Special Education

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PROFESSORS
FAAS, PRIETO,
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ASSOCIATE PROFESSORS
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The faculty in the Division of Curriculum and Instruction Special Education Program offer graduate programs leading to the M.A. and Master of Education degrees. M.Ed. degree concentrations are available in the education of gifted, mildly handicapped, the multicultural exceptional, and severely/multiply handicapped.

At the Ph.D. level, a concentration in special education is offered through the interdisciplinary Ph.D. degree program in Curriculum and Instruction. See pages 175–177 for more information on the interdisciplinary Ph.D. in Curriculum and Instruction.

To be considered for admission, applicants must meet all Graduate College requirements. The applicant for master's degree program admission is required to provide the following:

1. Graduate Record Examination test scores or Miller Analogies Test scores, or a 3.00 or higher junior/senior GPA;
2. three letters of recommendation;
3. a summary of professional experiences; and
4. evidence of certification in special education for applicants to the M.Ed. program. (The M.Ed. Initial Teacher Certification sequence must be pursued concurrently with the M.Ed. degree by applicants not meeting this requirement.)

MASTER OF ARTS

The M.A. program in Special Education requires at least 36 hours of course work. A thesis is required for the M.A. degree. Candidates are required to take an oral examination in defense of the thesis. For students in the M.Ed. or M.A. program lacking prerequisite courses, additional course work is required.

MASTER OF EDUCATION

The M.Ed. degree in Special Education requires a minimum of 36 hours of course work and a written comprehensive examination paper. The program structure includes a 12-hour methods core, a 12-hour knowledge core, and a 12-hour elective block which includes four content/theme areas: learning and instruction, diversity, foundations and values, and research and technology.

M.Ed. Initial Teacher Certification sequences leading to standard certificates by the state of Arizona in mental retardation, learning and emotional disabilities, as well as endorsement in gifted education, are available.

Concurrent admission to the M.Ed. initial certification sequence and the M.Ed. degree is required. Students seeking initial certification by the state of Arizona in Special Education who have already completed a master's degree in another area may enroll for the M.Ed. initial certification sequence without enrolling in a second master's degree program. Contact the Office of Student Affairs for more information about specific admission requirements for the initial certification option. Further information is available in the Special Education Program Office.

RESEARCH ACTIVITY

Faculty and student research and development activities focus on (1) improving instructional opportunities for exceptional individuals and those at risk for school failure and (2) increasing the effectiveness of teachers of exceptional and at-risk individuals. Recent research has included the following: academic precocity; instructional alternatives for preschool children; the cognitive development, linguistic proficiency, and academic achievement of minority students. Research focused on improving the preparation of teachers has included projects on field-based instruction, violence prevention, academic and behavioral interventions for students with disabilities and those at risk of school failure, and evaluation of alternative forms of technology integration. Program research efforts receive support from federal, state, and private sources.

SPECIAL EDUCATION (SPE)

SPE 411 Parent Involvement and Regulatory Issues. (3) F, S
Emphasis on parent and school relations through effective communication and state and federal regulations impacting services for the handicapped. Prerequisites: SPE 311; majors only.

SPE 455 Early Childhood and the Handicapped. (3) F
Early childhood education as it applies to the handicapped child.

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

SPE 512 Individuals with Mental Retardation. (3) F, S, 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.

SPE 514 Bilingual/Multicultural Aspects of Special Education. (3) F, S, SS
Theories and issues related to the education of bilingual and culturally diverse exceptional children.

SPE 515 Methods for the Remediation of Learning Problems of Exceptional Children. (3) S
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.

SPE 522 Academic Assessment of Exceptional Children. (3) F
Normative and criterion referenced assessment of learning problems in exceptional children. Formative evaluation included. Practicum required. Lecture, practicum. Prerequisites: SPE 311 or 511; elementary methods courses; program approval.

SPE 523 Prescriptive Teaching with Exceptional Children. (3) F
Language, reading, and arithmetic methods, techniques, and materials used in individualized instruction. Practicum required. Lecture, practicum. Prerequisites: elementary methods courses; SPE 311 (or 511), 522 (or concurrent and program approval).

SPE 524 Effective Classroom Behavior Management. (3) S
Organization and delivery of instruction including formative evaluation and techniques of academic behavior management for exceptional children. Practicum required. Lecture, practicum. Prerequisites: SPE 311 (or 511), 522, 523; program approval.

SPE 525 Social Behavior Interventions. (3) S
Analysis and intervention into social behavior problems of exceptional students. Focus on strategies to change maladaptive social behavior. Practicum required. Prerequisites: SPE 311 or 511 or 522 or 523; program approval.

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

SPE 536 Characteristics of Children with Behavioral Disorders. (3) F, S, SS
Variables contributing to behavior patterns of behaviorally disordered children.

SPE 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 and 511 *or* equivalents.

SPE 552 Management of Individuals with Severe Handicaps. (3) S
Instruction and management of school-aged and adult individuals with severe, physical, or multiple handicaps. Prerequisites: SPE 511 or equivalent; instructor approval.

SPE 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.

SPE 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 and 511 *or* equivalents.

SPE 561 Characteristics/Diagnosis of Learning Disabilities. (3) F, S, SS
Theories related to learning disabilities, including identification and characteristics.

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

SPE 574 Educational Evaluation of Exceptional Children. (3) F
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 in the teaching of reading and mathematics.

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

SPE 577 Mainstreaming Methods. (3) S
Successful mainstreaming methods, practical problem-solving sessions related to teacher's classroom needs, and individual contracts focusing on mainstreaming issues are addressed. General educators encouraged.

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

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

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

SPE 586 Advising the Gifted Child. (3) A
Focus on educational planning and guidance, social and emotional development, and family problem solving regarding needs of gifted children.

SPE 587 Controversies in Educating the Gifted. (3) F
In-depth analysis of major controversies in educating the gifted, including nature/nurture, the role of mental tests, and sex differences.

SPE 588 The Gifted Child. (3) F, SS
Gifted children's characteristics, identification, needs, school and home environments, definitions, and misunderstandings. Research by Pressey, Stanley, Terman, and others.

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

SPE 774 Characteristics and Causation of Exceptionality. (3) F
In-depth analysis of literature pertaining to causes of exceptionality and learning, educational, personal-social, and cognitive characteristics. Lecture, discussion.

SPE 775 Evaluation and Intervention in Special Education. (3) S
In-depth analysis of research and literature on evaluation procedures and intervention approaches for exceptional individuals at all age levels. Lecture, discussion.

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

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Speech and Hearing Science

Interdisciplinary Faculty

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ANTHROPOLOGY
Professor: Brandt

CHEMICAL, BIO, AND MATERIALS ENGINEERING
Assistant Professor: Kipke

COMMUNICATION
Professor: Kastenbaum

ENGLISH
Professors: Brink, Nilsen, Wilkins; Associate Professors: Adams, Bates

FAMILY RESOURCES AND HUMAN DEVELOPMENT
Professor: Roosa

NURSING
Professor: Melvin

PSYCHOLOGY
Professors: Braun, Killeen, Okun, Parkinson, Somerville, Van Orden, Zautra; Assistant Professor: Goldinger

SPEECH AND HEARING SCIENCE
Professors: Bacon, Case, Dorman, LaPointe, Mowrer, Wilcox; Associate Professor: Sinex; Assistant Professors: Hadley, Liss, Rispoli, Sharma

The Committee on Speech and Hearing Science offers an interdisciplinary graduate program leading to the Ph.D. degree in Speech and Hearing Science. Concentrations are available in developmental neurolinguistic disorders, neuroauditory processes, and neurogerontologic communication disorders.

The program is designed to prepare scholars for careers of basic and applied research in educational or health care delivery environments. The student pursues a program with the unifying theme of the influence of the neurologic system on human communication and its disorders. After a core curriculum, which may include aspects of neuroscience, methodology, or speech and hearing science, the student completes a program of study under the guidance of the program committee. As part of the interdisciplinary doctoral program, a programmatic research experience prepares the student for basic or applied research leading to the dissertation.

DOCTOR OF PHILOSOPHY

See pages 120–122 for general requirements.

Admission Requirements. Admission to the program is competitive; therefore, applications are considered only for fall admission. Applicants typically have completed a master's degree or equivalent in speech and hearing sciences, psychology, linguistics, or a related discipline. Applicants with a bachelor's degree and a strong research background are also considered.

Applicants must submit the following materials for admission review:

1. application for Admission to the Graduate College and official transcripts of undergraduate and graduate study;
2. verbal, quantitative, and analytical scores of the Graduate Record Examination (GRE);
3. professional résumé;
4. a statement describing academic and professional goals, specifying the focus of study desired in the Ph.D. program; and
5. three letters of recommendation.

All applicants whose native language is not English must submit a score from the Test of English as a Foreign Language (TOEFL) and the Test of Spoken English (TSE). Expected minimum scores are 600 on the TOEFL and 230 on the TSE.

Application materials are reviewed beginning February 1. Applications are reviewed by a three-member interdisciplinary admissions committee. Recommendations for admission or denial are forwarded to the dean of the Graduate College. Criteria for admission include the following:

1. evidence of high scholarship and research potential from GRE scores and previous academic record,
2. professional goals compatible with the degree program, and
3. scholarly interests compatible with one or more of the faculty active in the interdisciplinary degree program.

Areas of Concentration. Eighteen semester hours are taken in an area of concentration that focuses on the unifying theme of neurological or developmental/aging issues and human communication and its disorders. The student's program committee guides selection of these courses, which are concentrated in either developmental neurolinguistic disorders, neurogerontologic communication disorders, or neuroauditory processes.

Program Committee. The program committee consists of a chair and at least two other members appointed by the dean of the Graduate College upon recommendation of the director of the Committee on Speech and Hearing Science. Members of the program committee must represent more than one academic discipline. The purpose of the committee is to guide the student through the completion of the program of study, the initiation of programmatic research, and the comprehensive examination. Upon completion of the comprehensive examination, the student may initiate forming a dissertation committee.

Dissertation Committee. Upon completion of the comprehensive examination and based on the recommendation of the director of the Committee on Speech and Hearing Science, the dean of the Graduate College appoints the student's dissertation committee consisting of a chair and at least two other members. The dissertation committee must be interdisciplinary. This committee approves the design and implementation of the dissertation. Members of the program committee also may serve as members of the dissertation committee.

Preliminary Examination. The preliminary examination is composed minimally of the first-year research project. This project, to be completed by the end of the second semester of the first year, consists of an oral presentation and defense of the research, as well as a written manuscript. The program committee decides whether an optional written examination is necessary. The format of that examination is determined by the program committee and depends, in part, upon the background of the student. Results of the preliminary examination are used to determine shortcomings that should be offset by course electives, the level at which the student is capable of pursuing various topic areas, and whether deficiencies are of sufficient magnitude to preclude recommendation for continued doctoral study.

Research Methods and Statistics. The student is required to demonstrate proficiency in research methods (research design, statistics, computer languages). Evidence of required proficiency may be demonstrated by examination or by successful completion of a sequence of courses designated by the program committee.

Program of Study. The program consists of a minimum of 54 semester hours of graduate work beyond the master's degree or 84 semester hours of graduate work beyond the bachelor's degree. Of the required semester hours, at least 24 must be research (SHS 792) and dissertation (SHS 799) credit completed at ASU. A minimum of 30 hours of the approved Ph.D. program, exclusive of dissertation and research hours, must be completed after admission to the Ph.D. at ASU.

Comprehensive Examinations. Near the completion of course work and before commencing dissertation research, the student is given a written examination covering the field of study. The written examination, when passed, may be followed by an oral examination.

Programmatic Research. Twelve semester hours of programmatic research (SHS 792) are required before the dissertation prospectus meeting. The student must conduct several studies, each representing a facet of a research problem or a step toward a progressive solution. Each component study must be reviewed by the program committee and conducted in collaboration with a faculty member of the interdisciplinary

degree program. This research program allows the doctoral student to use different methodologies in various component studies, to exercise progressively tighter experimental controls as determined by serial investigations, or to pursue significant or unexpected outcomes of a study.

This systematic or serial research program engages the student and faculty in an ongoing research activity, the components of which allow increasing discretion and independence of the student investigator. The program is designed to prepare students for careers in basic or applied research and enhance the quality of the dissertation research.

Research and Dissertation Proposals. (1) Before conducting the programmatic research, the student is advised by the program committee on the appropriateness of the planned research. (2) Before conducting the research for the dissertation, each student must submit a dissertation proposal that is defended orally and approved by the dissertation committee.

Dissertation Requirements. The dissertation must consist of a fully documented written product of mature and original scholarship. It must be a significant contribution to knowledge that reflects the student's creativity and competence in independent research.

Final Examinations. A final oral examination in defense of the dissertation, conducted by the dissertation committee, is required.

RESEARCH ACTIVITY

Members of the Committee on Speech and Hearing Science are engaged in a variety of research activities. Current activity is in the following areas.

Hearing. Psychoacoustics; neurophysiology; physiological correlates of psychoacoustic phenomena; complex signal processing; effects of hearing loss on auditory perception; relationship between psychoacoustics and speech perception; speech perception in the normal and impaired auditory system; speech and auditory processing in persons with cochlear implants; amplification and hearing aids; auditory electrophysiology.

Speech. Phonetics and phonological theory; oral sensory perceptual physiology; speech motor control; neuromotor disorders of speech; oral-motor precursors to speech development; articulation; voice disorders; voice and speech characteristics associated with craniofacial anomalies; fluency disorders; phonological development and disorders.

Language Science. First and second language acquisition; language and gender; pragmatics; discourse analysis; languages in the U.S. Southwest; varieties of American English; psycholinguistics linguistics; sociolinguistics; theoretical syntax and semantics; language and evolution; metaphor; humor; irony; metonymy; epistemology; double entendre and ambiguity; implication and inference; verbal learning and verbal behavior in nonhumans, nonverbal communication theory; psychology or reading.

Language Disorders. Language assessment and intervention in early childhood; language patterns in children with specific language impairment; relationships among phonological and language disorders in school-age children; language disorders in school-age children; prelinguistic interventions; acquired dyslexia and developmental dyslexia; aphasia and related neurogenic communication disorders.

Basic and Applied Neurobehavioral Science. Neocortex and adaptive behavior; neurophysiology; applied neural control; central sensory processes; human olfaction; neural prosthesis design and development; neuroelectric interfacing and stimulation; neural modeling and theories of timing; cortical mechanisms of learning and memory; brain mechanisms involved in chemical and mechanical senses; information processing; creative processes; cerebral lateralization.

Developmental and Neurogenic Disabilities. Behavioral recovery following brain damage; adaptive technology; augmentative communication programming; developmental outcomes of high-risk children; pediatric neurogenic disabilities; communication disorders associated with genetic and chromosomal abnormalities adult neurogenic disabilities; pediatric feeding interventions; communication intervention for infants and toddlers who are at-risk for or have disabilities; right hemisphere syndrome; attention and resource allocation deficits.

Gerontology. Aging and short-term memory; public health and social consequences of aging; life stress, emotion, and physical health; communication changes accompanying aging; geriatric communication disorders; psychosocial effects of aging; aging and intergenerational issues; effects of aging on hearing.

Statistics

Interdisciplinary Faculty

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ACCOUNTANCY AND INFORMATION MANAGEMENT
Associate Professor: St. Louis

BIOLOGY
Associate Professor: Carroll

ECONOMICS
Professors: Burdick, Mayer;
Associate Professors: Reiser, Wilson

MANAGEMENT
Associate Professor: Brooks

MATHEMATICS
Professor: Young;
Associate Professors: Driscoll, Lohr;
Assistant Professor: Prewitt

The Committee on Statistics offers a program leading to the M.S. degree in Statistics. The program is interdisciplinary in the sense that it draws upon faculty research and teaching interests from a number of academic units so that programs of study can be tailored to reflect individual needs and goals. The committee, which sets program requirements and supervises programs of study, is composed of faculty from several departments in the College of Business and the College of Liberal Arts and Sciences.

MASTER OF SCIENCE

The program for the M.S. degree in Statistics provides preparation for either a research-oriented or a practice-oriented career. Requirements specific to this program (see pages 97–99 for general requirements) ensure balanced attention to the theoretical and applied

aspects of the discipline of statistics. Flexibility in the program reflects the fact that statistical analysis is one of the most widely used tools of modern scientific reasoning.

Admission. Applicants must satisfy the general requirements for admission to the Graduate College (see pages 89–90) and must, in addition, have three letters of academic recommendation submitted to the admissions subcommittee of the Committee on Statistics. Although most applicants earn the bachelor's degree in a quantitative area (such as statistics, quantitative business analysis, mathematics, engineering, or computer science), this is not required for admission to the program.

Applicants should have completed the following courses (equivalents at ASU are given in parentheses): calculus (MAT 270, 271, and 272), advanced calculus (MAT 371), linear algebra (MAT 342), computer programming (CSE 100 or 183), and introductory applied statistics (QBA 221 or STP 420). Applicants who lack more than two of these seven prerequisite courses should expect to be admitted with deficiencies or provisionally. The submission of the Graduate Management Admission Test or Graduate Record Examination test scores is strongly recommended.

Supervisory Committee. Upon entering the program, the student should contact the program director for assistance in selecting a three-member supervisory committee. (Typically, the student progress subcommittee of the Committee on Statistics serves as the student's initial supervisory committee.) The faculty member who directs the student's work on the thesis or applied project must be a member of the Committee on Statistics and serves as the chair of the student's final supervisory committee.

Program of Study. The student's program of study must contain at least 30 semester hours of credit, none of which may be from the prerequisites and at least 18 of which must be at or above the 500 level. The program must include the nine hours from three required theory courses: theory of probability (STP 421 or QBA 560), mathematical statistics (STP 427), and theory of statistical linear models (STP 526). The program must also include either three hours of applied project (QBA 593 or STP 593) or six hours of thesis (QBA 599 or STP 599).

The remaining 15 or 18 hours may come from elective courses chosen by the student with the approval of supervising faculty. A maximum of six hours may be chosen from a related field on which statistics relies (such as computer science) or in which statistics is an essential tool (e.g., biostatistics, quality control).

The required theory courses are fundamental to the education of statisticians and are necessary for more advanced graduate study. The elective courses allow the student to emphasize a particular area of statistical inference, culminating in an applied project report or a thesis on a topic in that area. The student has considerable flexibility in selecting an area of specialty. Possible areas of specialty include, among others, mathematical statistics, biostatistics, applied data analysis, statistical modeling, time series analysis, statistical process control, variance components analysis, statistical computing, and survey research. Sample programs of study for such areas of specialty may be obtained from the director of the program.

Foreign Language Requirements. None.

Comprehensive Examinations. None.

Thesis Requirements. Either an applied project or a thesis is required.

Final Examinations. An oral examination in defense of the applied project or thesis is required. The content of the applied project report or thesis must, in its final form, be suitable for submission to an academic journal or conference proceedings. The thesis must conform to Graduate College format requirements.

RESEARCH ACTIVITY

Research interests of the current members of the Committee on Statistics include the following: regression, variance components, generalized linear models; multivariate analysis, latent structure models, categorical data analysis; biostatistics, biomedical research; time series analysis, econometrics, statistical process control, statistical decision support systems; statistical computing, statistical graphics; panel data analysis, complex sampling designs; decision-theoretic methods, risk assessment. Students and faculty have access to excellent computing facilities, including mainframes, work stations, and personal computers running a broad selection of statistical software.

Taxation

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PROFESSORS
J. R. BOATSMAN, BOYD, FLAHERTY, JOHNSON, KAPLAN, PANY, PHILIPPAKIS, RECKERS, RENEAU, SCHULTZ, SHRIVER, R. SMITH, STEINBART, TIDWELL, WYNDELTS

ASSOCIATE PROFESSORS
CHRISTIAN, GOLEN, GOUL, GUPTA, KEIM, KIANG, KULKARNI, MOECKEL, O'DELL, O'LEARY, PEI, REGIER, ROY, ST. LOUIS, VINZE

ASSISTANT PROFESSORS
CHENOWETH, DAVID, HWANG, MISHRA, K. SMITH, WHITECOTTON

SENIOR LECTURER
MACCRACKEN

LECTURERS
J. L. BOATSMAN, DOWLING, GEIGER, HALL, TAYLOR

MASTER OF TAXATION

The faculty in the School of Accountancy and Information Management offer a professional program leading to the Master of Taxation degree. The M.Tax. degree is a specialized program providing persons with technical skills required to administer the tax laws in both the private and public sectors of the economy.

See page 116 for information on this degree program. See pages 123–124 for research activity and courses.

Teaching English as a Second Language

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PROFESSOR
NILSEN

ASSOCIATE PROFESSORS
ADAMS, BATES, MAJOR

ASSISTANT PROFESSORS
JOHNSON, VAN GELDEREN

MASTER OF TEACHING ENGLISH AS A SECOND LANGUAGE

The faculty in the Department of English offer a professional program leading to the Master of Teaching English as a Second Language degree (M.TESL). The M.TESL degree is a specialized program training students for the knowledge and the skills necessary to teach English as a second language. See pages 116–117 for information on this degree program. See pages 196–197 for descriptions of the courses in the program.

Technology

The Master of Technology degree program is offered by the faculty in four technology departments in the College of Technology and Applied Sciences. Courses are offered at the ASU East site. The areas of concentration include aeronautical engineering technology, aeronautical management technology, electronics and computer engineering technology, graphic communications technology, industrial management and supervision, manufacturing engineering technology, mechanical engineering technology, and welding engineering technology.

See page 117 for more information on the Master of Technology degree.

Department of Aeronautical Management Technology

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PROFESSOR
GESELL

ASSOCIATE PROFESSOR
MCCURRY

ASSISTANT PROFESSORS
JACKSON, KARP

LECTURERS
BORRMANN, O'BRIEN, SPENCE

Admission. Applicants are expected to satisfy all requirements for admission to the Graduate College. Industrial experience beyond completion of a baccalaureate degree is strongly recommended. Applicants having deficiencies or not meeting the prerequisites may be required to complete them before being admitted to the Master of Technology degree program.

Program of Study. All candidates for the Master of Technology degree program are required to complete 32 semester hours. Additional courses may be assigned by the supervisory committee depending on the background of the candidate.

Students must complete a minimum of 32 semester hours of approved courses. An applied project or research project is required. Upon completion of the approved course of study or during the last semester, an oral defense of the written applied or research project is required.

The program is designed for flexibility, permitting the student to select a combination of courses in a technical area and supporting area to meet individual goals.

Students may take courses in two areas of interest: aviation management and aviation human factors. Students will work with faculty advisor to define specific courses that satisfy degree requirements.

Final Examinations. A final oral examination in defense of the applied or research project is required.

RESEARCH ACTIVITY

Aeronautical Management Technology faculty interests and facilities support applied research in testing aerodynamics, fixed wing and helicopter performance, reciprocating and gas turbine engine development, aviation safety, and aviation management. Research support facilities consist of reciprocating engine and jet propulsion laboratories, materials and fabrication laboratories, nondestructive inspection laboratory, and a subsonic wind tunnel. The research activities complement course work supporting Master of Technology degree program emphases in aeronautical engineering technology and aeronautical management technology. These emphases are individualized to accommodate each student's background and interests.

AERONAUTICAL MANAGEMENT TECHNOLOGY (AMT)

Flight instruction costs are not included in university tuition and fees.

AMT 400 Flight Safety IV. (1) F, S, SS
Multiengine and crew training and safety briefings. Continuous enrollment required until completion of rating and multicrew training. Lecture, lab. Prerequisite: AMT 300. Pre- or corequisite: AMT 387.

AMT 408 National Aviation Policy. (3) F
Examination of aviation and airspace policies and policy process, including agencies involved in formulation, implementation, and evaluation of aviation policy. Prerequisite: AMT 308.

AMT 409 Nondestructive Testing and Quality Assurance. (1) N
Purpose of inspection and quality assurance. Theory and application of nondestructive inspection methods. Application of pertinent standards, specifications, and codes. Lecture, lab. Cross-listed as AET 409. Prerequisite: AMT 280 or MET 230.

AMT 410 Aviation Safety and Human Factors. (3) F
Aviation accident prevention, human factors, life support, fire prevention, accident investigation, and crash survivability. Development and analysis of aviation safety programs. Prerequisites: junior standing; completion of 1 semester of literacy and critical inquiry (L1) requirement.

AMT 442 Aviation Law/Regulations. (3) F
Aviation within context of U.S. Common Law system. Public law, administrative rule making, sovereignty, enforcement, and case law analysis. Prerequisite: junior standing.

AMT 444 Airport Management and Planning. (3) S
Orientation to administration and management of modern public airports, including overview of planning, funding, and development of airport facilities. Prerequisite: AMT 308.

AMT 482 Airline Instrument Procedures. (3) F
Advanced instrument flight using airline instrument procedures and airline crew and cockpit resource management. Lecture, lab. Prerequisites: AMT 222, 382.

AMT 484 Aeronautical Internship. (1–12) F, S, SS
Work experience assignment with aerospace industry commensurate with student's program. Special project guidance by industry with university supervision. Prerequisites: advisor approval; junior standing.

AMT 489 Airline Administration. (3) S
Administrative organizations, economics of airline administration, operational structure, and relationship with federal government agencies. Prerequisites: AMT 308; instructor approval.

AMT 491 Aviation Management Capstone. (3) S
Integration and overview of management tools, current business problems and topics related to aviation industry. Group project with industry and government and business partners. Prerequisite: senior standing.

AMT 496 Airline Aircraft Systems Capstone. (3) S
Commercial airline aircraft systems and flight procedures. Includes theoretical education for large, commercial passenger aircraft. Lecture, lab. Prerequisite: senior standing.

AMT 521 Air Transportation Regulation. (3) N
Reviews evolutionary history of government regulations. Explores alternatives for economic, safety, social, and administrative regulatory reform in air transportation. Prerequisite: AMT 444 or 489 or equivalent.

AMT 523 Aviation Systems Management. (3) N
Systems theory applied to intermodal transportation networks. Survey of air and ground transportation infrastructure, institutional frameworks, and intermediaries promoting connections between modes. Prerequisite: AMT 444 or 489 or equivalent.

AMT 525 Airport Planning and Design. (3) N
Students complete various phases of airport master planning process. Provide guidance for logical and timely development of airports. Project work groups assigned. Prerequisite: AMT 444 or 489 or equivalent.

AMT 527 Airline Management Strategies. (3) N
Since deregulation, airlines have undergone profound changes through mergers, consolidation, and acquisition. In-depth look at airline management strategies for the 21st century. Prerequisite: AMT 444 or 489 or equivalent.

AMT 528 International Aviation. (3) N
Major issues of international aviation, historical review of institutional framework. Bilateral route agreements, freedom versus sovereignty, current legal and political arrangements. Prerequisite: AMT 444 or 489 or equivalent.

AMT 529 Fixed-Base Operations Management. (3) N
Examination of FBO role in the national aviation system. Organization of flight line operations, aircraft maintenance, and administration for multiple aircraft types. Prerequisite: AMT 444 or 489 or equivalent.

AMT 541 Aviation Physiology. (3) N
Survey of human physiology and human performance principles related to modern aircraft and aircraft systems operating in multiple environments. Prerequisite: AMT 410 or equivalent.

AMT 543 Ergonomics in High-Technology Environments. (3) N
Examination of ergonomic design principles regarding man-machine interface requirements of high-technology workstations. Emphasis on computer workstation design issues. Prerequisite: AMT 410 or equivalent.

AMT 545 Human Factors in Aviation. (3) N
Overview of human role in aviation. Issues, problems of unsafe acts and attitudes in human behavior. Human engineering capabilities and limitations. Prerequisite: AMT 410 or equivalent.

AMT 546 Crew Resource Management / Line-Oriented Flight Training. (3) N
Evaluation of in-depth, multicrew coordination issues for commercial aviation pilots. Stresses importance of critical thinking, decision making, integrated resource utilization. Prerequisite: AMT 410 or equivalent.

AMT 547 Modern Human Factors Design Issues. (3) N
Research and discussion of current human factors issues. State-of-the-art analyses of information regarding rapidly evolving designs and applications. Prerequisite: AMT 410 or equivalent.

AMT 549 Human Factors Research. (3) N
Aviation human factors research principles applied and tested in operational settings. Group projects assigned in conjunction with industry partners. Prerequisite: AMT 410 or equivalent.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Department of Electronics and Computer Engineering Technology

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ASSOCIATE PROFESSORS
FORDEMWALT, NOWLIN, WOOD, ZENG

ASSISTANT PROFESSORS
LIPARI, MACIA, PETERSON, SUNDARARAJAN

The faculty in the Department of Electronics and Computer Engineering Technology offer a graduate program leading to the Master of Technology professional degree in Technology and a concentration in electronics and computer engineering technology. The technical areas of study available within this concentration include electronic systems, digital/computer systems, systems control and instrumentation, microelectronics, and electronics engineering technology education.

Admission and Proficiency Requirements. General admission requirements are outlined on pages 89–90 and under the Master of Technology section on page 117. Admission and proficiency requirements and course work specific to the electronics engineering technology concentration may be obtained from the department.

Program of Study. The minimum requirements for the Master of Technology degree offered by the Department of Electronics and Computer Engineering Technology are as follows:

Technical area of emphasis	17
Supporting area	9
Research methods course (EET 500)	2
Graduate seminar (EET 591)	1
Applied project (EET 593)	3
Total minimum semester hours	32

A minimum of 16 hours must be 500-level courses in the approved program. At least nine hours of 500-level course work must be included in the technical area of emphasis (18 hours minimum). A maximum of two semester hours of Applied Project (EET 593) may be applied toward the 16 hour, 500-level minimum. The applied project requires a supporting technical report and is defended in a final oral examination. All course work applied toward the minimum 32 hour total must be at the 400 and 500 level, excluding courses taken to remove deficiencies.

For more information concerning the Master of Technology degree, refer to page 117.

RESEARCH ACTIVITY

Research activities in the Department of Electronics and Computer Engineering Technology emphasize, but are not limited to, systems and circuit applications, hardware design, fabrication and manufacturing in the technical areas of electronics engineering technology (with emphases in electronics, digital or systems control, and instrumentation), computer engineering technology, and microelectronics engineering technology. In addition, research activities in

electrical/electronics, computer and microelectronics engineering technology education emphasize programs and projects for students interested in postsecondary teaching.

Master of Technology degree candidates find a broad range of applied project activities of interest to students and faculty, as well as the user-public in industry and education. Faculty research interests are concentrated in, but not limited to, the general areas and topics listed below.

Electronic Systems and Circuits. Analog and digital/data communication circuits and systems applications, antenna array systems, micro-strip techniques, MPSK signaling techniques in modern digital radio communications, coherent receivers and transponders, optoelectronic systems, microwave techniques, digital radio communications, digital signal processing and hardware design, and computer-aided design.

Digital Circuits and Systems and Computers. Digital systems logic design and applications, controller design and application, and programmed logic design and applications; digital IC switching circuits and logic design and applications; microcomputer and minicomputer hardware, programming, and interfacing and software systems application; computer-aided design and applications; automatic digital testing; computer process control hardware, techniques, and applications.

Systems Control and Instrumentation. Electrical power equipment and systems, control, and distribution; direct solar energy conversion; analog and digital process control components, instrumentation, systems, and process applications; electronic measurements and instrumentation circuits, systems, and applications; automatic test systems, test programming, and failure-tolerant design; computer-aided design; analog and digital simulation.

Microelectronics. Solid-state device design, testing, and fabrication; monolithic bipolar and MOS and thin-film/thick-film hybrid circuit fabrication and manufacturing techniques; vacuum vapor deposition and sputtering techniques and applications; new photolithographic processes; new computer-aided interconnection techniques and imprinted circuit techniques; device and system packaging; computer-automated manufacturing techniques; new hybrid materials and processing techniques; computer-aided design and manufacturing robotics applications.

Engineering Technology Education. Educational systems studies emphasizing curriculum and laboratory design and development in electronic/electrical, computer, and microelectronics engineering technology at the bachelor's and master's levels; studies involving faculty, student, administrative, and graduate characteristics; industry utilization and manpower needs; program curriculum and math science articulation requirements and characteristics; characteristics of excellence in engineering technology education; computer-aided educational design.

ELECTRONICS ENGINEERING TECHNOLOGY (EET)

EET 401 Digital Filters and Applications. (3) S
Analysis and design of digital filters. Time frequency and Z-transform techniques and waveform analysis. Computer applications. Prerequisites: EET 301; MAT 262.

EET 406 Control System Technology. (4) S
Control system components, analysis of feedback control systems, stability, performance, and application. Lecture, lab, computer simulations. Prerequisites: EET 301; MAT 262.

EET 407 Electrical Power Systems. (4) F
Electrical power systems analysis, generation, transmission, distribution, and utilization, including system protection. Lecture, lab. Prerequisite: EET 208.

EET 410 Electronic Circuits II. (3) F, S
Analysis and design of OP-amps, power amplifiers, and digital logic families. Feedback design using frequency response. Computer analysis and design. Prerequisites: EET 301, 310.

EET 420 Analog Filters and Applications. (3) A
Active and passive analog filter design. Frequency domain approximations, computer simulations using PSPICE. Lecture, lab. Prerequisites: EET 301, 410.

EET 422 Electronic Switching Circuits. (4) A
Analysis and design of electronic circuits operating in a switching mode. Waveshaping, timing, and logic. Computer simulation. Lecture, lab. Prerequisites: CET 350; EET 301, 310.

EET 430 Instrumentation Systems. (4) F
Measurement principles and instrumentation, techniques. Signal and error analysis. Lecture, lab. Prerequisites: EET 301, 310.

EET 440 Electrical Power Systems Technology. (4) S
Principles and analysis of rotating machines, transformers, and related control equipment. Lecture, lab. Prerequisite: EET 407.

EET 460 Power Electronics. (4) S
Analysis of circuits for control and conversion of electrical power and energy. Lecture, lab. Prerequisites: EET 301, 310, 407.

EET 470 Communication Circuits. (4) S
Analysis and design of passive and active communication circuits. Coupling networks, filters, and impedance matching. Modulation and demodulation techniques. Computer solutions. Lecture, lab. Prerequisites: EET 372; MAT 262.

EET 478 Digital Communication Systems. (3) S
Theory, design, and application of digital, data, and fiber optics communication systems. Prerequisites: EET 304, 372; MAT 262.

EET 500 Research/Writing. (2) F, S
Designed to help master's students develop their projects and write the first three chapters of their projects. Lecture, seminar. Prerequisite: instructor approval.

EET 501 Digital Signal Processing and Applications I. (3) F
Applications of discrete-time signals and systems, design of IIR and FIR filters using computer-aided design techniques. Prerequisites: EET 401 (or instructor approval); MAT 262.

EET 502 Digital Signal Processing and Applications II. (3) S
Application of FFT, fundamentals of probability theory and random processes, and quantization effects in digital filters. Prerequisite: EET 501.

EET 506 System Dynamics and Control. (3) S
Time, frequency, and transform domain analysis of physical systems. Transfer function analysis of feedback control systems performance and stability. Compensation. Prerequisites: EET 301, 501 (or MAT 262).

EET 508 Digital Real-Time Control. (3) A
Sample data control techniques and applications to process control. Prerequisites: CET 354; EET 406.

EET 510 Linear Integrated Circuits and Applications. (3) F
Analysis, applications, and design of linear integrated circuits and systems. Prerequisites: CET 350; EET 301, 310.

EET 522 Digital Integrated Circuits and Applications. (3) S
Analysis, applications, and design of integrated circuits and systems. Prerequisites: CET 350; EET 301, 310.

EET 530 Electronic Test Systems and Applications. (3) F
Analysis, applications, and design of electronic test equipment, test systems, specifications, and documentation. Prerequisites: CET 354; EET 301, 310.

EET 540 Electrical Power Systems. (3) S
Electrical power system analysis, transmission, distribution, instrumentation, protection and related system components. Prerequisites: EET 301, 407.

EET 560 Industrial Electronics and Applications. (3) S
Analysis, design, and application of special electronic devices and systems to industrial control, power, communications, and processes. Prerequisites: CET 350; EET 301, 310, 407.

EET 574 Microwave Amplifier-Circuits Design. (3) F
Analysis and design of microwave amplifier-circuits using s-parameter theory and computer-aided design. Prerequisites: EET 304, 470.

EET 576 Modern Telecommunication Systems. (3) F
Applied design and integration of microwave and satellite communication systems. Prerequisites: CET 473 and MAT 262 *or* instructor approval.

EET 578 Digital Filter Hardware Design. (3) S
Hardware design of FIR and IIR filters, including adaptive filters, based on DSP chips. Develop new applications using DSP microprocessor systems. Prerequisites: CET 354; EET 401.

EET 579 Digital Image Communication. (3) S
Image capture, transform, compression, storage, and transmission. Computer environment (software and hardware) is provided to emphasize the practical aspect. Prerequisite: EET 401 or instructor approval.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

COMPUTER ENGINEERING TECHNOLOGY (CET)

CET 426 Software Tools for the Semiconductor Industry. (3) S
Introduction to software tools commonly used in the semiconductor industry, such as SUPREM IV, PSPICE, VIEWLOGIC, and ICED. Cross-listed as UET 426. Prerequisite: UET 331.

CET 452 Digital Logic Applications. (4) S
Design of sequential machines using system design techniques and complex MSI/LSI devices with lab. Prerequisite: CET 350.

CET 454 Microcontrollers. (4) S
Microcontroller interfacing, organization, programming, and structure. Lecture, lab. Prerequisite: CET 354.

CET 456 Assembly Language Applications. (3) F
Programming using BIOS and DOS routines. High-level language interfacing. Disk operations, TSR routines, and device drivers. Prerequisite: CET 354.

CET 457 Microcomputer Systems Interfacing. (4) S
Applications of microcomputer hardware and software. Special purpose controllers, interface design. Lecture, lab. Prerequisites: CET 354; CSE 183; EET 310.

CET 458 Digital Computer Networks. (3) A
Network technology, topologies, protocols, control techniques, reliability, and security. Prerequisite: CET 354.

CET 473 Digital/Data Communications. (4) F, S
Signals, distortion, noise, and error detection/correction. Transmission and systems design. Interface techniques and standards. Lecture, lab. Prerequisites: CET 354; EET 372.

CET 483 UNIX Utilities Using C Language. (3) S
Applications of C language to the development of practical programs for the UNIX operating system. Prerequisite: senior standing in technology or equivalent.

CET 485 Digital Testing Techniques I. (3) A
Hardware/software aspects of digital testing technology; systems, board, and logic testing and equipment. Lecture, lab. Cross-listed as UET 485. Prerequisites: CET 350; EET 310.

CET 486 Electronics Computer-Aided Design. (3) F
CAD/EHDL for digital logic simulations and electronic circuit designs. Various software packages will be used. Prerequisites: CET 350; EET 310.

CET 487 Hardware Description Languages: VERILOG. (3) F
Introduction to hardware description languages, digital modeling, and simulation techniques using the VERILOG HDL. Prerequisites: CET 350, 354.

CET 520 Computer Architecture. (3) F
The basics of computer architecture. RTN, RISC, CISC concepts; computer arithmetic; ALUs; memory systems; I/O. Prerequisite: CET 354.

CET 552 Digital Systems Design. (3) S
Digital system design techniques and applications. Prerequisite: CET 452 or instructor approval.

CET 556 Windows Programming. (3) F
Programming techniques in the MS Windows and X Window environments. Prerequisite: CET 256 or equivalent.

CET 557 Microcomputers and Applications. (3) F
Applications of small computer systems, mini- and microcomputer hardware and software. Prerequisites: CET 354; CSE 100 (or 183); EET 310.

CET 583 UNIX Utilities Using C Language II. (3) S
C language applications using the UNIX operating system. Also Fourth Generation languages and other UNIX utilities. Prerequisite: graduate standing in technology.

CET 585 Digital Testing Techniques II. (3) F
Testing technology as applied to digital systems, boards, and chips. Lecture, lab. Prerequisite: CET 354.

CET 586 Digital Modeling Techniques. (3) S
Digital system modeling and simulation using hardware description languages. Prerequisites: CET 350, 354.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

MICROELECTRONICS ENGINEERING TECHNOLOGY (UET)

UET 411 Applied Vacuum Technology. (3) S
Fundamentals, applications, and practical aspects of vacuum systems and their uses in semiconductor fabrication. Prerequisite: UET 331.

UET 415 Electronic Manufacturing Engineering Principles. (3) F, S
Electronic equipment design and fabrication principles and practice. Completion of electronics hardware design project and report. Lecture, lab. With lab fee. Prerequisite: EET senior standing (113 hours).

UET 416 Monolithic Integrated Circuit Devices. (3) F
Physics and electronics of bipolar and MOS devices used in integrated circuits. Prerequisite: UET 331. Corequisite: UET 417.

UET 417 Monolithic Integrated Circuit Laboratory. (2) F
Laboratory practice in the fabrication of integrated circuits. Lab. Prerequisite: UET 331. Corequisite: UET 416.

UET 418 Hybrid Integrated Circuit Technology. (4) S
Layout, fabrication, design, and manufacture of thin and thick film hybrid circuits. Lecture, lab. Prerequisites: EET 310; UET 331.

UET 421 Applied Device Physics. (3) F
Band structures of solids, physics of current carriers in solids, pn junctions, MOS and bipolar transistors. Prerequisite: senior standing in the department.

UET 424 Integrated Circuit Mask Making Technology. (3) F
Fundamentals, applications, and techniques for the fabrication of integrated circuit masks. Prerequisite: UET 331.

UET 426 Software Tools for the Semiconductor Industry. (3) S
Introduction to software tools commonly used in the semiconductor industry, such as SUPREM IV, PSPICE, VIEWLOGIC, and ICED. Cross-listed as CET 426. Prerequisite: UET 331.

UET 432 Semiconductor Packaging and Heat Transfer. (3) S
Packaging theory and techniques; hermetic and plastic assembly; thermal management; electrical characteristics and reliability. Prerequisites: ETC 340 and UET 331 *or* equivalents.

UET 437 Integrated Circuit Testing. (3) S
Principles, techniques, and strategies employed at wafer level and final product testing, both destructive and nondestructive. Prerequisite: UET 416.

UET 485 Digital Testing Techniques I. (3) F
Hardware/software aspects of digital testing technology systems, board and logic testing equipment. Lecture, lab. Cross-listed as CET 485. Prerequisites: CET 350; EET 310.

UET 513 VLSI Circuit Design and Layout. (3) F
Techniques and practice for the design and layout of very large-scale integrated (VLSI) circuits. Emphasis on “system on silicon” using tools for computer-aided design layout. Seminar. Prerequisite: UET 416.

UET 516 Semiconductor Process Simulation and Integration. (3) S
Modern IC processes and process integration; design of modern IC processes using SUPREM. Lecture, lab. Prerequisite: UET 416.

UET 518 Hybrid IC Technology and Applications. (3) S
Theory, processing, fabrication, and manufacturing of hybrid microelectronics devices and products. Applications. Prerequisite: UET 331 or equivalent or instructor approval.

UET 521 Device Physics. (3) F
Band structure of solids, electron hole-pairs, mobility, lifetime, fermilevel, pn junctions, diodes, and bipolar and MOS transistors. Prerequisite: graduate standing in the department.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Department of Information and Management Technology

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LECTURERS
LESTAR, WILSON

The faculty in the Department of Information and Management Technology through the College of Technology and Applied Sciences, ASU East, offer a Master of Technology degree. The student may select one of the five areas below to meet the concentration area requirement of 15–26 hours: graphic communications technology and industrial management and supervision (areas of study may be in safety management; hazardous materials and waste management, and interactive computer graphics.

Admission. Applicants are expected to satisfy all requirements for admission to the Graduate College. Industrial experience beyond completion of a baccalaureate degree is strongly recommended. Applicants with deficiencies or not meeting the prerequisites may be required to complete them before being admitted to the Master of Technology degree program.

Program of Study. All candidates for the Master of Technology degree program are required to complete a minimum of 32 semester hours of graduate credit. Additional courses may be assigned by the faculty supervisory committee depending on the background of the candidate.

RESEARCH ACTIVITY

Master's degree candidates are required to complete a research block that includes three courses (ITM 549 Research Techniques and Applications, ITM 598 Quantitative Research Analysis, and ITM 593 Applied Project).

The program is designed for flexibility, permitting the student to select a combination of courses in a technical area and supporting area to meet individual goals.

Final Examinations. An applied project is required. Upon completion of the approved course of study or during the last semester, an oral defense of the written applied or research project is required.

For more information concerning the Master of Technology degree, refer to page 117.

Research interests of the faculty in the Department of Information and Management Technology include computer-assisted design (CAD), graphic communications, Internet/Web development, multi-media, animation, 3-D modeling, hazardous materials and waste management, environmental regulations, remediation processes, interactive computer graphics, simulation and modeling of industrial process, operations management, manufacturing processes, motivation, quality control, production supervision, decision making, technical communications, industrial training.

COMPUTER GRAPHIC COMMUNICATIONS (CGC)

CGC 410 Graphics User Interfaces and Database Programming (C++). (3) F, S
GUI design and programming: Window standards, protocols, tools and files; use of project managers, database components, visual libraries and OOPS. Lecture, lab. Prerequisites: CGC 310 (or equivalent C++ language programming course) and 314 *or* instructor approval.

CGC 411 Computer Animation and Special Effects (F/X). (3) F
2D and 3D computer animation principles and methods: project planning, scripting; character generation; storyboards; and modeling, lighting, rendering, special effects, and plug-in techniques. Lecture, lab. Prerequisites: CGC 313 and 314 *or* instructor approval.

CGC 412 Multimedia Authoring, Scripting, and Production. (3) F
Production of multimedia projects using authoring software applications, including project management, client considerations, interactive navigation, cross-platforming, testing, and documentation issues. Lecture, lab. Prerequisites: CGC 314 and 336 and 352 and 411 *or* instructor approval.

CGC 413 Professional Portfolio Design and Presentation. (3) S
Digital media portfolio: planning, targeted audience(s), design appearance, authoring, packaged media formats, media presentation formats, production, marketing, and copyright considerations. Lecture, lab, field trips. Prerequisites: CGC 411 and 412 *or* instructor approval.

CGC 414 Web Site Design and Internet/Web Technologies. (3) S
Web site design, authoring, standards, protocols, tools, and development techniques; HTML, CGI and Perl coding; Web servers, browsers, interfaces and URLs. Lecture, lab. Prerequisites: CGC 311 and 314 *or* instructor approval.

CGC 415 Computer Graphics: Business Planning and Management Issues. (3) S
Implementation planning: feasibility and application studies; needs assessment and operational analysis techniques; organization, managerial and technology considerations; business plan development. Lecture, lab, field trips. Prerequisite: CGC 412 or instructor approval.

CGC 416 Emerging Computer Graphics and Digital Media Technologies. (3) S
Emerging computer graphics and digital media technologies and databases: VR/VRML; inverse kinematics; F/X plug-ins; hybrid modeling; Web intermedia; GIS/mapping. Lecture, lab, field trips. Prerequisites: CGC 410 and 411 *or* instructor approval.

CGC 417 JavaScript, VBScript, HTML, and ActiveX Programming. (3) S
Use of JavaScript, VBScript, HTML, and ActiveX software programs and standards to create customized, interactive, Internet/Web site applications. Lecture, lab. Prerequisites: CGC 410 and 412 and 414 *or* instructor approval.

CGC 433 Graphic Production Processes. (3) N
Systematic production planning experience involving a mock enterprise and defined management responsibilities. Lecture, lab. Prerequisites: CGC 333, 334.

CGC 436 Gravure Technology. (3) S
In-depth study of the market profile and production sequences related to the gravure method of printing. Prerequisite: CGC 135 or instructor approval.

CGC 437 Color Reproduction Systems. (3) F
Scientific analysis for the engineering of color reproduction systems used in industry. Prerequisite: CGC 336.

CGC 438 Graphic Arts Techniques and Processes. (3) N
Survey of production sequences and profile of the printing and publishing industry. Lecture, lab. Prerequisite: junior standing.

CGC 439 Digital Prepress. (3) N
The study of digital prepress systems, hardware, software, networks, and direct imaging technology. Lecture, lab. Prerequisite: IMC 233.

CGC 510 Computer Graphics Programming: Design, Customization, and Development. (3) N
Advanced design, development, and documentation of Windows application programs, including GUIs, OOP, RAD, API, DLLs, and GDI in C++ and Java. Lecture, lab. Prerequisites: CGC 310 and 410 (or equivalent GUI/OOP course) *or* instructor approval.

CGC 511 Procedural and Physically Based Character Animation. (3) N
Creative and aesthetic design, storyboarding, planning, development, and documentation of constraint-based, procedural, and interactive character, avatar-actor, and product animations/simulations. Lecture, lab. Prerequisites: CGC 411 and 510 (or equivalents) *or* instructor approval.

CGC 512 Multimedia-Based Education and Training. (3) F, SS
Creative design, planning, development, documentation, and production of technology-based learning and multimedia-based education and training materials and programs. Lecture, lab. Prerequisites: CGC 412 and 413 (or equivalents) *or* instructor approval.

CGC 513 Computer Graphics Systems Design and Development. (3) N
Research, design, and development of computer graphics systems; involves project proposal, scheduling, management, production, analysis, testing, evaluation, documentation, and implementation. Lecture, lab, field trips. Prerequisites: CGC 414 and 415 *or* instructor approval.

CGC 514 Interactive Virtual Reality Environments and Technologies. (3) N
Research and development of passive, exploratory, and interactive VR environments in education and training, infotainment, Internet/Web, and VRML programming and simulation arenas. Lecture, lab, field trips. Prerequisites: CGC 510 and 511 and 513 (or equivalents) *or* instructor approval.

CGC 537 Current Issues in Quality Assurance. (3) N
Directed group study of selected issues relating to quality assurance in the printing, publishing, and information industry.

CGC 538 Personnel Development for the Graphics Industry. (3) N
Employee training and development specific to production and management in the graphics industry.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

ENVIRONMENTAL TECHNOLOGY MANAGEMENT (ETM)

ETM 401 Hazardous Waste Management. (3) F, S
Definition of hazardous waste, RCRA classification, and OSHA criteria. Overview of requirements and methods of waste management. Prerequisite: ETM 301.

ETM 402 Unit Treatment Technologies. (3) S
Addresses various treatment technologies for contaminated air, water, and soil. Emphasizes design based upon medium, type of contamination, and concentration. Prerequisite: ETM 302.

ETM 406 Environmental Chemistry. (3) F, S
Examines reactions, transport, and fates of hazardous chemicals in water, soil, air, and living organisms. Prerequisites: CHM 113 and 115 *or* CHM 114; MAT 170.

ETM 407 Occupational Hygiene. (3) S
Overview of occupational health hazards, including recognition, evaluation, and control. Includes regulatory status and health standards. Prerequisites: CHM 101 (or 113 or 114); MAT 170.

ETM 424 Comprehensive Emergency Management. (3) SS
Addresses theory and management techniques for emergency preparedness, including mitigation, preparedness, response, and recovery. Pre- or corequisite: ETM 301.

ETM 426 Environmental Issues. (3) S
Exploration of the science and policy implications of contemporary problems that threaten the environment. Pre- or corequisites: CHM 113; MAT 170.

ETM 428 International Environmental Management. (3) SS
Emphasis on technological and economic pressures experienced by developing countries. Prerequisite: ETM 301.

ETM 501 Principles of Hazardous Materials and Waste Management. (3) F
Foundation for courses in curriculum. Topics include definitions of toxic and hazardous substances and wastes, RCRA classification, and OSHA criteria. Pre- or corequisites: CHM 113 and 115 *or* CHM 114.

ETM 502 Regulatory Framework for Toxic and Hazardous Substances. (3) F
Examination of federal, state, and local regulations for hazardous materials and wastes. Includes history and trends in regulatory development. Prerequisite: ETM 501.

ETM 503 Principles of Toxicology. (3) S
Interaction of chemicals with life and environment. Mechanisms of toxic action, dose-response relationships, toxicity testing models, predictive toxicology, and epidemiology. Prerequisites: CHM 113 and 115 *or* CHM 114.

ETM 504 Technology for Storage, Treatment, and Disposal of Hazardous Materials. (3) F
Current and state-of-the-art technologies and future trends for storage, treatment, and disposal of hazardous materials and waste. Prerequisites: CHM 113 and 115 *or* CHM 114; ETM 501.

ETM 505 Quantitative Analysis and Practical Laboratory Techniques. (3) F, S
EPA methodologies for sampling and analysis of soils and water. Includes quality assurance and regulatory requirements. Lab will be arranged off site. Prerequisites: CHM 113 and 115 (or CHM 114), 231; MAT 170.

ETM 506 Chemistry of Hazardous Materials. (3) F
Chemistry and toxicology of hazardous chemicals. Topics include proper handling, storage, transportation, and disposal. Prerequisites: CHM 113 and 115 (or CHM 114); MAT 170. Corequisite: CHM 231.

ETM 507 Industrial Hygiene. (3) N
Emphasis on chemical hazards in industrial settings. Topics include recognizing and measuring hazards, control techniques, and regulatory standards. Prerequisites: CHM 113 and 115 (or CHM 114); MAT 170.

ETM 522 Air Pollution and Toxic Chemicals. (3) F
Examines issues in the measurement analysis and control of toxic chemicals in air pollution. Prerequisites: CHM 113 and 115 (or CHM 114); ETM 501; MAT 170.

ETM 523 Soils and Groundwater Contamination. (3) F
Theoretical and practical hydrogeology as it applies to cleaning up contamination. Investigative techniques, monitoring, risk assumptions, and assessment methodology. Prerequisites: CHM 113 and 115 (or CHM 114); ETM 501; MAT 170. Corequisite: CHM 231.

ETM 524 Emergency Preparedness, Response, and Planning for Hazardous Materials. (3) SS
In-house or on-site emergency response contingency planning. Pre-emergency assessment, resources for cooperation, equipment requirements, and coordination with other agencies. Prerequisites: CHM 113 and 115 (or CHM 114); ETM 501; MAT 170.

ETM 525 Risk Assessment for Hazardous Materials. (3) S
Application of the risk assessment process in situations ranging from hazardous facilities regulation to toxic substances in the environment. Prerequisites: CHM 113 and 115 (or CHM 114); ETM 501; MAT 170.

ETM 526 Current Issues: Radon, Asbestos. (3) F
Topics of current interest in environmental technology and management. Prerequisites: CHM 113 and 115 (or CHM 114); ETM 501; MAT 170.

ETM 527 Environmental/Resources Regulations Concepts. (3) S
Development of environmental regulations from common law to statutory requirements. Emphasis on Superfund, hazardous materials, toxics, and liability contracts. Pre- or corequisite: ETM 501.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

INDUSTRIAL TECHNOLOGY MANAGEMENT (ITM)

ITM 402 Industrial Laws, Contracts, and Regulations. (3) F
Review of city, state, county, and federal laws that affect industrial and construction operations, materials, supplies, and acquisition procedures. Prerequisite: IMC 346.

ITM 430 Ethical Issues in Technology. (3) S
Topics in social responsibility for industrial technology and engineering. Prerequisite: IMC 346.

ITM 440 Introduction to International Business. (3) S
International business principles and operations, including partnerships, trade agreements, currency issues, international sales, and cultural differences between countries. Prerequisite: IMC 346.

ITM 445 Industrial Internship. (1–10) F, S, SS
Work experience assignment in industry commensurate with student's program. Specialized instruction by industry with university supervision. Pass/fail. Prerequisites: advisor approval; junior standing; 2.50 GPA.

ITM 451 Materials Control. (3) N
Activities of material handling, including purchasing, receiving, warehousing, traffic, plant layout, inventory, and production control and shipping relating to technical procedures. Prerequisites: IMC 346; ITM 343.

ITM 452 Industrial Human Resource Management. (3) F
Concepts and practices of human resource management in a global industrial environment. Prerequisite: IMC 346.

ITM 453 Safety Management. (3) N
Development and management of safety programs, education and training, and relationships within an organization. Prerequisite: ITM 343 or instructor approval.

ITM 455 Industrial Marketing Concepts. (3) N
Customer and sales strategies for industrial organizations, including current practice and future planning. Prerequisites: ECN 111; IMC 346; junior standing.

ITM 456 Introduction to Organized Labor. (3) S
Introduction to labor relations, unions, federations, collective bargaining, grievances, and labor legislation. Prerequisites: IMC 346; ITM 344.

ITM 461 Operations Management. (3) F
Introduction to supervisory principles as applied to production of goods and services. Prerequisites: IMC 346; ITM 344.

ITM 480 Organizational Effectiveness. (3) S
Human aspects of supervisory behavior in the industrial setting and how they influence efficiency, morale, and organizational practices. Prerequisite: IMC 346.

ITM 501 Managerial Economics. (3) N
Basic managerial economic tools and techniques applied to unique concerns of scientifically intensive firms operating in rapidly evolving industrial sectors.

ITM 502 Financial Management. (3) N
Examination of corporate financial and managerial accounting systems, budgeting, and financial policy, using microcomputers to analyze, forecast, and report information.

ITM 503 Marketing Management. (3) N
Modern methods and industrial case studies of planning, pricing, promoting and distributing, goods and services in the global marketplace. Prerequisites: ITM 480 (or equivalent); instructor approval.

ITM 504 Law and Ethics for Technical Professionals. (3) N
Analysis of legal and ethical framework for making managerial decisions in the corporate environment of engineering- and technology-related industries.

ITM 520 Strategic Management of Technology. (3) N
Analysis of entrepreneurial dynamics and technology development, methods of research and development management, new technology implementation, and start-up organization. Prerequisites: ITM 480 (or equivalent); instructor approval.

ITM 540 International Management. (3) N
Practices and procedures for effective management of multinational business organizations, including partnerships, joint ownerships, and global subsidiaries.

ITM 548 Quantitative Research Methods. (3) F, S
Use of statistical techniques to analyze and interpret data. Concentration on computerized statistical software and practical applications. Prerequisite: STP 420.

ITM 549 Research Techniques and Applications. (3) F, S
Selection of research problems, analysis of literature, individual investigations, preparing reports, and proposal writing. Prerequisite: STP 420 or equivalent.

ITM 550 Industrial Training and Development. (3) N
Training techniques and learning processes. Planning, developing, evaluating, and managing industrial and governmental programs. Prerequisite: ITM 480.

ITM 552 Global Management Philosophies. (3) N
Analysis and comparison of significant supervision philosophies developed in various industrial nations and their potential application in the United States.

ITM 560 Managerial Decision Making. (3) F
Analysis of common decision-making bias and techniques to overcome them. Uses both subjective quantitative decision tools and computerized decision aids.

ITM 570 Advanced Project Management. (3) S
Planning, organizing, coordinating, and controlling staff and project groups to accomplish the project objective.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Department of Manufacturing and Aeronautical Engineering Technology

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PROFESSOR
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ASSOCIATE PROFESSORS
BIEKERT, KELLEY, PALMGREN, REED, SCHMIDT

ASSISTANT PROFESSORS
RAJADAS, ROGERS

LECTURER
OKONKWO

The faculty in the Department of Manufacturing and Aeronautical Engineering Technology (MAET) in the College of Technology and Applied Sciences, ASU East, offer the Master of Technology degree. A minimum of 32 semester hours of approved courses is required. The flexible program permits the student to select a combination of courses in the relevant concentration and supporting areas to meet individual career goals in technology or to provide the foundation for further advanced study.

The MAET Department provides the student with a number of programs of study which presuppose a sound technical undergraduate degree. The programs are designed to provide the graduates with technical and professional skills that will facilitate preparation for and advancement in leadership positions in industry, education, government, and military. Laboratories and classrooms are well equipped and the faculty members administering the classes have the relevant teaching, research, industry and training experience and background. The major concentrations are manufacturing engineering technology, aeronautical engineering technology, mechanical engineering technology, and welding engineering technology.

The student may select one of the above areas to meet the concentration area requirement of 15–18 semester hours. Careful program selection in coordination with a faculty advisor and/or advisory committee will be an essential aspect of this process resulting in a focused program for the student. The selection process also facilitates the potential for expanding the depth and breadth of the training the student may receive in related areas. The supporting area (nine to 12 hours) may be selected from outside the MAET Department upon approval from the supervisory committee. Applied Project (MET 593) and Research (MET 592) are also required.

Admission. Applicants are expected to satisfy all requirements for admission to the Graduate College. Industrial experience beyond completion of a baccalaureate degree is strongly recommended. Applicants with deficiencies or those not meeting the prerequisites may be required to complete them before being admitted to the Master of Technology degree program.

Program of Study. All candidates for the Master of Technology degree program are required to complete a minimum of 32 semester hours of graduate credit as follows:

Technical area of emphasis	17
Supporting area	6
Research methods course	3
Applied project (MET 593)	3
Research (MET 592)	3
Total	32

Additional courses may be assigned by the supervisory committee depending on the background of the candidate. The program is designed for flexibility, permitting the student to select a combination of courses in a technical area and supporting area to meet individual goals.

Final Examinations. An applied project or research project is required, upon completion of the approved course of study or during the last semester. An oral defense of the written applied or research project is required.

RESEARCH ACTIVITY

Research interests of the faculty of MAET include computer-assisted design (CAD), computer-assisted manufacturing (CAM), computer-integrated manufacturing (CIM), decision making, energy conversation system design and analysis, energy management, simulation and modeling of industrial processes, machinability, manufacturing processes, motivation, numerical control (N/C), quality control, robotics and automation, supervision, weld-ability of metals, and welding-related metallurgy.

The Aeronautical Engineering Technology faculty interests and facilities support applied research in testing aerodynamics, fixed wing and helicopter performance, and reciprocating and gas turbine engine development. Research support facilities consist of reciprocating engine and jet propulsion laboratories, materials and fabrication laboratories and a subsonic wind tunnel.

AERONAUTICAL ENGINEERING TECHNOLOGY (AET)

Flight instruction costs are not included in university tuition and fees.

AET 409 Nondestructive Testing and Quality Assurance. (1) N
Purpose of inspection and quality assurance. Theory and application of nondestructive inspection methods. Application of pertinent standards, specifications, and codes. Lecture, lab. Cross-listed as AMT 409. Prerequisite: AMT 280 or MET 230.

AET 415 Gas Dynamics and Propulsion. (3) F
Introduction to compressible flow, internal and external flow, and aerothermodynamic analysis of propulsion systems. Prerequisites: ETC 340; MAT 262.

AET 417 Aerospace Structures. (3) F
Analysis and design of aircraft and aerospace structures. Shear flow. Semimonocoque structures. Effects of dynamic loading. Prerequisites: AET 300, 312, 420; MAT 262; MET 313.

AET 420 Applied Aerodynamics and Wind Tunnel Testing. (4) F
Introduction to viscous and inviscid flow and their relationship to aircraft lift and drag. Wind tunnel design and testing. Lecture, lab. Prerequisites: AET 300; MAT 262.

AET 432 Applied Heat Transfer. (3) F
Steady-state and transient conduction, heat transfer by convection and radiation. Applications of heat transfer. Prerequisite: MET 434 or instructor approval.

AET 487 Aircraft Design II. (3) S
Basic aerodynamics and airplane performance analysis methods applied to practical design project. Prerequisite: AET 300.

AET 490 Advanced Applied Aerodynamics. (3) N
Study of fluid motion and aerodynamics. Essentials of incompressible aerodynamics and computational fluid dynamics. Elements of laminar and turbulent flows. Prerequisites: AET 312; ETC 100; MAT 262.

AET 524 Application of Heat Transfer. (3) F
Energy conservation, steady-state and transient conduction, convection transfer, free and forced convection Reynolds analogy, blackbody and environmental radiation. Prerequisite: MET 434 or instructor approval.

AET 525 Advanced Propulsion. (3) S
Mechanics and thermodynamics of propulsion systems. Solid, liquid propellant rocket design performance. Electrical nuclear propulsion systems. Space missions. Prerequisites: AET 420 (or MET 434) and 415 *or* instructor approval.

AET 531 Experiments and Design in Aeronautics. (3) N
Advanced measurement techniques for fluid flows, wind tunnel testing, and treatment of experimental data. Automatic control systems.

AET 560 Numerical Methods in Engineering Technology. (3) N
Analyzing problems in physical sciences, modeling of physical problems, perturbation techniques, curvefitting, data analysis, numerical solutions, ordinary and partial differential equations.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

MANUFACTURING ENGINEERING TECHNOLOGY (MET)

MET 401 Statistical Process Control. (3) S
Introduction to statistical quality control methods as applied to tolerances, process control, sampling, and reliability. Prerequisite: MAT 117 or 170.

MET 420 Welding Metallurgy I. (4) N
Metallurgical principles applied to structural and alloy steel and aluminum weldments; laboratory emphasis on welding experiments, metallography, and mechanical testing. Lecture, lab. Prerequisites: MET 300, 302.

MET 421 Welding Metallurgy II. (3) N
Metallurgical principles as applied to stainless steel, super alloy, titanium, and other refractory metal weldments and braze joints. Prerequisite: MET 300.

MET 432 Thermodynamics II. (3) S
Thermodynamics of mixtures. Combustion process. Applications of thermodynamics to power and refrigeration cycles. Prerequisite: ETC 340.

MET 433 Thermal Power Systems. (4) N
Analysis of gas power, vapor power, and refrigeration cycles. Components of air conditioning systems. Direct energy conversion. Psychrometry. Analysis of internal combustion engines and fluid machines. Lecture, lab. Prerequisite: MET 432 or instructor approval.

MET 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.

MET 435 Alternate Energy Sources. (3) F
Alternate energy systems, energy use and its impact on the environment, and demonstrating practical alternative energy sources to fossil fuels. Prerequisite: instructor approval.

MET 436 Turbomachinery Design. (3) N
The application of thermodynamics and fluid mechanics to the analysis of machinery design and power cycle performance predictions. Prerequisite: MET 432 or instructor approval.

MET 438 Design for Manufacturing II. (4) F
Application of mechanics in design of machine elements and structures. Use of experimental stress analysis in design evaluation. Lecture, lab. Prerequisite: AET 312 or MET 331 or instructor approval.

MET 442 Specialized Production Processes. (3) F
Nontraditional manufacturing processes, emphasizing EDM, ECM, ECG, CM, PM, HERF, EBW, and LBW. Prerequisite: MET 231.

MET 444 Production Tooling. (3) F
Fabrication and design of jigs, fixtures, and special industrial tooling related to manufacturing methods. Lecture, lab. Prerequisite: MET 345.

MET 448 Expert Systems in Manufacturing. (3) F
Introduction to expert systems through conceptual analysis, with an emphasis on manufacturing applications. Prerequisite: MET 231.

MET 452 Implementation of Robots in Manufacturing. (3) N
Robotic workcell design, including end effectors, parts presenters, and optimum material flow. Prerequisite: MET 451 or instructor approval.

MET 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 325 or instructor approval.

MET 461 Manufacturing Capstone Project II. (3) S
Small-group projects applying manufacturing techniques, with an emphasis on demonstrating state-of-the-art technology. Lecture, lab. Prerequisite: MET 460 or instructor approval.

MET 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: MET 302, 313.

MET 501 Statistical Quality Control Applications. (3) S
SPC problem-solving techniques for implementation in industrial setting, design and analysis of experiments. Prerequisite: instructor approval.

MET 502 Specialized Production Processes. (3) F
Specialized production processes, including lasers,; electronic beam,; abrasive and water jet; and chemical and thermal processes. Prerequisite: instructor approval.

MET 504 Applications of Production Tooling. (3) F
Design and fabrication of fixtures, jigs, templates, and specialized industrial tooling for manufacturing. Lecture, lab. Prerequisite: instructor approval.

MET 507 Manufacturing Enterprise. (3) F, S
Organization and project management of cellular manufacturing methods, including IIT and lean manufacturing. Prerequisite: instructor approval.

MET 512 Introduction to Robotics. (3) N
Introduction to industrial robots. Topics include: robot workspace, trajectory generation, robot actuators and sensors, design of end effectors, and economic justification. Application case studies. Prerequisite: MET 303 or instructor approval.

MET 513 Advanced Automation. (3) F
Analysis and design of hard and flexible automation systems. Particular attention to material handling technology. Prerequisite: instructor approval.

MET 514 N/C Computer Programming. (3) S
Point-to-point and continuous path control system programming emphasizing metal removal procedures and processes. Lecture, lab. Prerequisite: instructor approval.

MET 517 Applied Computer-Integrated Manufacturing. (3) F
Techniques and practices of computer-integrated manufacturing, with an emphasis on computer-aided design and computer-aided manufacturing. Prerequisite: MET 346 or instructor approval.

MET 560 Fundamentals of Security Engineering. (3) F
Definitions of threats, fundamentals of design of physical protection systems, computer modeling and analysis of security systems.

MET 571 Waste Minimization and Waste Prevention. (3) S
Life cycle analysis, selection of environmentally compatible materials, design of waste minimization equipment and operation, economics of waste minimization and prevention. Prerequisite: ETC 340 or instructor approval.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Theatre

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ASSISTANT PROFESSORS
REYES, THOMSEN

FINE ARTS SPECIALIST
SCHNEIDER

SENIOR LECTURER
B. WILLS

LECTURER
IRVINE

The faculty in the Department of Theatre offer graduate programs leading to the M.A., the Master of Fine Arts, and the Ph.D. degrees in Theatre. Areas of concentration are acting, scenography and theatre for youth at the M.F.A. level (see pages 105–108) and theatre for youth at the Ph.D. level. Students may also pursue an interdisciplinary program leading to the M.F.A. degree in Creative Writing. This program is offered by the faculties in the Departments of English and Theatre (see pages 194–197).

MASTER OF ARTS

The M.A. degree in Theatre is a flexible program of advanced theatre studies that provides preparation for teaching in secondary schools and colleges and for graduate study beyond the master's level. The program primarily emphasizes theoretical studies; however, the exceptional student may be allowed to choose the practical application of theatre skills in directing.

See pages 97–99 for general requirements.

Admission. Applicants must meet all admission requirements of the Graduate College. In addition, the Department of Theatre requires comprehensive undergraduate preparation in theatre (at least a Theatre minor or its equivalent), acceptable scores on either the Graduate Record Examination (GRE) or Miller Analogies Test, and three letters of recommendation. Those seeking admission to specialize in directing must be interviewed by a representative from the directing faculty. Dates and times may be arranged through the Department of Theatre.

Application Deadline. The first deadline for receipt of applications and test scores is March 1. After that date, admission is subject to space availability.

Deficiencies. Deficiencies in undergraduate preparation (not to exceed 12 hours) may be removed while pursuing the M.A. degree; courses taken to remove deficiencies may not be counted toward the degree.

Program of Study. Normally, the core courses are THE 500, 504, 505, 520, and 521. Additional course work to complete the degree is selected by the student with the approval of the supervisory committee. Theatre courses must be completed with a grade of "B" or higher. A thesis or equivalent is required.

Foreign Language Requirements. Optional, depending upon research area, and with the approval of the supervisory committee.

Thesis or Equivalent Requirements. For students electing to prepare a thesis, the program consists of a minimum of 24 semester hours of graduate work and three hours each of thesis (599) and research (592) credit. Normally, 15 semester hours on the program of study are in 500-level courses and at least 20 semester hours must be in the major field. The thesis is especially recommended for students planning to continue graduate study beyond the master's degree and may be elected with the approval of the supervisory committee.

For students electing to prepare a thesis equivalent, the program consists of 36 semester hours of graduate work, of which six hours are research (592) credit, and three hours of THP 593 Applied Project. Each student develops an approved project and supports this project with a written document. The document (thesis equivalent) is bound and placed in the University Library.

In addition, at least 18 semester hours of course work on the program of study must be 500-level courses and 20 semester hours must be in the major field.

Final Examinations. Both final written and oral examinations are required of all candidates. The written examination is comprehensive; the oral examination is a defense of the thesis or equivalent.

MASTER OF FINE ARTS

See pages 105–108 for program descriptions and requirements.

DOCTOR OF PHILOSOPHY

The Ph.D. degree is designed to give students a broad knowledge of theatre as well as special research, production and teaching skills in theatre for youth. A detailed description of the program may be obtained from the Department of Theatre.

See pages 120–122 for general requirements.

Admission. Applicants must meet all admission requirements of the Graduate College. In addition, the Department of Theatre requires a master's degree in theatre or education; a minimum of 36 hours of undergraduate and graduate course work in theatre (to include courses in dramatic literature, acting, directing, stagecraft, improvisation with youth, theatre for children, children's literature, research methods, theatre history, and theatre theory/criticism); acceptable scores on the GRE, and on the Test of English as a Foreign Language (where applicable); and three letters of recommendation. Teaching certification at the elementary or secondary level is strongly recommended but not required.

Application Deadline. The first deadline for receipt of applications and test scores is March 1. After that date admission is subject to space availability.

Program of Study. A total of 90 semester hours is required for this degree, consisting of

1. a minimum of 66 hours of graduate course work (including a maximum of 30 semesters accepted from the first year of graduate study, a core of 15 semester hours of required courses, and 21 semester hours of elective and research credits);
2. a comprehensive examination; and
3. 24 semester hours of research and dissertation preparation.

A minimum of 30 semester hours of the approved Ph.D. program, exclusive of dissertation and research hours, must be completed after admission to the Ph.D. at ASU.

In meeting these requirements, students, with the advice of the supervisory committee, may select theatre courses in areas such as theatre education, directing, acting, design, playwriting, theatre history, and theatre theory/criticism, in addition to tutorial courses as well as courses offered by other departments in areas such as pertinent research methodologies, educational theory and methodology, aesthetic theory, the arts and arts education, oral interpretation, and children's literature. Students are encouraged to be involved in on- and off-campus production and teaching. All activities are selected to help students meet the goals of the program and develop the capability of becoming leaders in the field.

Research Technique Requirement. Students must successfully complete a second graduate level course in qualitative or quantitative research, or they must successfully pass an examination in a foreign language approved by their committee.

Preliminary Reviews. Reviews of a student's performance in courses and development of research skills, artistic skills, and teaching competencies are conducted by the supervisory committee at the end of each semester.

Comprehensive Examinations. This exam is composed of written and oral components centering upon: theatre history, literature, and criticism; theatre for youth and theatre in education; and the research area.

Dissertation Requirements. A dissertation based on original work of high quality and demonstrating proficiency in the student's special field is required. (See dissertation requirements, page 119.)

Financial Assistance. University scholarships, fellowships, grants, and other forms of financial assistance are available as outlined on pages 48–50 and 95. Graduate assistantships are granted by the Department of Theatre; application forms and information concerning graduate assistantships are available through the director of graduate studies, Department of Theatre. A current résumé and a minimum of three letters of recommendation must accompany applications for graduate assistantships.

RESEARCH ACTIVITY

Recent and continued research by members of the Department of Theatre includes the following: workshops and production of new scripts for audiences of all ages and cultural backgrounds; voice production; study and performance of Shakespeare; history of American theatre; new production utilization in lighting, scene design, and production; aesthetic education; implementation of national standards and assessment for theatre education K–12; teacher training; history; criticism; and theory of theatre for youth.

THEATRE (THE)

THE 400 Focus on Film. (3) N
Specialized study of prominent film artists, techniques, and genres. Emphasis is on the creative process. May be repeated for credit. Prerequisite: ENG 101 or 105.

THE 401 Focus on Multiethnic Film. (3) F, S, SS
Specialized study of major ethnic films and prominent film artists. Emphasis is on the creative process. Lecture, film viewing, papers. Prerequisite: ENG 101. *General Studies: HU, C.*

THE 420 History of the American Theatre. (3) F
History of the plays, artists, and events in the development of American theatre from colonial to modern times. *General Studies: HU, H.*

THE 421 History of the English Theatre. (3) S
History of the artists, events, and plays in the development of English theatre from medieval times to the present. Lecture, group and independent work. *General Studies: L2/HU.*

THE 424 Trends in Theatre for Youth. (3) N
A survey of the history, literature, and contemporary practices in theatre for youth.

THE 425 History of Asian Theatre. (3) N
History and production techniques of theatre forms in India, China, and Japan. Prerequisite: 6 hours of theatre history or instructor approval. *General Studies: L2/HU.*

THE 430 History of Costume: Western Tradition. (3) N
Study of major costume styles throughout history of Western civilization and how these fashions reflected society. Exploration of how styles can be used by theatrical costumers.

THE 431 History of Costume: Non-Western Tradition. (3) N
Study of major costume styles of India, Asia, Eastern Europe, and the Middle East and how these fashions reflected society. Exploration of how styles can be used by theatrical costumers.

THE 480 Methods of Teaching Theatre. (4) F
Application of materials, techniques, and theories for theatre with ninth- through twelfth-grade students. Emphasis on curriculum development and praxis. Prerequisite: theatre education concentration or instructor approval.

THE 500 Research Methods. (1–3) F
Introduction to graduate study in theatre.

THE 504 Studies in Dramatic Theory and Criticism. (3) F
Dramatic theory, criticism, and aesthetics from the classical period to the 19th century. Related readings in dramatic literature. Prerequisite: Theatre major.

THE 505 Studies in Dramatic Theory and Criticism. (3) S
Dramatic theory, criticism, and aesthetics from the 19th century to the present. Related readings in dramatic literature. Prerequisite: Theatre major.

THE 510 Studies in Literature. (1) F, S
Assigned individual reading programs in standard sources and masterpieces in theatre literature. Topics may be selected from the following:
(a) Acting–Directing
(b) Criticism
(c) Design–Technical
(d) History
May be repeated for credit in different sections.

THE 520 Theatre History and Literature I. (3) F
A survey of historiographical issues, historical periods, and theatre literature, through the 17th century.

THE 521 Theatre History and Literature II. (3) S
A survey of historiographical issues, historical periods, and theatre literature, from the 17th century to present.

THE 524 Advanced Studies in Theatre for Youth. (3) F
An in-depth study of the history, literature, and contemporary practice of theatre for youth. Prerequisite: instructor approval.

THE 591 Seminar. (3) A
Selected topics in child drama, community theatre, and theatre history. Prerequisite: written instructor approval.

THE 700 Advanced Research Methods. (3) F
Critical review of research, development, and design of research in theatre and theatre for youth.

THE 791 Seminar. (3) N
Selected topics offered on a revolving basis. May be repeated for credit when topic changes.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

THEATRE PERFORMANCE AND PRODUCTION (THP)

THP 401 Theatre Practicum. (1–3) F, S, SS
Performance and production assignments for advanced students of acting, technical production, stage and business management, and design. May be repeated for credit. Prerequisite: instructor approval.

THP 406 Scenography. (3) N
The process of production collaboration. Taught in conjunction with THP 419. Prerequisites: THP 330 and 340 and 345 *or* instructor approval.

THP 411 Methods of Teaching Drama. (3) F
Application of materials, techniques, and theories with grades K–8 youth. Regular participation with children. Prerequisite: THP 311 or instructor approval.

THP 414 Directing: The Production Concept. (2) A
Play analysis, development, and implementation of the director's concept. Studio. Prerequisites: THP 315; instructor approval.

THP 415 Directing the Actor. (3) A
Practical applications of directing for the stage. Rehearsal and presentation of scenes and short plays. Prerequisites: THP 414; instructor approval.

THP 419 Preproduction Workshop: Director/Designer Collaboration. (3) A
Study and practice of the collaborative process necessary for developing a production concept. Various styles (realism, nonrealism, theatre for youth). Taught in conjunction with THP 406/506; cannot be enrolled concurrently with THP 406 or 506. Prerequisite: THP 415 or written instructor approval.

THP 430 Costume Design. (3) N
Principles of costume design, with projects in both modern and period styles. Prerequisite: THP 330.

THP 431 Advanced Costume Construction. (3) A
Specialized training in costume construction problems and crafts with projects in tailoring, millinery, and period accessories. Prerequisites: THP 330 and 331 *or* instructor approval.

THP 435 Advanced Technical Theatre. (3) A
Selection of materials, drafting of working drawings, tool operation, and construction techniques. 2 hours lecture, 2 hours lab. Prerequisites: THP 340 and 345 *or* instructor approval.

THP 440 Advanced Scene Design. (3) A
Advanced studio projects in designing scenery for a variety of stage forms. Prerequisite: THP 340 or instructor approval.

THP 441 Scene Painting. (3) N
Studio projects in painting stage scenery. Prerequisite: THP 340 or instructor approval.

THP 442 Drawing. (3) N
Techniques in drawing and rendering for scenic, costume, and lighting design. Prerequisite: instructor approval.

THP 444 Drafting for the Stage. (3) N
Fundamentals of and practice in graphic techniques for the stage. Introduction to computer-aided design for the stage. 2 hours lecture, 3 hours studio. Prerequisites: THP 213; instructor approval.

THP 445 Advanced Lighting Design. (3) N
Specialized techniques in stage lighting. Advanced application of design process, graphic techniques of design presentation, and use of qualities of light. Lecture, class workshops. Prerequisite: THP 345 or instructor approval.

THP 450 Theatre Organization and Management. (3) N
Box office, house management procedures, production budgeting, and publicity. Prerequisite with a grade of "C" or higher: THE 220.

THP 460 Playwrights Workshop. (3) F, S
Practice and study of creating characters, dialogue, scenes, plays, and monologues for the stage. May be repeated for credit. Studio, lecture. Prerequisite: written instructor approval.

THP 461 Scripts-in-Progress. (3) F, S
Studio work with the instructor, centered on revisions of original plays. Preparing the script for productions, and rewriting while in production. May be repeated for credit. Studio. Prerequisite: THP 460 or written instructor approval.

THP 472 Advanced Movement for the Stage. (3) F
Movement techniques for the classical and nonrealistic theatre; stage combat and special skills. Prerequisites: THP 385 and acting emphasis *or* instructor approval.

THP 477 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; stage dialects. Prerequisites: THP 385 and acting emphasis *or* instructor approval.

THP 481 Secondary School Play Production. (3) F
Methods of directing, designing, and coordinating play production experiences at the secondary school level. Off-campus practicum. Prerequisites: THP 315 and theatre education concentration *or* instructor approval.

THP 485 Acting: Advanced Classical Scene Study. (3) S
Rehearsal and performance of period, classical, and nonrealistic plays. Emphasis on delivery of poetic language. Prerequisites: THP 385 and acting emphasis *or* instructor approval.

THP 487 Acting for TV and Film. (3) A
Professional television and film acting techniques, terminology, and on-camera experience. Prerequisites: THP 101 (or 102), 110; junior standing.

THP 494 Special Topics. (1–4) A
Topics may be selected from the following:
(a) Advanced Acting Techniques
(b) Advanced Scene Painting
(c) Advanced Stage Management
(d) Curriculum and Supervision of Theatre in the School K–12
(e) Properties and Dressings Design and Construction
(f) Puppetry in Performance
(g) Storytelling
(h) Technical Theatre III
(i) Video and Industrial Scene Design

THP 498 Pro-Seminar. (1–6) A
Topics may be selected from the following:
(a) Directing
(b) Projects:
Costume Design
Lighting Design
Properties Design
Scenery Design
Technical Direction
(c) Stage Management
(d) Theatre for Youth Tour
(e) Theatre in Education
Prerequisite: written instructor approval.

THP 501 Acting: Personalization I. (8) F
Fundamentals: activation, articulation-ear training, neutral masks, physical-vocal dynamics. Scene study, contemporary realistic ensemble performance projects. Collaboration with playwrights. Studio. Prerequisite: admission to M.F.A. Acting program or instructor approval.

THP 502 Acting: Personalization II. (8) S
Fundamentals for actor as creative artist. Scene study, poetic period, and style ensemble performance projects. Collaboration with directors, playwright. Studio. Prerequisite: THP 501 or instructor approval.

THP 503 Acting: Transformation I. (8) F
Fundamentals plus character and transformation, character masks-voices, dialects, extravagant language. Comedy of manners, new scripts scene study, ensemble performance projects. Studio. Prerequisite: THP 502 or instructor approval.

THP 504 Acting: Transformation II. (8) S
Fundamentals including combat, scansion, poetic language, acting style. Scene study, ensemble performance projects focused on Shakespeare, new scripts. Studio. Prerequisite: THP 503 or instructor approval.

THP 506 Scenography. (3) N
The process of production collaboration. Taught in conjunction with THP 419. Prerequisite: theatre graduate standing or instructor approval.

THP 508 Multiethnic Workshop. (3) F, S
Advanced workshop for development and presentation of works originating out of American ethnic cultures. Lecture, lab.

THP 509 Singing for Actors. (1) F, S
Introduction of the basics of singing technique. Breath control, resonance, articulation, exploration, and expansion of singing range. May be repeated for credit. Studio. Prerequisite: admission to M.F.A. Acting program or instructor approval.

THP 511 Improvisation with Youth Workshop. (3) S
Theories and techniques of drama with various populations of youth. Emphasis on how research informs practice. Practicum included. Prerequisites: THP 411 *or* graduate standing and instructor approval.

THP 512 Puppetry Workshop. (3) F, S
Survey of puppetry in education, puppetry as an art form in design and performance. Lab fee required. Prerequisite: graduate standing or instructor approval.

THP 515 Problems in Directing. (3) S
Analysis of common directing problems. Topics include: creating the ensemble, conceptual unity, metaphor, nonliteral strategies, and organizational responsibilities of the director. Prerequisite: instructor approval.

THP 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.

THP 519 Directing: Works in Progress. (3) F
Advanced projects in directing concentrating on a collaborative process between director, playwright, actors, and designers. Focus is primarily on new scripts or adaptations of literature. May be repeated for credit. Studio, on-site practicum. Prerequisites: graduate standing; written instructor approval.

THP 530 Advanced Costume Design. (3) N
Advanced studio projects in costume design for a variety of production forms. Prerequisite: instructor approval.

THP 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. Prerequisite: instructor approval.

THP 545 Lighting Design Applications. (3) N
Advanced studio projects in stage lighting design. Prerequisite: instructor approval.

THP 560 Playwright's Workshop. (3) F, S
Practice and study of creating characters, dialogue, scenes, plays, and monologues for the stage. Maybe repeated for credit. Studio. Prerequisite: written instructor approval.

THP 561 Scripts in Progress. (3) F, S
Studio work with the instructor centered on revisions of original plays. Preparing the script for productions and rewriting while in production. May be repeated for credit. Studio. Prerequisite: THP 560 or written instructor approval.

THP 562 Literary Management Workshop. (3) F
Advanced literary management for the contemporary theater, including trends in new play development, festivals and productions throughout the United Stated. Participation in Arizona Playwriting Competition. Prerequisite: THP 560 or instructor approval.

THP 584 Internship. (1–3) A
Field research and on-site training in theatre for youth, community theatre, and production techniques. Prerequisite: written instructor approval.

THP 593 Applied Projects. (1–12) A
Prerequisite: instructor approval.

THP 594 Conference and Workshop in Child Drama. (3) A
Prerequisite: instructor approval.

THP 598 Special Topics. (1–4) A
Topics may be selected from the following:
(a) Acting
(b) College Teaching:
  Acting
  Dramatic Analysis
  Improvisation with Youth
  Movement
  Puppetry
  Voice
(c) Directing
(d) Works in Progress:
  Actor
  Playwright.
Lecture and studio.

THP 611 Improvisation with Youth Seminar. (3) A
Examination of current research, theory, and practices in drama with youth. Development and execution of research projects. Prerequisite: instructor approval.

THP 618 Directing Practicum. (3) A
Practical experience in directing and producing an entire play or musical for young audiences. Prerequisite: instructor approval.

THP 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. Prerequisite: instructor approval.

THP 684 Internship. (3–6) F, S, SS
Field research in acting, improvisation with youth, theatre for youth, puppetry, and scenography. Prerequisite: instructor approval.

THP 691 Seminar: Scenography. (3) N
Examination of and research into modern concepts and practices of scenography. Prerequisite: instructor approval.

THP 693 Applied Project. (1–12) F, S, SS
Final projects for M.F.A. Theatre candidates in acting, scenography, and theatre for youth. Prerequisite: instructor approval.

Omnibus Graduate Courses: See pages 51–52 for omnibus graduate courses that may be offered.

Theory and Composition

See "Music," pages 251–254.

Transportation Systems

Interdisciplinary Faculty

Mary Kihl
Interim Director
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AERONAUTICAL MANAGEMENT TECHNOLOGY
Professor: Gesell;
Assistant Professors: Jackson, Karp

CIVIL AND ENVIRONMENTAL ENGINEERING
Professors: Mamlouk, Matthias, Upchurch; Assistant Professors: Owusu, Zhu

GEOGRAPHY
Professor: Burns;
Associate Professor: Kuby

PLANNING AND LANDSCAPE ARCHITECTURE
Professors: Kihl, Mushkatel, Pijawka;
Associate Professor: Guhathakarta

Under the auspices of the Graduate College, the interdisciplinary Certificate in Transportation Systems program is administered by the Committee on Transportation Systems. The objective of this program is to enable existing ASU graduate students and transportation professionals with advanced degrees to examine transportation-related issues from a variety of perspectives and in the context of different travel modes.

The certificate program requires a minimum of 15 semester hours of course work. To qualify for the certificate, the student must complete an interdisciplinary issues proseminar class (three semester hours), complete three elective courses (nine semester hours) from an approved list of transportation-related courses in at least two disciplines that are outside the student's degree program, and complete a capstone research paper that explores a transportation problem from a multidisciplinary perspective (three semester hours). A thesis in the area of transportation may substitute for the capstone paper.

Master's degree candidates in good standing in participating departments or current practicing professionals who already hold a graduate degree may apply for admission to the certificate program. The applications will be reviewed by the Transportation Systems Certificate Admissions and Advisory Committee, made up of representatives of participating departments. Enrollment in all classes outside the major requires permission of the instructor. For more information, contact the interim director, 602/965–6395.