instrumental Music Practicum. 5 F S
See MUE 481 Prerequ s te Secondary Educat on ma or

485 String Practicum. 2 F S
A 2 semester course w th MUE 486 for students preparing to adm n ster a string program and teach strings at the e ementary leve

486 String Practicum. 2 F S
Cont nuat on of *MUE 485.*

548 Introduction to Research in Music Education. 3 F, SS
Survey of research methods and terature n mus c edu cat on Focus on nterpretat on and evaluat on

549 Foundations of Music Education. 3 A
A treatment of h stor ca perspect ves, ph osophy aesthet cs 'dent f ed w th mus c educat on, and earn ng theor es app ed to mus c teach ng learning Bas c research and wr t ng sk s appropr ate to graduate studies n mus c edu cat on

550 Studies in Music Curricula. 3 A
Scope and sequence of mus ca experiences Deve op ment of cr ter a for the eva uat on of mus c curr cu a

551 Advanced Studies in Elementary School Music. 3 A
For experienced teachers; organ zat on and content of the genera music c asses n k ndergarten and the f rst 6 grades of e ementary schoo Emphas s on teach ng mus c read ng and ear tra n ng to young ch ldren

552 General Music, Music Theory and Music History Classes in the Junior and Senior High School. 3) N
Organ zat on and content of schoo mus c c asses wh ch are not performance or ented

553 Contemporary Elementary Music. (3) F
Ident f cat on and deve opment of materials and tech niques for teach ng spec a un ts of mus c study to e e mentary (K 8) ch dren

560 Teaching Contemporary Music. *3)* N
Strateg es for us ng contemporary mus c with schoo mu sic c asses and organizat ons

564 Instrumental Music, Advanced Rehearsal Techniques. 3 A
An n depth ana ys s of nstrumenta techn ques n prepa *ration for a thorough d scuss on of* band tun ng prob ems and so ut ons D scuss on of product ve conduct ng and rehearsal techn ques for schoo mus c teachers

566 Instrumental Literature for Schools. (3) N
Comprehens ve study and ana ys s of a types of nstru menta mus c

568 Choral Music, Advanced Rehearsal Techniques. (3) A
Mus ca and voca techn ques necessary for presentat on of chora terature Ana ys s and exper mentat on w th psy cho og ca , acoust ca and other problems of rehearsal and performa ce.

570 Choral Literature for Schools. 3 A
Comprehens ve study and ana ys s of chora mus c for the h gh schoo w th spec al emphas s on octavo terature

579 Psychology of Music. 3) N
The nature of mus ca ty and ts eva uat on A rev ew of re cent research

585 Vocal Acoustics and Production. (3 A
An n depth approach to the psycho og ca phys o og ca work ngs of the voca mechan sm.

733 Contemporary Issues and Research in Music Education. (3 S
Emphas s upon recent research re at ng to mus c nstruc t on at a leve s current and historica ssues n chora , genera and nstrumenta music

744 Higher Education Instruction. 3) F
Ph osoph ca and psycho og ca pr nc p es of co ege uni vers ty teach ng. Patterns of mus c teacher educat on and a project on of course out nes

755 Philosophy and Aesthetics in Music Education. 3 SS
Ph losophy and aesthetics as they nf uence curr cu um content and teach ng procedures

Special Courses: MUE 294 298 394 484 492, 493 494, 497 498, 499 500, 580 583 584 590, 591 592, 593, 594 598 599 600 680 683, 684 690, 691 692, 693, 700 780, 783 784 790 791 792 799 See pages 43–44

MUSIC HISTORY

MHL 142 Music Listening. 1 S
Aura percept on of a var ety of mus c trad t ons, genres, forms and techn ques Prerequ s te Mus c major

152 Jazz Listening. 1 F
An ntroduct on to jazz forms d oms and major nnova tors.

341 Music History. 3 F S
Western mus c from the Greeks to the present day Need not be taken n sequence w th MHL 342 Prerequ site· MTC 221

342 Music History. (3 F S
See MHL 341 Prerequ s te MTC 221

352 The Evolution of Jazz. 3 F
Or g n, deve opment and sty es of jazz music and ts expo nents Prerequ s te MTC 223 *[Satisfies General Studies Requ rement H]*

438 Music in the Classic Era. 3 N
Development of the c ass c sty e of the 18th century ma jor works of Haydn, Mozart and Beethoven Prerequ s tes MHL 341, 342, MTC 327.

439 Music in the 19th Century. 3 N
Europea art mus c after Beethoven Prerequis tes MHL 341 342 MTC 327 *[Sat sf es Genera Stud es Requ re ment L2]*

441 Music of the Baroque Era. 3 N
Works of ma or composers and sty st c tendenc es of the per od Prerequ s tes· MHL 341, 342 MTC 327 *[Sat sf es Genera Stud es Requ rement L2]*

447 Music Since 1900. 3 F SS
Survey of the works by major composers and sty st c trends Prerequ s tes MHL 341 342 MTC 327. *[Sat sf es Genera Studies Requ rement L2*

456 History of Opera. 3 S
The deve opment f ope a from ts creat on c 1600 to present Emphas s p aced n major sty st c deve opments and representat ve works Prerequ s tes MHL 341, 342 MTC 222

466 North American Indian Music. 3 N
Various styles of nd an mus c n the Un ted States, Can ada and Mex co Open to Mus c ma ors and nonmajors *[Satisf es Genera Stud es Requ rement HU]*

532 Music Bibliography. 3 F
Major h stor ca and ana yt ca wr t ngs systemat c and h stor ca co ect on of mus Read ng know edge of a fore gn anguage recommended

535 Medieval Mus c. 3 F
Mus c of Europe n the M dd e Ages Greg r an chant re g ous and secu ar monophony and po yphony to 1400

536 Music of the Rena ssance. 3 F
Mus c n Europe w th emphas s on sty st c concepts and changes c 1400–1580

544 World Music I. 3 N
Mus of t ad t ona and fo k cu tures of Afr ca Europe and the Amer cas

545 World Music II. 3 N
Trad t ona fo k and art mus c of the Pac f c, Near East and As a

547 Topics in American Music. 3 S
Se ected top cs n the h story of mus c Composers work ng n the Ame cas w th emphas s upon mus c s nce 1900

575 History of Choral Music. 3 F
Major chora works

644 Notation of Polyphonic Music. 3 N
Mus c notat on from the 15th through 17th centur es, n c ud ng prob ems of transcr pt on nto modern notat on

Special Courses: MHL 294 298 394 484 492 493, 494, 497 498 499 500 580, 583 584 590 591 592 593, 594 598, 599 600 680, 683 684, 690 691 692 693, 700, 780 783 784 79 791 792 799 See pages 43–44

MUSIC THEORY AND COMPOSITION

MTC 125 Basic Mus c Theory. 3 F S
For Mus c ma ors Des gned to deve op aural and nota t ona sk s Meets da y

221 Music Theory: 18th Century. 3 F S
Mus c from the 18th century w th a v ew toward deve op ng students ab t es to ana yze, theor ze, perform and create examp es w th n the ty e Deve opment of re ated aura v sua and keyboard k s Prerequisite· MTC 125

222 Music Theory: 19th Century. (3 F, S
Mus ca compos t ons chosen from the ate 18th and 19th centur es Harmon c progress ons, me od c construct on and rhythm c deve opments deve opment of re ated aura v sua and keyboard sk s Prerequ s te MTC 221

223 Music Theory: 20th Century. 3) F S
Representat ve 20th century compos tions w th part cu ar emphasis on those e ements of me od c, harmon c and rhythm c treatment wh ch break w th past convent ons. Deve opment of re ated aura v sual and keyboard sk ls Prerequ s te MTC 222

315 Modern Arranging. 2) F
Techn ques n arrang ng for the contemporary jazz, rad o te ev s on and stud o orchestra. Prerequis te MTC 223

316 Modern Arranging. 2) S
Cont nuat on of MTC 315 Prerequis te MTC 315

320 Modal Counterpoint. 2 F
Counterpo nt based on 16th century vocal polyphonic sty e. Prerequ s te· MTC 221

321 Tonal Counterpoint. 2 S
Counterpo nt based on 18th century po yphon c sty e Pre requ s te. MTC 221.

323 Composition. 2 3 F, S
Creative wr t ng n the sma ler forms nc ud ng the use of harmon c textures and contrapunta dev ces May be re peated for cred t Prerequ s te: instructor approva

324 Survey of Jazz Styles. 2 A
Large ensemble compos t ons and recorded improv sed so os Prerequ s te MHL 352

327 Form and Analysis I. 3 F S
Organ z ng e ements n the most mportant contrapunta and homophon c mus ca forms from the Rena ssance through the 19th century. Prerequ s te MTC 223

422 Musical Acoustics. 3 F S
Propert es of sound and tone Harmon c ser es nstru ments the ear aud torium acoust cs and the reproduct on of sound A thorough know edge of mus cal notation nter va s sca es and harmony or 2 years of mus c theory wi be assumed

425 Studies in 20th-Century Theory. 3 F
Cont nued deve opment of ana yt ca techn ques and aural sk w th an exam nat on of theoret ca systems app cab e to 20th century mus c Prerequ s te MTC 223

428 Form and Analysis II. 3 S
Organ z ng pr nc p es of the arge forms of mus ca compo s t on n the 19th and 20th centur es Prerequ s te MTC 327

429 Canon and Fugue. 2 N
Wr t ng of canons and fugues n tona sty e Prerequ s te: MTC 321

430 20th-Century Counterpoint. 2 N
Counterpo nt stud es ut l z ng 20th century d oms Pre requ s te MTC 223

431 Choral Arranging. 2 S
Pract ca studies n ed t ng and arrang ng for chora organ zat ons Preparation of su tab e matena s for young choirs and advanced groups. Study of accompan ments Pre requ s te· MTC 223

433 Orchestration. 3 N
Theoret ca and pract ca study of scor ng for orchestral in- struments n various comb nat ons, rang ng from smal en semb es to symphon c orchestra and concert band Pre requ s te MTC 223

436 Electronic Studio Techniques I. (2) F
Pr nc p es of ana og e ectron c music systems and their app cat on n the compos t on of electronic mus c A thor ough know edge of mus c notat on and nterva s w l be assumed

437 Electronic Studio Techniques II. (2) S
Principles of digital electronic music systems and their applications in the composition of electronic music. Prerequisite: MTC 436.

441 Jazz Composition. (2) F
Creative writing in the smaller forms and in the idiom of jazz. Prerequisite: MTC 321.

495 Final Project. (0) F, S
A half recital of compositions or approval of a large scale composition or a research paper.

496 Theory Project. (3) F, S, SS
Supervised individual writing project dealing with music theory.

501 Ear Training Review. (2) SS
Melodic and harmonic dictation. Credit cannot be applied toward the graduate theory requirement.

520 Analytical Techniques. (3) S, SS
Analytical techniques systematically applied to music. Concentration on structural and compositional procedures.

523 Advanced Composition. (2) F, S
Creative writing in the larger forms for chorus, orchestra and band. May be repeated for credit.

525 Pedagogy of Theory. (3) N
Practices and principles of teaching music theory. Emphasizes most desirable and practical offerings possible. Comparative studies of existing practices.

527 Evolution of Musical Theory. (3) F, S
Theory from Pythagoras to the present. Need not be taken in sequence with MTC 527.

528 Evolution of Musical Theory. (3) F, S
See MTC 527.

553 Advanced Choral Arranging. (2) F
Choral techniques in composition and arranging. Vocal writing through analysis of choral works. Projects in both arranging and composition.

554 Advanced Scoring Problems. (2) N
Instrumentation. Playing characteristics of each instrument; writing and arranging idiomatic music for the instrument. Projects in both scoring and composition.

Special Courses: MTC 294, 298, 394, 484, 492, 493, 494, 497, 498, 499, 500, 580, 583, 584, 590, 591, 592, 593, 594, 598, 599, 600, 680, 683, 684, 690, 691, 692, 693, 700, 780, 783, 784, 790, 791, 792, 799. (See pages 43–44.)

MUSIC PERFORMANCE

MUP 100 Concert Attendance. (0) F, S
Required of all music majors for 6 semesters in each degree program, with a minimum of 7 concerts attended each semester.

111 Studio Instruction. (2) F, S
For majors in Music degree program. Placement audition required. Piano, organ, harpsichord, voice, harp, flute, oboe, clarinet, saxophone, bassoon, trumpet, cornet, horn, euphonium, guitar, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of 1 hour plus studio class weekly. May not be taken for audit.

121 Studio Instruction. (1) F, S, SS
For secondary or minor instrument instruction and nonmajors in the university. Placement examination and audition required. Piano, organ, harpsichord, voice, harp, flute, oboe, guitar, clarinet, saxophone, bassoon, trumpet, cornet, horn, euphonium, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of ½ hour per week. May not be taken for audit.

127 Studio Instruction. (4) F, S
For Performance majors in Bachelor of and Master of Music degree programs only. Placement examination and audition required. Piano, piano accompanying, organ, harpsichord, voice, harp, flute, oboe, clarinet, guitar, saxophone, bassoon, trumpet, cornet, horn, euphonium, trombone, tuba, percussion, violin, viola, cello, contrabass. May be repeated for credit. Minimum contact of 1 hour plus studio class weekly. May not be taken for audit.

130 Beginning Group Piano. (1) F, S
Provides a basic introduction to playing piano through music reading, chords, rhythmic and written activities. Non-Music majors only.

131 Class Piano. (1) F, S
A four-semester sequence (with MUP 132, 231 and 232) designed for those lacking piano experience and those who need piano as a classroom tool. Emphasis on keyboard technique, sight reading simple accompaniments and improvisation. 2 hours per week. May not be taken for audit.

132 Class Piano. (1) F, S
See MUP 131.

133 Class Voice. (1) F, S
A four-semester sequence (MUP 134, 233 and 234) open to all students. 2 hours per week. May not be taken for audit.

134 Class Voice. (1) F, S
See MUP 133. Prerequisite: MUP 133 or instructor approval.

141 Jazz Fundamentals. (1) F
Principles, methods and theory of jazz performance, especially designed for the small jazz ensemble. 2 hours per week.

142 Jazz Fundamentals. (1) S
Continuation of MUP 141. 2 hours per week.

209 Beginning Choral Conducting. (1) F, S
Essentials of choral conducting techniques. 2 hours per week.

210 Beginning Instrumental Conducting. (1) S
Essentials of instrumental conducting techniques. 2 hours per week.

217 Improvisation Workshop. (2) F, S
Emphasis on basic jazz literature, chord symbol reading, melodic patterns, ear training, melodic concepts and analysis of improvised solos. Must be taken in sequence with MUP 218. May not be taken for audit. Prerequisites: MTC 125; MUP 111 (1 semester).

218 Improvisation Workshop. (2) F, S
Continuation of MUP 217. Prerequisite: MUP 217.

231 Class Piano. (1) F, S
See MUP 131.

232 Class Piano. (1) F, S
See MUP 131.

233 Class Voice. (1) F, S
See MUP 133. Prerequisite: MUP 134 or instructor approval.

234 Class Voice. (1) F, S
See MUP 133. Prerequisite: MUP 233 or instructor approval.

235 Jazz Piano. 1 F S
A four semester sequence w th MUP 236 335 and 336 des gned for azz keyboard exper ence Emphas s w be on chord symbo read ng, s mp e mprov sat on and vo c ng 2 hours per week Prerequ site MUP 132

236 Jazz Piano. 1 F S
See MUP 235 Prerequ s te MUP 132

250 Diction for Singers. 1 F S
Use of phonet cs n the study of song and opera terature Language emphas s d ffers each semester May be re peated for cred t

301 Advanced Class Piano. 1 F
Requ red for chora and genera majors Open to other Mus c majors who have comp eted MUP 232 Emphas s on accompan ments, ensemb e play ng score read ng, advanced harmon zations reperto re technique and m prov sat n May not be taken for aud t 2 hours per week Prerequ s tes MUP 232 or prof c ency p acement exam nat on

302 Advanced Class Piano. 1 S
Requ red for chora a d genera majors Open to other Mus c majors who have comp eted MUP 301 A sequent a cont nuat on of MUP 301 sk s wh ch nc ude both group and stud o nstruct on May not be taken for aud t 2 hours per week Prerequ s tes MUP 301 or prof c ency, p ace ment exam nat on

311 Studio Instruction. 2 F S
See MUP 111

321 Studio Instruction. 1 F S, SS
See MUP 121

327 Studio Instruction. 4 F S
See MUP 127.

328 Fretboard Harmony and Pedagogy. 3 S
App cat on of trad t ona me od c and harmon c concepts to the f ngerboard Method books and pedagog ca ap proaches Prerequ s te MTC 223

335 Jazz Piano. 1 F S
See MUP 235 Prerequ s te MUP 132

336 Jazz Piano. 1 F S
See MUP 235 Prerequ s te MUP 132

337 Studio Instruction-Piano Accompanying. 2 S
Lessons for accompany ng majors on y Reperto re to be se ected from voca and nstrumenta terature P acement exam nat on requ red 1 hour esson per week May be re peated for cred t

339 Choral Conducting. 2 F S
E ements of chora conduct ng techn que and nterpreta t on 3 hours per week Prerequ s te MUP 209 or 211

340 Instrumental Conducting. 2 F
Fundamenta s of score read ng and nterpretat on of in strumenta mus c 3 hours per week Prerequ s te MUP 210 or 211

341 Jazz Pedagogy. 3 S
Tra n ng and superv sed pract ce n conducting jazz en semb es w th emphas s on terature, programm ng and rehearsa techn ques 2 c ass hours and 2 fie d exper ence hours each week Prerequ s te MUP 210

344 Chamber Orchestra. 1 F S
Membersh p by aud t on Important masterp eces from al per ods of mus c w be performed throughout the year May be repeated for cred t.

345 Symphony Orchestra. 1 F S
Open to a students who can qua fy on the bas s of aud t ons w th the d rect r Over a 4 year per od the student is ntroduced to the masterp eces of symphony orchestra l t erature 3 times per week May be repeated for cred t

350 Choral Union 1 F, S
Open to a students n the un vers ty and to nterested s ngers n the commun ty by aud tion Preparat on and performance of the arger chora works May be repeated for cred t. 2 hours per week

352 Concert Choir. 1 F S
Membersh p chosen by aud t on May be repeated for cred t. 4 hours per week

353 University Choir. 1 F, S
Membersh p chosen by aud t on May be repeated for cred t 4 hours per week

355 Men's Chorus. 1 F S
Open to a l ma e students n the un vers ty who can qua fy on the bas s of aud t ons Rehearsa and performance of mus c for ma e vo ces 2 hours per week May be re peated for cred t

357 Women's Chorus. 1 F S
Membersh p chosen by aud t on 2 hours per week May be repeated for cred t

361 Marching and Concert Bands. 1 F S
Open to a l students who can qua fy on the bas s of aud t ons with the d rector Stag ng of format ons and dr s for footba games and other events Fa , masterp eces of symphon c band terature Spring) Meets da y May be repeated for cred t

362 Concert Bands. 1 F
Night rehearsa s Membersh p chosen by aud t on May be repeated for cred t

370 Music Theatre: Techniques. 1) F S
Exerc ses and mprov sat ons for the s ng ng actor empha s z ng body awareness so at ons and freedom of the vo ca and breath mechan sms Sect on 1 nterpretat on Sect on 2 Express on , Sect on 3 Movement for S ngers) Each sect on 3 hours per week May be repeated for cred t

371 Music Theatre: Workshops. 1 F, S
Deve opment of spec f c sk s for mus ca dramat c nter pretat on Sect on 1 Ro e Preparat on ; Sect on 2 Sty es ; Sect on 3 Opera Scenes ; Sect on 4 Mus ca Comedy ' Sect on 5 (Revue Ensemb es . Each sect on 1 ecture demonstrat on 1 ab per week May be repeated for cred t

372 Music Theatre: Orchestras. 1 F, S
Open to a students who can qua fy on the basis of aud t ons w th the nstructor Part c pat on n Lyr c Opera The atre product ons. Section 1 Orchestra) Sect on 2 Cham- ber Orchestra , Sect on 3 Chamber Ensemb e May be repeated for cred t

373 Music Theatre: Performance. 1 F S
Open to a students who can qua fy on the bas s of aud t ons w th the nstructor. Part c pat on in Lyr c Opera The atre product ons Sect on 1 Pr nc pa Ro es ; Section 2 Chorus May be repeated for cred t

374 Music Theatre: Production. 1 F S
Part c pat on in Lyric Opera Theatre product ons. Sect on 1 (Voca Performance Sect on 2 (Techn ca Mus c The- atre , Sect on 3 Problems n Product on) to be taken con current y w th MUP 373 Sect on 2 May be repeated for cred t.

379 Chamber Music Ensembles. 1) F S
Str ng brass woodw nd, percuss on, keyboard voca and mixed ensemb es. May be repeated for cred t. 2 hours per week Prerequ s te nstructor approva

382 Collegium Musicum. (1) F, S
Singers and instrumentalists specializing in the performance of early and unusual music. May be repeated for credit. 2 hours per week. Prerequisite: instructor approval.

383 New Music Ensemble. (1) F, S
Rehearsal and performance of music written in the last 20 years. May be repeated for credit. Prerequisite: instructor approval.

384 Brass Choir. (1) F, S
Specializing in public performance of music written for brass instruments. May be repeated for credit. 3 hours per week. Prerequisite: instructor approval.

385 Percussion Ensemble. (1) F, S
Rehearsal and performance of standard and original repertoire for the percussion ensemble and related instruments. Membership by instructor approval. May be repeated for credit. 2 hours per week.

386 Stage Band. (1) F, S
Rehearsal and performance of literature for the stage band. Membership by instructor approval. May be repeated for credit. 4 hours per week.

387 Ethnomusicology Ensembles. (1) F, S
Performance learning experience for the music of various cultures of the world. May be repeated for credit. Prerequisite: knowledge of instrument or instructor approval.

388 Piano Accompanying. (1) F, S
Accompanying majors (others at the discretion of instructor). Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. May be repeated for credit. 2 hours per week.

417 Advanced Improvisation. (2) F, S
Emphasis on analysis and performance of advanced jazz literature; composition in contemporary styles. Must be taken in sequence with MUP 418. May not be taken for audit. Prerequisite: MUP 218.

418 Advanced Improvisation. (2) F, S
Continuation of MUP 417. Prerequisite: MUP 417.

440 Keyboard Harmony. (1) F
Performance-oriented class emphasizing chord progressions, harmonization, figured bass realization, stylistic improvisation, transposition, open score reading and sight reading. Prerequisite: keyboard major or instructor approval.

451 Repertoire. (2) F, S
Literature available for performance in all performing media. May be repeated for credit. Prerequisite: junior standing in major performance field.

452 Piano Repertoire II. (2) S
Continuation of MUP 451 (Piano). Romantic and contemporary keyboard literature. Prerequisites: junior standing as piano major; instructor approval.

453 Song Literature. (2) A
American, Russian, Spanish, Scandinavian and contemporary song.

454 Song Literature. (2) A
Early Italian, English, German and French art song.

481 Performance Pedagogy and Materials. (2) F, S
Principles and methods of performance techniques for each performance field. May be repeated for credit. Prerequisite: senior standing or instructor approval.

482 Piano Pedagogy II. (2) N
Continuation of MUP 481 (Piano). Problems and techniques of teaching intermediate to advanced piano students. Prerequisites: junior standing as piano major; instructor approval.

487 Piano Accompanying. (1) F
Keyboard majors. Piano accompaniments found in vocal and instrumental literature; discussion of styles and performance practices; experience in public performance. May be repeated for credit. 2 hours per week. May not be taken for audit.

495 Solo Performance. (0) F, S
For Bachelor of Music degree candidates where one-half recital is a graduation requirement.

496 Solo Performance. (0) F, S
For Bachelor of Music in Performance degree candidates where a full recital is a graduation requirement. Prerequisite: MUP 495.

507 Group Piano Practicum. (2) F
Curricula, materials, teaching techniques for group teaching at the university and community college levels. Observation/supervised teaching in group piano.

508 Studio Observation. (1) F, S
Weekly observation of studio teaching by various piano faculty. Paper as final requirement. Prerequisite: M.M. performance/pedagogy piano student.

511 Studio Instruction. (2) F, S
See MUP 111.

521 Studio Instruction. (1) F, S, SS
See MUP 121.

527 Studio Instruction. (2 or 4) F, S
See MUP 127.

540 Advanced Conducting. (3) F
Score preparation and conducting techniques for instrumental music. Concentration on study of historical styles. Required of D.M.A. students in Instrumental Music.

541 The Art Song. (3) N
Solo song from its beginning to the present day.

544 Chamber Orchestra. (1) F, S
Membership by audition. Important masterpieces from all periods of music will be performed throughout the year. May be repeated for credit.

545 Symphony Orchestra. (1) F, S
Open on the basis of audition with the director. Masterpieces of symphony orchestra literature. 3 times per week. May be repeated for credit.

550 Choral Union. (1) F, S
Open to all students in the university and to interested singers in the community by audition. Preparation and performance of the larger choral works. 2 hours per week. May be repeated for credit.

551 Repertoire. (2) N
Literature available for performance in all performing media. May be repeated for credit.

552 Concert Choir. (1) F, S
Membership chosen by audition. 4 hours per week. May be repeated for credit.

553 University Choir. (1) F, S
Membership chosen by audition. 4 hours per week. May be repeated for credit.

555 Men's Chorus. (1) F, S
Open to male students in the university who can qualify on the basis of audition. Rehearsal and performance of music for male voices. 2 hours per week. May be repeated for credit.

557 Women's Chorus. 1 F S
Membersh p chosen by aud t on 2 hours per week May be repeated for cred t

561 Marching and Concert Bands. 1 F, S
Open by aud t on on y Stag ng of format ons and dr s for footba games and other events Fa masterp eces of symphon band terature Spr ng Meets da y May be repeated for cred t

562 Concert Bands. 1 F S
Membersh p chosen by aud t on Fa May be repeated for cred t

570 Music Theatre: Techniques. 1 F, S
Exerc ses and mp ov sat ons for the s ng ng actor empha s z ng body awareness so at ons and freedom of the vo ca and breath mechan sms Sect on 1 I terpretat on Sect on 2 Express on Sect on 3 M vement for S ngers Each Sect on 3 hours per week May be repeated for cred t

571 Music Theatre: Workshops. 1 F, S
Deve opment of spec f c sk s for the mus ca dramat c n terpretat on Sect o 1 Ro e Preparat on Sect on 2 Sty es Sect on 3 Opera Scenes Sect on 4 Mus ca Comedy , Sect on 5 Revue Ensemb es Each sect on 1 ecture demonstrat on 1 ab per week May be repeated for cred t

572 Music Theatre· Orchestras. 1 F S
Open to a students wh a qua fy on the bas s of aud t ons w th the nstructor Part c pat on n Lyr c Opera The atre product ons Sect on 1 Orchestra Sect on 2 Cham ber Orchestra Sect on 3 Chamber Ensemb e May be repeated for cred t

573 Music Theatre: Performance. 1 F S
Open to a students who can qua fy on the bas s of aud t ons w th the nstructor Part c pat on n Lyr c Opera The atre product ons Sect on 1 Pr nc pa Ro es , Sect on 2 Chorus May be repeated for cred t

574 Music Theatre: Production. 1 F S
Part c pat on n Lyr c Opera Theatre product ons Sect on 1 V ca Performan e Sect on 2 Techn ca Mus c The atre Sect on 3 Prob ems n Product on to be taken con current y w th MUP 373, Sect on 2 May be repeated for cred t

579 Chamber Music Ensembles. 1 F, S
Str ng brass woodw nd, percuss on, keyboard, voca and m xed ensemb es 2 hours per week May be repeated for cred t Prerequ s te nstructor approva .

581 Performance Pedagogy and Materials. 2 N
Princ p es and methods of performance techn ques for each performan e f e d May be repeated for cred t

582 Collegium Musicum. 1 F S
S ngers and nstrumenta sts spec a z ng n the perform ance of ear y and unusua mus c 2 hours per week May be repeated for cred t Prerequ s te nstructor approva

583 New Music Ensemb e. 1 F, S
Rehearsa and performance of mus c wr tten n the ast 20 years May be repeated for cred t Prerequ s te nstructor approva

584 Brass Choir. 1 F, S
Pub c performance of mus c wr tten for brass nst uments 2 hours per week May be repeated for cred t Prerequ s te nstructor approva

585 Percussion Ensemble. 1 F S
Rehearsa and performance of standard and or g na rep erto re for the percuss on ensemb e and re ated nstru ments Membersh p by nstructor approva 2 hours per week May be repeated for cred t

586 Stage Band. 1 F S
Rehearsa and performance of terature for the stage band Membersh p by nstructor approva 4 hours per week. May be repeated for cred t

587 Ethnomusicology Ensembles. 1 F, S
Performance earn ng exper ence for the mus c of var ous cu tures of the wor d May be repeated for cred t Pre requ s te know edge of nstrument or nstructor approva

588 Piano Accompanying. 1 F S
P ano accompany ng majors others at the d scret on of the nstructor . P ano accompan ments found n voca and nstrumenta terature d scuss on of sty es and perform ance pract ces exper ence n pub c performance 2 hours per week May be repeated for cred t

595 Solo Performance. 1) F S
For Master of Mus c cand dates n app ed mus c on y May be fu rec tal, major operat c ro e so o performance w th orchestra or an ensemb e or ecture rec ta

596 Solo Performance. 1 F S
See MUP 595.

727 Studio Instruction. (4 or 2 F S
For D M A cand dates on y M n mum contact of 1 hour per week May be repeated for cred t

796 Solo Performance. 1 5 F S
For D M A cand dates on y May be repeated for cred t

Special Courses: MUP 294 298 394 484, 492 493 494, 497 498, 499 500 580 583, 584 590 591 592 593 594 598, 599 600 680, 683 684 690 691 692 693 700 780 783 784, 790 791, 792, 799 See pages 43–44

Theatre

PROFESSORS:
WRIGHT (GHALL 232), AKINS, DOBKIN, DOYLE YEATER

ASSOCIATE PROFESSORS:
BARTZ EDWARDS ENGEL, SALDANA STARK, THOMSON VINING

ASSISTANT PROFESSORS:
BARKER, BR TTEN RISKE SINGER

VISITING LECTURER:
LEONARD

Departmental Major Requirements

For advisement purposes, all students registering n a Theatre degree program w ll enroll through the College of Fine Arts. Spec al advisement checksheets, providing complete information re garding requirements and suggested electives, are available in the Department of Theatre office for each degree program and area of concentration.

Bachelor of Arts Degree Curriculum

Theatre. Consists of a minimum of 45 semester hours and a maximum of 56 semester hours Within the major (including related area studies considered part of the major), only courses with a grade of "C" or higher may be applied toward graduation. The following core of course work in theatre is required. THE 220, 225, 320, 321; THP 101, 213, 315, 330, 340, 345; at least two semester hours in THP 301, chosen from different production options. Theatre electives, chosen in consultation with an advisor, may be concentrated in one area of theatre specialization or selected to provide a balanced general program. Up to 15 hours of approved course work in a related area or areas may be included in the major.

General Studies. In addition to meeting all requirements for General Studies as established by the university, the B.A. in Theatre also requires 15 hours of courses designed to further develop the student's artistic and cultural literacy. This requirement may be met in one of two ways:

1. Completion of a foreign language at the intermediate level (202 or equivalent), or completion of a foreign language course at the 300 level or above taught in the foreign language.
2. Completion of a 15 hour block of courses approved for university General Studies core credit in literacy and critical inquiry, humanities and fine arts. Courses selected must be from at least three different departments. Courses used to fulfill other university General Studies requirements may not be counted in completing this option.

General Studies Electives. After satisfying all other requirements, remaining electives to total a minimum of 54 hours may be chosen from any of the approved university General Studies core courses or any courses in the College of Fine Arts. Lower division courses in foreign language may also be used as electives.

Bachelor of Fine Arts Degree Curriculum

Consists of 74–84 hours in theatre (including approved related area studies considered part of the major). On the basis of personal interests and professional objectives, the student may select one of two curriculum options: theatre education or performance/production with an emphasis in acting, or design/technology. Candidates for the B.F.A degree must take the last 60 hours of course work in residence at ASU. Retention in the B.F.A. program will be determined by annual faculty review of all candidates for the degree; the review process will include consideration of the student's academic record, professional activities and growth and artistic potential. A minimum of 42 hours in General Studies is required. See page 369 for approved areas of study and distribution of hours as required by the College of Fine Arts. Some adjustments are made in the theatre education option in order to meet certification requirements. Admission procedures and theatre course requirements for each curriculum option emphasis follow.

Performance/Production

Acting. Consists of 74 hours in theatre (including approved related area studies considered part of the major) Admission is by audition prior to the junior year and a 3.00 GPA in theatre courses is required Students may enter the B.F.A track as freshmen in preparation for the admission auditions during the spring semester of the sophomore year Auditions for transfer students and for scholarship applicants will be held only in spring and in late summer Specific dates may be obtained from the Department of Theatre. Retention in the B.F.A. program will be determined by review of all candidates at the end of the junior year. The following courses are required: THE 220, 225, 320, 321, THP 101, 110, 200, 213, 270, 275, 301 (three hours), 307, 310, 315, 370, 371, 410, 471, 498 (Senior Project) and two courses from THP 330, 340 or 345; 12 hours of theatre history and literature; and graduation requirements selected in consultation with a B.F.A. advisor.

Design Technology Acceptance in this emphasis is by interview and portfolio review and requires a 3.00 GPA in theatre courses. Retention in the emphasis is determined at the end of each semester of the junior year The following theatre courses are required: THE 220, 225, 320, 321; THP 101, 213, 315, 330, 340, 345, 431, 435, 440, 445, 498 (Senior Project), three hours of theatre history or literature; and theatre related area electives selected in consultation with a B.F.A. advisor, to complete the major requirement of 74 hours.

Theatre Education

Acceptance in this option is by interview only (or submission of three letters of recommendation and a letter of intent if distance prohibits coming to campus) and with the approval of the faculty of

the Department of Theatre. Application will normally be made at the end of the sophomore year; applications for early admission of ASU freshmen will be accepted toward the end of the second semester of full time study. The student will also be required to meet admission standards mandated by the ASU College of Education and the Arizona Department of Education for teacher certification (see page 249). Although the Department of Theatre may admit a student into the B.F.A. Theatre (Theatre Education) program, the College of Education may reject a student's application for admission into the Professional Teacher Preparation Program.

The following theatre professional courses are required: THE 220, 320, 321, 325 (three hours), 480; THP 101, 110, 113, 213, 270, 275, 311, 315, 330, 340, 345, 411, 415, 481, 498 (Production Practicum); a minimum of two semester hours in THP 301, Summer High School Theatre Workshop (as offered), theatre production electives, and all course test requirements in professional education as established by the College of Education to complete the major requirements of 84 hours. For retention in the theatre education option a grade point average of 3.00 in the major and professional courses and a 2.50 in graduate requirements course work in addition to an annual review is required. Although a minor teaching field (24–30 hours in such areas as English and communications is not required for the B.F.A. degree in Theatre (Theatre Education), employment opportunities are enhanced for the student by taking this option.

Departmental Minor Teaching Field Requirements

Elementary Education Major: Minor in Theatre. Consists of 30 semester hours, including: THE 220; THP 101, 113, 213, 311, 312, 318, 330, 411, and 418.

Postbaccalaureate and Secondary Education Major: Minor in Theatre. Consists of 30 semester hours, including: THE 220, 325 (Play Reading: Plays for High School Production), 480; THP 101, 213, 301, 311, 315, 415, and two from THP 330, 340 or 345.

Department Graduate Programs

The Department of Theatre offers programs leading to the degree of Master of Arts in Theatre and the Master of Fine Arts in Theatre with concentrations in scenography and theatre for youth. Consult the *Graduate Catalog* for requirements.

THEATRE

General Studies in Theatre history, literature and theory

THE 100 Introduction to Theatre. 3 F S
Elements and principles of the theatre. Lecture and discussion. Nonmajors only. *[Satisfies General Studies Requirement. HU]*

220 Principles of Dramatic Analysis. 3 S
Analysis, interpretation and evaluation of dramatic literature for theatrical production. Selected readings of classic modern and contemporary plays. Prerequisite: Theatre major. *[Satisfies General Studies Requirement L1]*

225 Orientation to Theatre. 1) F
Orientation to university and department resources and procedures. Career planning and guidance. Research and writing related to theatre production. Required for B.A. Theatre majors.

300 Film: The Creative Process. 3 F, S, SS
Elements of the theatrical film, cinematography, sound, editing, directing, acting, scriptwriting, producing and criticism. 3 lectures, 2 hours lab. *[Satisfies General Studies Requirement HU]*

320 History of the Theatre. 3 F S
Traces major developments in theatre production from its beginning to the 17th century. *[Satisfies General Studies Requirements HU, H]*

321 History of the Theatre. 3 F S
Traces major developments in theatre production from the 17th century to modern times. *[Satisfies General Studies Requirements HU H]*

325 Play Reading. 1 F, S, SS
Assigned independent reading programs of plays most frequently included in the modern repertory. May be repeated for credit in different sections. Areas of emphasis:
a Modern European
b Modern English and Irish
c Modern American
d Plays for High School Production. Prerequisite: theatre education option.
Prerequisite: Theatre major. *[Satisfies General Studies Requirement HU]*

400 Focus on Film. 1 F, S, SS
Intensive study of a particular film director actor genre or other film topic. May be repeated for credit. Prerequisite: THE 300, ENG 360 or instructor approval. *[Satisfies General Studies Requirement HU]*

420 History of the American Theatre. 3) S
History of the plays, artists and events in the development of American theatre from colonial to modern times. *[Satisfies General Studies Requirements HU H]*

421 History of the English Theatre. 3 F
History of the plays, artists and events in the development of the theatre in England since the Restoration. *[Satisfies General Studies Requirements L2 HU H]*

425 History of the Oriental Theatre. 3 N
History and production techniques of theatre forms in India, China and Japan. Prerequisite: 6 hours of theatre history or instructor approval. *[Satisfies General Studies Requirements HU]*

480 Methods of Teaching Theatre. 4) F
Methods of drama and theatre instruction at the secondary school level. Prerequisite: acceptance to the Professional Teacher Preparation Program.

500 Research Methods. (3) F
Introduction to graduate study in theatre.

504 Studies in Dramatic Structure and Criticism. (3) S
Structural principles and critical theory from the classical period to the present, related readings in dramatic literature.

510 Studies in Literature. (1) F, S
Assigned individual reading programs in standard sources and masterpieces in theatre literature. May be repeated for credit in different sections. Topics may be selected from the following:
(a) Acting–Directing (c) History
(b) Design–Technical (d) Criticism

520 Theatre History and Literature. (3) F
A survey of historical periods, dramatic genres and theatre literature, beginning–17th century.

521 Theatre History and Literature. (3) S
A survey of historical periods, dramatic genres and theatre literature, 17th century–present.

591 Seminar. (3) A
Selected topics in child drama, community theatre and theatre history. Prerequisite: written instructor approval.

Special Courses: THE 294, 394, 484, 492, 494, 498, 499, 500, 590, 591, 592, 593, 594, 598, 599. (See pages 43–44.)

THEATRE PERFORMANCE AND PRODUCTION

THP 101 Introduction to the Art of Acting. (3) F, S, SS
Lectures, exercises and projects in acting. Special sections provided for the nonmajor and theatre students.

110 Acting: Beginning Scene Study. (3) F, S
Rehearsal and performance of modern plays with emphasis on realistic acting styles. Special sections for majors. Prerequisite: THP 101.

113 Makeup. (3) F, S
Techniques of theatrical make-up. 1 hour lecture; 2 hours lab.

200 Actor's Workshop. (0) F, S
Attendance at a variety of guest lectures and performances, demonstrations of new techniques and individual acting projects. Required of all B.F.A. acting emphases for 4 semesters.

207 Acting: Intermediate Scene Study. (3) F, S
Rehearsal and performance of modern realistic and nonrealistic plays. Emphasis on scene structure, character analysis and actor-to-actor relationships. 6 hours a week including lab/rehearsal period. Prerequisites: THP 110; written instructor approval.

210 Acting: TV/Film. (3) S
Special technical aspects of acting before a camera. Prerequisites: THP 110; written instructor approval.

213 Introduction to Technical Theatre. (3) F, S
Procedures of technical theatre production and demonstration. Topics include design and construction of scenery, lighting and properties. 2 hours lecture, 3 hours lab.

270 Introduction to Stage Speech. (3) A
Exercises and techniques to free the voice and improve projection, resonance and articulation. International Phonetic Alphabet and Standard Stage Speech covered. Prerequisite: THP 101 or instructor approval.

275 Introduction to Stage Movement. (3) A
Movement vocabulary and physical training in relaxation, alignment, conditioning, rhythm and poise. Prerequisite: THP 101 or instructor approval.

294 Special Topics. (1–4) A

301 Theatre Production. (1–4) F, S, SS
Participation in University Theatre productions. Prerequisite: written instructor approval. May be repeated for credit.

307 Acting: The Inner Process. (3) F
An advanced class for individualized work on concentration, personalization, self-awareness, visualization, substitution, creating inner and outer characters. Exercises, monologues and scenes. Prerequisite: B.F.A. acting emphasis or written instructor approval.

310 Acting: Advanced Scene Study. (3) S
Script analysis and performance of modern classics. 6 hours a week. Prerequisites: THP 307, B.F.A. acting emphasis; or written instructor approval.

311 Creative Drama. (3) F, S, SS
Theories, procedures and materials for creative drama in the elementary and junior high schools. Related drama activities—storytelling and choral speaking. Not open to freshmen.

312 Puppetry With Children. (3) A
Construction and manipulation of puppets; practice in performance skills. Emphasis on educational and recreational uses of puppetry by and with children. Prerequisite: junior standing or above required.

315 Directing: Theatre Techniques. (3) A
Basic tools of the director: composition, blocking, floor plans, stage business, auditions, rehearsal techniques, etc. Prerequisites: THP 101, 213; or written instructor approval.

318 Theatre for Children. (3) F
Dramatic literature for children. Experience in acting, directing and production techniques for child audiences. Prerequisites: written instructor approval; not open to freshmen.

330 Introduction to Costuming. (3) F, S
Survey of costume history, basic principles of costume design and construction. Costume design project and laboratory experience in construction of costumes. 3 lectures, 2 hours lab.

331 Costume Construction. (3) N
Uses of materials and techniques for stage costumes with actual construction of period apparel. Prerequisite: THP 330 or instructor approval.

340 Scene Design. (3) F, S
Studio projects in designing realistic scenery for the contemporary proscenium stage. Prerequisite: THP 213 or instructor approval.

345 Lighting Design. (3) F, S
Principles of modern stage lighting. 2 lectures, 2 hours lab. Prerequisite: THP 213 or instructor approval.

370 Beginning Voice and Movement for the Stage. (3) F
Introduction to stage speech and movement techniques for the professional actor. Prerequisite: B.F.A. acting emphasis or written instructor approval.

371 Intermediate Voice for the Stage. (3) S
Development of increased vocal power and variety for the actor; mastery of phonetic alphabet and standard speech and diction. Prerequisites: THP 370; B.F.A. acting emphasis or instructor approval.

376 Intermediate Movement for the Stage. (3) S
Training for a strong, well-aligned flexible, expressive body. Tumbling, mime, juggling, combat, characterization. Prerequisites: THP 370; B.F.A. acting emphasis or instructor approval.

394 Special Topics. 1–4 A

401 Theatre Practicum. 1 3 F, S, SS
Performance and production assignments for advanced students of acting, technical production and design May be repeated for credit Prerequisite. B F A. student

406 Scenography. 3) N
Concepts of total design direction Production analysis and design incorporating a major visual elements including scenery ghting costumes and makeup Prerequisites THP 330 340 345, senior standing· instructor approval

410 Acting: Classical Styles. 3 A
Rehearsal and performance of period classical and nonrealistic plays Emphasis on delivery of poetic language Prerequisites THP 310 B F A acting emphasis or written instructor approval

411 Advanced Studies in Creative Drama. 3 S
Application of theories techniques and materials for dramatization Regular participation with children Prerequisite THP 311 or instructor approval

415 Directing Workshop. 3) S
Rehearsal and performance of scenes and short plays May not be taken concurrently with THP 110 Prerequisites THP 315 417 written instructor approval.

417 Stage Management. 3 F
Readings in stage management and participation as a stage manager in a University Theatre production. Prerequisite written instructor approval

418 Advanced Studies in Theatre for Children. (3) F
Concentration on specific directing and producing techniques in theatre for young audiences Practical experience in directing scenes from plays. Prerequisite: THP 318.

430 Costume Design. 3 N
Principles of costume design, with projects in both modern and period styles. Prerequisite THP 330

431 Advanced Costume Construction. 3 A
Specialized training in costume construction problems and crafts with projects in tailoring, millinery, and period accessories Prerequisite· THP 330 331 or instructor approval

435 Advanced Technical Theatre. 3) N
Specialized training in costume construction problems and crafts with projects in tailoring millinery, and period accessories Prerequisite THP 330, 331 or instructor approval.

440 Advanced Scene Design. 3) A
Advanced studio projects in designing nonrealistic scenery for a variety of stage forms. Prerequisite THP 340 or instructor approval

441 Scene Painting. 3 N
Studio projects in painting stage scenery Prerequisite THP 340 or instructor approval

442 Rendering. 3 N
Techniques in drawing and rendering for scenic, costume and lighting design Prerequisite: instructor approval

445 Advanced Lighting Design. (3) N
Specialized techniques in stage lighting. 2 lectures 2 hours lab Prerequisite· THP 345 or instructor approval

450 Theatre Organization and Management. 3) N
Box office publicity, production budgeting and house management procedures

460 Dramatic Composition for the Stage and Screen. 3) F S
Fundamentals of and practice in writing for the theatre the motion picture and television. Prerequisite written instructor approval.

461 Playwrights Workshop. 3 F S
Staged readings and discussion of completed works and works in progress by advanced students of playwriting May be repeated for credit Prerequisite THP 460 or written instructor approval

471 Advanced Voice for the Stage. 3 F
Exercises to develop vocal flexibility and power mastery of elevated American diction and language skills applied to classical and nonrealistic drama Prerequisites· THP 371 B F A acting emphasis or instructor approval

476 Advanced Movement for the Stage. (3) S
Movement techniques for the classical and nonrealistic theatre. Prerequisites THP 376 B F A acting emphasis or instructor approval

481 Secondary School Play Production. (3 S
Methods of directing designing and coordinating play production experiences at the secondary school Off campus practicum. Prerequisites THP 315 and acceptance to the Professional Teacher Preparation Program

494 Special Topics. 1–4 A
Topics may be selected from the following
a Advanced Acting Techniques
b) Curriculum and Supervision of Child Drama in the School
c) Puppetry in Performance
(d Storytelling
e) Advanced Scene Painting
f Costume Design I
g Drafting for Theatre
(h Lighting Design I I
) Technical Theatre I
(j Properties and Dressings Design and Construction
k) Scene Design I I
Video and Industrial Scene Design

498 Pro–Seminar. (1 7 A
Topics may be selected from the following
(a) Senior Project Acting
(b) Children's Theatre Tour
(c) Theatre in Education
d Technical Theatre
Prerequisite: written instructor approval.

506 Scenography. 3 N
Concepts of total design direction. Production analysis and design incorporating all major visual elements including scenery, lighting, costume and makeup Prerequisites THP 330 340 345; senior standing instructor approval

511 Creative Drama Workshop. 3 A
Readings in textual materials for creative drama, alternative methods and materials for drama with children and special populations practicum included. Prerequisites THP 311 instructor approval

512 Puppetry Workshop. 3 F
Survey of puppetry in education, puppetry as an art form design and performance

515 Problems in Directing. 3 A
Analysis of common directing problems Topics including. creating the ensemble, conceptual unity, metaphor non literal strategies, organizational responsibilities of the director. Prerequisites THP 415, instructor approval.

517 Stage Management Practicum. (3 F
Readings and research in stage management and participation as a stage manager in a University Theatre production. Prerequisite written instructor approval.

518 Directing Practicum. 4 A
A study of recent production practices and practical experience in directing and producing an entire play or musical

for young audiences. Prerequisites: THP 418; instructor approval.

530 Advanced Costume Design. (3) N
Advanced studio projects in costume design for a variety of production forms. Prerequisites: THP 430, 506; instructor approval.

540 Scene Design Applications . (3) N
Conceptual and practical application of the design process including graphic and sculptural projects. Practical design problems investigated in laboratory. Lab fee. Prerequisites: THP 440, 506; instructor approval.

545 Lighting Design Applications. (3) N
Advanced studio projects in stage lighting design. Prerequisites: THP 445, 506; instructor approval.

584 Internship. (1–3) A
Field research and on-site training in child drama, community theatre and production techniques. Prerequisite: written instructor approval.

594 Conference and Workshop in Child Drama. (3) A
Prerequisite: instructor approval.

593 Applied Projects. (1–12) A
Prerequisite: instructor approval.

611 Creative Drama Seminar. (3) A
Examination of current theory and practices in the field. Prerequisite: instructor approval.

618 Directing Practicum. (2) A
Practical experience in directing and producing an entire play or musical for young audiences. Prerequisites: THP 518; instructor approval.

649 Design Studio. (3) F, S
Projects include design of scenery, costume, lighting or sound for, laboratory or mainstage productions. May be repeated for credit. Prerequisites: THP 506; instructor approval.

684 Internship. (3–6) F, S
Field research in creative drama, children's theatre, puppetry and scenography. Prerequisite: instructor approval.

691 Seminar: Scenography. (3) N
Examination and research into modern concepts and practices of scenography. Prerequisite: instructor approval.

693 Applied Project. (1–12) F, S
Final projects for M.F.A. Theatre candidates in scenography and theatre for youth. Prerequisite: instructor approval.

Special Courses: THP 294, 394, 484, 492, 494, 498, 499, 580, 584, 590, 591, 592, 593, 594, 598, 599. (See pages 43–44.)

THEATRE EDUCATION

The following Theatre courses may be applied to a major's teacher certification for the State of Arizona. See page 249.

THE 325, 480

The following Theatre Performance and Production courses may be applied to a major's teacher certification for the State of Arizona. See page 249.

THP 311; 312; 318; 411; 418; 481; 494 (Curriculum and Supervision of Child Drama in the School, Puppetry in Performance, Storytelling); 498 (Children's Theatre Tour, Theatre in Education)

College of Law

Purpose

The prime function of the College of Law is to train men and women for the practicing legal profession and related professional assignments. In addition, the college has the responsibility to contribute to the quality of justice administered in our society.

Juris Doctor Degree

The College of Law offers a three year program of professional studies at the graduate level leading to the degree of Juris Doctor Graduates enter many branches of the legal profession as well as careers in government, business, finance, industry and education

To fulfill the requirements for a J.D. degree, a student must satisfy all of the following:

1. Admission to the college as a candidate for the degree and satisfaction of any conditions imposed at the time of admission or prior to graduation during the law course.
2. Satisfaction of residency requirements for the College of Law.
3. Successful completion of a minimum of 87 hours of academic credit of which 60* must be graded with a cumulative weighted average of 70 or better and no more than eight semester hours of "D" 60–69) grade work after the first year can be applied toward the 87 hours.
4. Completion of all required college courses.
5. Completion of the degree requirements within five years of entry into law school.
6. Completion of one substantial paper

* Students who wish to be eligible for membership in the Order of the Coif, an honor society open to the top 10% of each graduating class, must complete at least 75% (66 hours) of their law studies in graded classes.

Except in the case of a transfer student, a student must be in residence at the college as a full time student for a minimum of six semesters or their equiva ent. A semester in residence is earned where a student has been enrolled in a minimum of 10 hours of course work A transfer student must complete the work of at least three semesters in the college immediately preceding the granting of a degree

The College of Law offers several dual/concurrent degree programs.

J.D./M.S. in Economics
J.D./M.B.A.
J.D./Master of Health Services Administration
J.D /Ph.D in Justice Studies

Additional information about these programs is available from the College of Law.

Admissions

First year students are admitted only for the fall semester. The formal requirements for admission to the College of Law are:

1. An undergraduate degree from an accredited four year college or university (B.S., B.A or equivalent).
2. A score on the Law School Admission Test (administered by the Law School Admissions Services, Box 2000, Newtown, PA 18940, in centers throughout the country).

To be assured of consideration, completed applications, college transcripts on all completed course work, the Law School Data Assembly Service Report and the Law School Admission Test score, including a typed personal statement not to exceed three pages, should be received by the College of Law no later than March 1.

Each year many more students apply than can be accepted The College of Law receives about 10 applications for each of the 150 places to be